A BACKCOUNTRY VISITOR IMPACT MANAGEMENT STRATEGY FOR RIDING MOUNTAIN NATIONAL PARK

by
Valerie Toews

A practicum
submitted to the Faculty of Graduate Studies
in partial fulfilment of the requirements
for the degree of

Masters of Natural Resources Management

Natural Resources Institute
University of Manitoba
Winnipeg, Manitoba

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

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Abstract

Riding Mountain National Park (RMNP) provides visitors with over 500 kilometres of maintained trails in the park's backcountry. The trails are used for hiking, cycling and horse travel. Over 200 kilometres of trails are maintained in the winter for cross-country ski use. There are 21 backcountry campsites along the trail system (Riding Mountain National Park 1998).

Parks Canada's Guiding Principles and Operational Policies (Parks Canada 1994a) states that the primary mandate of national parks is to preserve ecological integrity. It also states that the national parks will allow appropriate visitor activities. RMNP's Management Plan (RMNP Round Table 1996) and Ecosystem Conservation Plan (Parks Canada 1997a) echo these objectives and further specify that the park will manage its backcountry to maintain both ecological integrity and visitor experience.

RMNP management recognizes that visitor use of the park's backcountry may jeopardize the integrity of both the resources and visitor experience and that a strategy of preventing, monitoring, measuring and mitigating backcountry visitor impacts is required. This report provides a framework for developing an ongoing backcountry visitor impact management process. Steps in the process range from assembling an interdisciplinary team to help determine the purpose and significance of the park's backcountry through to development of indicators, standards, monitoring plans and management action plans. Stakeholder involvement occurs throughout the process. The strategy involves initial implementation steps as well as ongoing monitoring. It remains flexible and will likely undergo an initial testing period and a number of revisions as monitoring reveals additional data that may signal a need for changes to indicators, standards or management actions.

Acknowledgements

Throughout this study, I was pleased to discover the many people, both in Riding Mountain National Park and in park systems throughout the world, who are dedicated to preserving ecological integrity while encouraging park visitors to have satisfying wilderness experiences. In this age of dwindling wilderness resources, it will be people such as these who help preserve these precious resources for future generations.

The staff and management of RMNP are unquestioningly dedicated to achieving the goals outlined in Guiding Principles and Operational Policies and in the park management plans, however unfavourable politics and limited financial resources may be. I would like to thank Steve Malcolm, Sharon Vanderschuit, Glenn Schmidt, Debbie Kilfoyle and other RMNP staff members for providing guidance as well as many facts and figures throughout this study.

I gratefully acknowledge the guidance, direction and expertise provided by my practicum committee: Glenn Schmidt, Backcountry Warden, Moon Lake Warden Station, Riding Mountain National Park and co-author of RMNP's Backcountry Management Strategy; Diane Kunec, Program Coordinator, Canadian Council of Ministers of the Environment; Dr. Michael Campbell, Professor, Faculty of Physical Education and Recreation Studies, University of Manitoba; Professor Thomas Henley, Faculty Advisor, Natural Resources Institute, University of Manitoba. These individuals are dedicated in their professions and were equally dedicated to their task of guiding this study.

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Chapter 1: Introduction

1.0 Background

An increasing global population is resulting in rapid urbanization and resource consumption at unprecedented levels. The amount of land protected from these threats is diminishing just as rapidly. Politicians and other decision makers must strive to set aside as much wild land as possible in order to preserve the integrity of the world's ecosystems. However, setting aside lands protected from external threats is not sufficient. Wilderness managers are then faced with the daunting responsibility of keeping the land and its inhabitants as wild and intact as possible. This is no easy task given the popularity of wilderness recreation.

Wilderness Recreation

Wilderness recreation, defined by Hammitt and Cole (1998) as "activities that offer a contrast to work-related activities and that offer the possibility of constructive, restorative, and pleasurable benefits," depends on natural resources either directly or as a backdrop for recreational activities.

Parks and wilderness recreation areas are popular with hikers, backpackers, horseback riders, cyclists, boaters, canoeists and other recreation enthusiasts. In Canada, outdoor sports (such as golfing, skiing, hunting, fishing, hiking, snowmobiling and numerous others) are the most popular category of activity in nonurban areas (Environment Canada 1996). Even areas set aside predominantly for protection are now being sought out by visitors (Giongo and Bosco-Nizeye 1998).

The increase in demand for outdoor recreation has brought about new technology that allows wilderness users to venture further into the backcountry, to stay for longer periods of time and to try new types of activities. In fact, some recreation areas that were designed for the casual use of the 1950s and 60s are trampled under by today's heavy use (Douglass 1982).

Participants in wilderness recreational activities often unknowingly engage in ecologically damaging actions. Although most wilderness enthusiasts enjoy scenery and wildlife, their actions can have self-defeating consequences when they damage soils and vegetation and disturb wildlife (Liddle 1975; Edington and Edington 1986; Knight and Gutzwiller 1995). These impacts challenge wilderness managers who must provide recreational opportunities while protecting the area's ecological integrity.

Riding Mountain National Park

Riding Mountain National Park (RMNP), comprising 2,976 square kilometres, is a small patch of wilderness surrounded by land developed for agriculture. Located in western Manitoba, the park is representative of the southern boreal plains and plateaux natural region of Canada. The park, while protecting the unique natural resources of the region, is the province's largest tourist destination and provides economic returns from tourism and employment. The park employs approximately 135 - 140 people during the peak visitor season and approximately 70 people during the off-season (RMNP Round Table 1996).

RMNP provides natural and cultural heritage and many recreational opportunities for park visitors (see Figures 1.0 and 1.1). Most of the park's approximately 425,000 annual visitors come from Manitoba and Saskatchewan. Wasagaming, the park's townsite, and other frontcountry areas are the most highly used areas of the park. However, park management has expressed concern about the potential for impacts caused by recreation in the park's backcountry (RMNP Round Table 1996). Over 90% of the park is considered backcountry and is zoned as wilderness. Motorized access is not permitted in the backcountry. However, an extensive trail system exists for visitors who hike, cycle, ride horses or travel on horse-drawn wagons through the backcountry. The park's backcountry receives several hundred visitors every year. Given that many visitors spend more than one night in the backcountry, the number of person nights per year is in the thousands (Riding Mountain National Park 1998).

Overuse of RMNP's backcountry is not currently a big problem but park management does not want the park's ecosystems to suffer from the impacts of large numbers of backcountry visitors like many other parks have (e.g. Canada's mountain parks). Within the context of the park's broad management objectives lies the framework for the development of a backcountry visitor impact management strategy. This study occurs within the broader context of RMNP's Ecosystem Conservation Plan (ECP). The ECP calls for the development of a Visitor Activities Management Plan, containing a Backcountry Management Plan and a Frontcountry Management Plan which are currently being developed by the park's Warden Service.

This study falls under the requirements of the Backcountry Management Plan. The backcountry visitor impact management strategy for RMNP developed in this study addresses many of the issues discussed in the Backcountry Management Plan such as trail and campsite monitoring and mitigating backcountry ecological and social impacts. A Recreational Study Group is currently looking at recreational issues in the park and

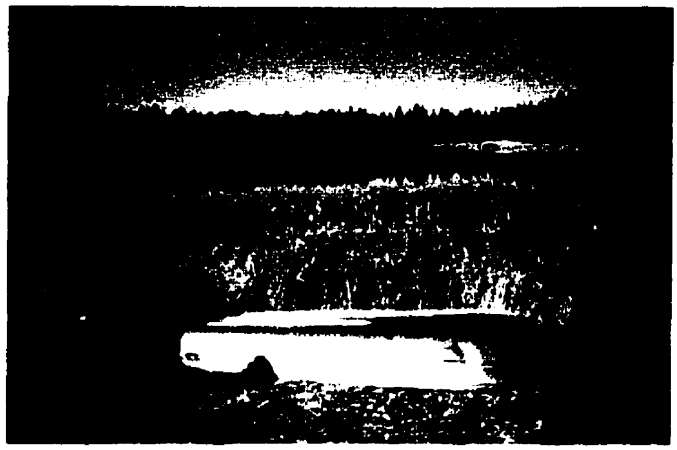

Figure 1.0: The Long Lake Backcountry Campsite, Riding Mountain National Park.

Figure 1.1: Central Trail, an old logging road, is one of the park's longest backcountry trails.

has been subdivided into smaller working committees, including a Backcountry Working Group which will play an important role in implementing the backcountry visitor impact strategy.

1.1 Problem Statement

RMNP offers visitors many backcountry recreational activities such as hiking, cycling, horseback riding, wagon use and camping. The number of park visitors that visit the backcountry is low in comparison to the number who stay in the frontcountry. However, there is still the potential for significant negative ecological or social impacts caused by visitor and/or park maintenance activities.

There are other parks and protected areas throughout North America and worldwide with significant backcountry visitor activity. Many of these have management strategies in place that are designed to measure impacts on the ecosystem and on visitor satisfaction caused by backcountry recreation and to prescribe preventative and/or mitigative measures for areas under threat from undue impact.

Parks Canada (1994a) is committed to ecosystem-based management, maintaining ecological integrity and providing visitor opportunities in all national parks. A backcountry visitor impact management strategy will help park managers meet this goal. The purpose of this study, therefore, is to develop an appropriate backcountry visitor impact management strategy for RMNP.

1.2 Objectives

The following objectives will fulfill the purpose of the study:

1. To identify and evaluate visitor impact strategies (i.e. prevention, monitoring, measurement and mitigation) previously developed and used in other parks and protected areas.

2. To use the results of the above evaluation combined with RMNP management plans, policies and management input to adapt a backcountry visitor impact management strategy to fit RMNP and to recommend the necessary steps in its implementation.

1.3 Methods

Methods for this study included a review and comparison of existing strategies to reveal alternatives available to be considered for RMNP's backcountry visitor impact management strategy. These alternatives were assessed and a plan appropriate to RMNP was developed in consultation with RMNP staff. This involved adapting existing strategies to suit RMNP's unique ecological and social conditions. RMNP staff will implement and test the backcountry visitor impact management strategy.

The three main considerations in this study are:

1. Parks Canada's mandate for protecting ecological integrity
2. Visitor satisfaction
3. Budget constraints

The backcountry visitor impact management strategy developed for RMNP must integrate and balance these considerations as described below.

Ecological Integrity

Protecting ecological integrity is Parks Canada's primary mandate. Ecological integrity exists when an ecosystem's structure and function are not adversely affected by human impact and when its biodiversity and supporting processes are likely to persist. Parks Canada's policy framework, Guiding Principles and Operational Policies (Parks Canada 1994a) states:

> *"Protecting ecological integrity and ensuring commemorative integrity take precedence in acquiring, managing and administering heritage places and programs. In every application of policy, this guiding principle is paramount."*

Maintaining ecological integrity is defined as managing ecosystems in such a way that ecological processes are maintained and genetic, species and ecosystem diversity are assured for the future. By these definitions, human behaviour is strongly linked to ecological integrity. Human activity within a protected area and in surrounding areas may either threaten or preserve ecological integrity. Parks Canada will strive to ensure the highest possible protection of ecosystems within its jurisdiction and will not permit human activities within a park that threaten the integrity of the park's ecosystems.

Visitor Satisfaction

Guiding Principles and Operational Policies (Parks Canada 1994a) also states that, while Parks Canada does not have a direct mandate for tourism, it does have a part to play in recognizing and supporting tourism's place in presenting an image of Canada to visitors, in helping to maintain a sound and prosperous economy and in fostering sustainable development that benefits local communities. In doing so, Parks Canada will provide national park visitors with opportunities that enhance public understanding, appreciation, enjoyment and protection of the national heritage and which are appropriate to the purpose of each park. National parks should provide essential and basic services while maintaining ecological and commemorative integrity and recognizing the effects of incremental and cumulative impacts.

Parks Canada does, however, recognize the need for control and management of appropriate visitor activities. Public demand alone is not sufficient justification to provide facilities and services that support visitor activities because national parks cannot sustain the full range of activities and development which many visitors may desire. These must only be provided if they meet several stringent criteria that take ecological and commemorative integrity into consideration. Generally, each park will provide access and services which relate directly to the park's objective while a broader range of needs will be met in the region surrounding the park.

Furthermore, Guiding Principles and Operational Policies defines *visitor activity* as an educational or recreational pursuit that contributes to an understanding, appreciation and enjoyment of heritage resources, and *appropriate visitor activity* as an activity which:

- is consistent with these policies and with the protection of ecological and/or commemorative integrity of protected heritage areas;
- is suited to the particular conditions of a specific protected heritage area; and
- provides the means to appreciate, understand and enjoy protected heritage area themes, messages and stories.

Budget Constraints

Despite Parks Canada's mandate to protect ecological integrity and provide visitor opportunities, the RMNP Management Plan (RMNP Round Table 1996) states that future budgets will be less and, as a result, revenues must increase, operational costs must be reduced and users must pay more for services. This fiscal reality will challenge

park managers and other stakeholders to explore new and alternative ways of reducing costs and generating revenue such as negotiating partnerships with the private sector, non-government organizations and other agencies.

RMNP management has stated that ecological integrity and visitor satisfaction are both equally important and are couched in a budget environment. This is confirmed by the park's vision statement (RMNP Round Table 1996) which states:

> *"RMNP should remain representative for all time of the southern boreal plains and plateaux natural region of Canada. RMNP is a place where plants, animals and natural features endemic to this area are allowed to evolve as free as possible. The broader ecosystem, of which the Park is the core, is seen as dependent for its integrity not only upon the management practices within the park boundaries, but also upon the wise management of the outlying lands and resources.*
>
> *Public understanding, appreciation and enjoyment must be accommodated and enhanced by measures which complement and encourage visitors' interest in this example of Canada's natural heritage. RMNP should be a place where people go to experience wilderness - leaving it unimpaired for future generations. It should be a place where the mysteries of nature, of wild lands and wild animals can be studied and explored. These living communities constitute a significant educational resource."*

1.4 Scope

This study focuses on visitor impact management methods described in the literature and used in other parks and protected areas in Canada and the U.S. and their successes and failures where applicable.

This study analyzes the management of recreational impacts or other impacts directly related to backcountry recreational activity and other human-caused impacts such as those created through park operations.

1.5 Delimitations

The results of this study are applicable only to RMNP as each park and protected area has unique visitation rates, activities and ecological conditions and, therefore, different management objectives.

This study does not analyze frontcountry or townsite impacts. Results are based on backcountry recreational impacts only.

1.6 Outline

This practicum is divided into six chapters. After the introduction in Chapter 1, a review of the visitor impact management literature is carried out in Chapter 2. The third chapter discusses current ecological and visitation conditions in Riding Mountain National Park and the policy and management framework that exists in the park. The process undertaken in the study is presented in Chapter 4 and this leads to the results, analysis and discussion of the various strategies in Chapter 5. The final chapter provides the summary and conclusions reached during the study and recommendations to park managers regarding implementation of the strategy. Appendix A is a summary of the backcountry visitor impact management strategy.

Chapter 2: Visitor Impact Management in Parks and Protected Areas

2.0 Introduction

There is a significant body of literature related to parks and protected area management. Recently, the literature has included visitor impact management which is necessary in parks and protected areas that have a significant visitor component and the potential for ecological and social impacts caused by visitor activity. Recreational activity in parks and protected areas has become more prevalent since the second world war and many managers have noticed problems associated with increased visitation rates. Many of these problems require complex solutions that cannot be dealt with solely through regulatory methods. A shift in focus that now includes a combination of social science and natural science perspectives in park management has occurred as a result of these problems (Payne and Graham 1993).

Several concepts have been developed to deal with the problems associated with ecological and social impacts caused by visitor use in parks and protected areas. The United States (U.S.) National Park Service (NPS) and Forest Service have developed many of the current visitor management approaches but they ultimately come from a variety of sources. Visitor impact management owes its origins to the carrying capacity concept. Dissatisfaction with the limitations of this concept led to the development of several frameworks, all of which are in use in various North American parks and protected areas.

This chapter presents the theoretical basis for visitor impact management as established in the related literature. While the purpose of this study is to develop a backcountry visitor impact management strategy, many visitor impact management concepts and strategies may apply to both frontcountry and backcountry management.

Carrying capacity, as the original concept in wilderness management, is discussed first, followed by the human use planning and management frameworks that arose out of the carrying capacity concept. Finally, an introduction to the nature of visitor impacts in wilderness areas and various management techniques for dealing with these impacts are discussed.

2.1 Carrying Capacity

The carrying capacity concept is central to the management of parks and protected areas with a recreation component. It implies that there are limits to the amount and

type of human activity an area can sustain.

Managing visitor activity in parks and protected areas involves both preserving ecological integrity and maintaining the wilderness experience for visitors because both are potentially sensitive to the use an area receives. Wilderness areas have limited capacity to absorb the impacts of use and still retain important wilderness qualities. Carrying capacity - the use an area can tolerate without unacceptable change - offers a framework for managing visitor use to preserve these qualities (Pigram 1983).

The term carrying capacity is taken from ecology and also has roots in wilderness recreation management. An environment's carrying capacity is its maximum persistently supportable load (Catton 1986). Recreational carrying capacity is the level of recreation an area can sustain without an unacceptable degree of deterioration of the character and quality of the resource or the recreation experience (Tivy 1972). The concept has both a natural resources and a social component, described as ecological and social carrying capacity.

Ecological carrying capacity is concerned with the maximum level of recreational use, in terms of numbers and activities, that an area or ecosystem can handle before an unacceptable or irreversible decline in ecological values occurs. *Social carrying capacity* is concerned with visitor enjoyment and appreciation of a recreation site. It is defined as the maximum level of recreational use, in terms of numbers and activities, above which there is a decline in the quality of the recreation experience from the visitors' point of view (Tivy 1972).

Ecological Carrying Capacity

While ecological carrying capacity refers in part to the *number* of people that can use an area, the severity of impact does not necessarily correlate with absolute numbers. The spatial and temporal distribution of visitors to a site is another important consideration of park management as is the site's tolerance and user behaviour. It is, therefore, questionable whether limiting use in order to increase carrying capacity is appropriate. Many studies point out that use intensity is a poor predictor of total impact. The season and type of use involved are frequently more important in explaining impact than the amount of use (Cole 1985; Kuss 1986). Any recreational use produces some change; typically, much of the total impact found in an area occurs with only light recreational use (Cole 1985). Thus, if a manager elects to allow a level of use producing little or no change, it will be necessary to restrict use very stringently (Wagar 1968). Much of the recent literature concludes that limiting use is often not very effective.

There is also disagreement as to how, or even if, a site's carrying capacity can be determined. Several writers have warned against the misconception that capacity levels are somehow inherent or site-specific (Wagar 1968). Bury (1976) is especially critical of the notion of a fixed recreational carrying capacity for a site because judgement of what is unacceptable in a site's quality is subjective. Carrying capacity is not an uncomplicated, straightforward concept. The dynamic nature of ecosystems makes a static determination of carrying capacity difficult, if not impossible, to calculate for a site or region. The standards of ecological integrity and user satisfaction that are established for an area and the specific area management objectives that express these standards help define the carrying capacity of an area. Carrying capacity can be increased or decreased by management actions; it is not an inherent or fixed value (Lindberg et al. 1997).

Social Carrying Capacity

Social carrying capacity is also a difficult concept to determine. Since user satisfaction is a personal and subjective notion, it is the least tangible aspect of recreational carrying capacity and the most difficult to measure. Not only does it vary between individuals or user groups, but also for the same person at different times and situations. It is difficult to establish when user satisfaction has declined to an unacceptable level.

Beyond Carrying Capacity

Research findings determined that user behaviour is more influential than the actual numbers of users in causing impacts. This contradicted the basis upon which recreational carrying capacity was implemented - as a use limit policy - thus rendering the concept virtually useless in backcountry visitor impact management (McCool 1990a). Managers realized that what began as a strictly biological concept was not sufficient to deal with the complexities of visitor behaviour and the resulting impacts. These realizations and the evolving recognition that carrying capacity depends on social judgements about appropriate conditions has resulted in a series of efforts to develop a better framework for managing recreational use and its associated impacts. The question about the carrying capacity of recreation sites has changed from 'How much use is too much?' to 'How much change is acceptable?'.

The new approaches, including the U.S. Forest Service's Limits of Acceptable Change (LAC) framework, the U.S. National Parks and Conservation Association's Visitor Impact Management (VIM) framework, the U.S. NPS's Visitor Experience and Resource Protection (VERP) strategy and Parks Canada's Visitor Activity Management Process

(VAMP) attempt to provide a more comprehensive and systematic decision-making framework for managing visitors.

It is important for decision makers to be aware of the dynamic, multi-dimensional nature of the carrying capacity concept in order to adopt a balanced approach to parks and protected areas management. The challenge facing wilderness managers in dealing with carrying capacity is not to develop 'magic numbers' that describe how much use is too much. Rather, it is a matter of prescribing what kind of social and resource conditions are desired, comparing these desired states against existing conditions, and identifying the kinds of policies and actions needed to maintain or restore the desired conditions. Managerial judgement is the key element in this strategy.

2.2 Human Use Planning and Management Frameworks

The five human use planning and management frameworks described below have been in existence for less than 20 years. Several researchers have compared and analyzed the frameworks to determine how well they integrate visitor issues in parks and protected areas planning and management (Nilsen and Tayler 1998; Payne and Graham 1993; Graefe et al. 1990b).

While the specifics of each framework vary, they all include common components such as specific objectives, indicators, standards and monitoring. All require increasing the level of explicitness in decision making on the part of managers and thus reducing the amount of unchecked subjectivity in management (McCool 1990a).

2.2.1 Recreation Opportunity Spectrum (ROS)

The Recreation Opportunity Spectrum (ROS) is a management approach that identifies a range of outdoor recreational environments across a spectrum while addressing both ecological and social carrying capacity (Hendee et al. 1990; Clark 1987; Payne et al. 1997). The U.S. Forest Service developed the strategy in an attempt to meet their mandate for outdoor recreation management and integrated resource management.

In Canada, ROS has been used in national parks to a limited extent (Payne and Graham 1993; Rollins 1990). A pilot project in Pukaskwa and Yoho National Parks tested a modified version of ROS with some success. The project was done in recognition of the limitations of Parks Canada's Visitor Activity Management Process (VAMP) which is an activity-based management approach (See Section 2.2.5). The researchers found that a modified ROS framework was beneficial in overcoming

VAMP's shortcomings (Payne et al. 1997).

ROS assumes that quality recreation experiences depend on the provision of a diverse set of recreation opportunities. The basic framework classifies opportunities into six categories: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded and natural, rural, and urban (Driver 1990). These opportunity areas can only support specific kinds of recreation activities and experiences based on certain physical (e.g. size), social (e.g. encounters with other people) and managerial (e.g. zoning) characteristics (Payne et al. 1997).

ROS classifies facilities, management practices and visitor behaviours appropriate to each type of recreation opportunity (Clark and Stankey 1979; Brown et al. 1977). This framework allows for the development of a management plan that protects sensitive areas while identifying settings where visitors may achieve diverse recreational experiences (Parks Canada 1986a). Specifically, ROS can assist park managers by providing guidelines for:

- taking inventory of the supply of recreation opportunities;
- analyzing the effects of other activities on the supply of recreation activities;
- linking user demand with available opportunities;
- identifying complementary roles for regional recreation suppliers; and
- establishing standards and guidelines for recreation settings (Payne et al. 1997).

Steps of the ROS process are as follows:

1. Inventory and map the physical, social and managerial components that affect visitor experience.
2. Complete analysis:
    - identify inconsistencies with the three components mentioned in Step 1;
    - define recreation opportunity classes;
    - integrate with forest management activities; and
    - identify conflicts and recommend mitigation.
3. Schedule.
4. Design.
5. Execute projects.
6. Monitor.

The end product of this process is a definition of the opportunity for experience expected in each of the six classes, the indicators of the experience and management guidelines

(Nilsen and Tayler 1998).

ROS links supply and demand of recreational opportunities and can be easily integrated with other frameworks. The strategy ensures that park managers can provide a range of recreation opportunities to visitors while striving to preserve ecological integrity. However, the success of ROS depends on management agreement on the spectrum of recreation opportunities, the setting indicators and their criteria.

The Limits of Acceptable Change framework has been described as an extension of ROS (McCool 1990a). LAC depends on ROS for the identification of opportunity classes, but its theoretical basis departs from ROS quite radically in that ROS lacks the public involvement component that is built into the LAC framework (Payne and Graham 1993; Shannon 1987).

2.2.2 Limits of Acceptable Change (LAC)

The Limits of Acceptable Change strategy was developed by the U.S. Forest Service to balance the conflicting goals of recreational use and maintaining wilderness quality (Stankey et al. 1985). It is a popular decision-making framework for managers of recreation areas (wilderness or otherwise) (Nilsen and Tayler 1998) where carrying capacity is an issue (McCool 1990b; Hendee et al. 1990).

Hendee et al. (1990) describe LAC as a planning framework that establishes explicit measures of the acceptable resource and social conditions in recreation settings as well as the appropriate management strategies for maintaining and/or achieving those conditions. LAC was designed to assist managers in meeting the challenge of distinguishing between changes that are acceptable and those that hold negative implications for ecological integrity and quality outdoor recreation experiences (Knopf 1990).

The LAC framework involves the use of value judgements to determine acceptable conditions in wilderness areas (Stankey et al. 1990). The strategy includes the input of wilderness users and other stakeholders in the decision-building process. This participative or co-operative management component of LAC allows those involved to make modifications in response to actual ecological and social impacts (Shands 1992).

LAC consists of four basic components (Stankey et al. 1985, 1990):

- identifying acceptable and achievable resource and social standards;

- documenting gaps between desired and existing circumstances;
- identifying management actions to close these gaps; and
- monitoring and evaluating management effectiveness.

The LAC strategy consists of the following steps:

1. Identify issues and concerns.
2. Define and describe management objectives/opportunity class allocations.
3. Identify indicators of resource and social conditions.
4. Inventory resource and social conditions.
5. Develop standards which define the limits of acceptable change.
6. Identify alternative opportunity class allocations.
7. Identify management actions for each alternative.
8. Evaluate and select one alternative.
9. Implement actions and monitor conditions (McCool 1990a; Hendee et al. 1990).

The LAC strategy is not linear in that Step 9 is not the end of the process. Managers should continue to identify area concerns and issues and amend management objectives, opportunity classes, indicators, standards and management actions as necessary (Stankey et al. 1985; Hendee et al. 1990).

2.2.3 Visitor Impact Management Framework (VIM)

The Visitor Impact Management (VIM) framework was developed by the U.S. National Parks and Conservation Association and academic researchers for use by the U.S. NPS. It was derived through an analysis and synthesis of the existing literature (Miles 1995). VIM is designed to reduce or control the undesirable impacts of human use that threaten the quality of outdoor recreation areas and opportunities (Graefe et al. 1984, 1990a, 1990b; Graefe 1990; Payne and Graham 1993; Nilsen and Tayler 1998).

The VIM framework deals with three basic issues inherent to impact management:

- identification of unacceptable visitor impacts;
- determination of potential causal factors affecting the occurrence and severity of the unacceptable impacts; and
- selection of potential management strategies for mitigating the unacceptable impacts (Graefe 1990; Nilsen and Tayler 1998).

The framework consists of an eight-step process for meeting these objectives:

1. Conduct a preassessment data base review to determine current conditions.
2. Review management objectives.
3. Select key indicators.
4. Select standards for key impact indicators.
5. Compare standards and existing conditions. If a discrepancy is found, the following steps are taken:
6. Identify probable causes of impacts.
7. Identify management strategies.
8. Implement the chosen strategy.

These steps are followed by a monitoring process.

The VIM framework is similar to LAC in that it can be applied in a wide variety of settings and applies a similar methodology to assess and identify existing impacts and their causes (Nilsen and Tayler 1998). However, VIM depends more on professional expertise in its decision-making process than does LAC, in which public involvement is a key component. Also, VIM operates at a site-specific level, rather than relying on the regional focus used by ROS and LAC.

2.2.4 Visitor Experience and Resource Protection (VERP)

The U.S. NPS made a commitment in 1992 to develop a visitor use management/carrying capacity process that could be integrated with park management plans. The Visitor Experience and Resource Protection (VERP) strategy was developed to help park managers address visitor carrying capacity and to adequately manage visitor use. VERP was developed by incorporating both VIM and LAC frameworks (Hof 1993; U.S. National Park Service 1995).

VERP interprets carrying capacity not so much as a prescription of numbers of people but rather the determination of appropriate resource conditions and visitor experiences. Resource impacts and visitor uses are monitored to identify discrepancies between existing and desired conditions and to ensure that standards are not exceeded over the long-term. Management actions are taken, when necessary, to keep conditions within acceptable standards. VERP also provides a rationale that park managers can use to explain to visitors why they are taking certain actions. Monitoring is also done to evaluate the appropriateness of individual management actions and the overall effectiveness of the park's VERP program (U.S. National Park Service 1995 and 1997a).

Management zones are a primary component of VERP. They identify how different areas of the park can be managed to achieve a variety of resource conditions and visitor experiences. Management action will depend on the prescribed conditions for each zone (U.S. National Park Service 1995 and 1997b). Each zone has specific indicators and standards that enable park managers to determine whether or not a park's resources are being adequately protected and desired visitor experiences are being provided (U.S. National Park Service 1995).

Steps of the VERP strategy are as follows:

1. Assemble an interdisciplinary project team.
2. Develop a public involvement strategy.
3. Develop statements of park purpose, significance and primary interpretive themes; identify planning mandates and constraints.
4. Analyze park resources and existing visitor use.
5. Describe a potential range of visitor experiences and resource conditions (potential prescriptive zones).
6. Allocate the potential zones to specific locations within the park (prescriptive management zoning).
7. Select indicators and specify standards for each zone; develop a monitoring plan.
8. Monitor resource and social indicators.
9. Take management actions (Nilsen and Tayler 1998).

2.2.5 Visitor Activity Management Process (VAMP)

The Visitor Activity Management Process (VAMP) was developed by Parks Canada and academic researchers to provide effective interpretation and services to park visitors (Rollins 1993). Parks Canada uses VAMP to prepare, integrate and implement the visitor opportunity requirement of park management and service plans and uses it together with natural resources management. VAMP is intended to aid in planning and management of human/environment relationships in the parks and in incorporating social science input, along with natural sciences input, into park management plans (Tayler 1990; Payne and Graham 1993).

VAMP identifies visitor characteristics and needs; evaluates visitor market potential; and identifies, plans, implements and evaluates interpretive and educational opportunities (Graham et al. 1988; Graham 1990). Parks Canada's Guiding Principles and Operational Policies (1994a) states that VAMP will be used to match visitor interests

with the specific educational and outdoor recreation opportunities determined for each national park through the management plan and to evaluate effectiveness in providing service to the public consistent with Parks Canada's mandate.

The VAMP framework revolves around visitor activity profiles which connect particular activities with the social and demographic characteristics of park visitors, with the activity's setting requirements and with trends affecting the activity (Payne and Graham 1993). VAMP, and specifically the visitor activity profile, assess activities in terms of their relationship to the four policy objectives for national parks: protection, understanding, appreciation and enjoyment.

Steps of the VAMP strategy are as follows:

1. Produce a project terms of reference.
2. Confirm existing park purpose and objectives.
3. Organize a database describing park ecosystems and settings, potential visitor educational and recreational opportunities, existing visitor activities and services and the regional context.
4. Analyze the existing situation to identify heritage themes, resource capability and suitability, appropriate visitor activities, the park's role in the region and the role of the private sector.
5. Produce alternative visitor activity concepts for these settings, experiences to be supported, visitor market segments, levels of service guidelines and roles of the region and the private sector.
6. Create a park management plan including the park's purpose and role, management objectives and guidelines, regional relationships and the role of the private sector.
7. Implementation - set priorities for park conservation and park service planning (Nilsen and Tayler 1998).

Although the two frameworks are related in their aim of providing appropriate visitor activity while protecting resource bases, VAMP's objectives go much further than those of the ROS strategy, especially in its use of marketing concepts and in its connections with interpretation, visitor services and public safety (Graham et al. 1988). However, Payne et al. (1997) feel that VAMP, an activity-based management approach, is limited by its activity focus and a-spatial nature. They ran a pilot project in two national parks and determined that ROS helps alleviate these deficiencies of VAMP.

While VAMP, like ROS and VIM, does not have a public involvement component built

into the framework, VAMP is beginning to consider the roles of stakeholders in planning its services (Payne and Graham 1993).

Parks Canada policy states that VAMP will be used in park management planning. However, not all parks currently use this strategy. Nilsen (pers. comm.) states that there was a loss of momentum and management commitment to the VAMP strategy during the mid 1990s for the following reasons:

- the approach was seen as too complicated and time consuming;
- an era of management dislike for planning and processes; and
- dismantling of the Visitor Activities function at the National Office, regional offices and at the field level.

However, while the specifics of VAMP are not being applied as originally conceived - to produce plans - VAMP's principles and concepts are still being used to develop visitor management plans.

2.2.6 Comparison

The comparative analyses conducted by researchers on the above frameworks looked at their information requirements, their use of factors, indicators and standards and the appropriate applications.

Information Requirements

The frameworks vary in the nature of the information used in the decision-making process and how it is used. ROS uses technical models which require formal information (e.g. natural and scientific information and professional expertise). LAC, because of its dependence on public input, primarily uses informal information (e.g. customary and traditional knowledge held by stakeholders) in consensus building sessions but also requires formal information. VIM uses formal natural and social scientific information in a problem solving context. VAMP requires both formal social science information and informal information derived from park staff and other stakeholders (Payne and Graham 1993). VERP, like LAC, includes a public involvement strategy and, therefore, requires informal information as well as formal information (Nilsen and Tayler 1998).

Factors, Indicators and Standards

Factors, indicators and standards play an important role in these frameworks. Stankey et al. (1990) make a distinction between the three concepts and define them as follows:

- *Factors* - broad categories of issues or concerns (e.g. trail conditions, campsite solitude) from which one or more indicators can be identified that reflect the overall condition of the factor;
- *Indicators* - specific measurable variables (e.g. soil compaction, number of trail or campsite encounters) that, alone or in combination, are taken as indicative of the conditions of the overall opportunity class or factor;
- *Standards* - measurable aspects of indicators that provide a base against which a particular condition can be judged as acceptable or not (e.g. one encounter or less per day in a primitive zone).

The five frameworks vary in the language they use and the degree of emphasis they place on factors, indicators and standards.

ROS uses seven setting indicators which represent aspects of recreation settings that facilitate a range of experiences that can be influenced by managers:

- access;
- remoteness;
- visual characteristics;
- site management;
- visitor management;
- social encounters; and
- visitor impacts.

Factors in the LAC strategy depend on issues identified during the first step in the process. These include resource factors, such as trail or campsite conditions and wildlife populations, and social factors, such as solitude and conflicts. Standards in the LAC framework are the measurable aspects of the indicators and are the basis for judging whether a condition is acceptable or not. Standards describe acceptable and appropriate conditions for each indicator in each opportunity class.

Indicators of impact used in the VIM strategy include physical impacts such as soil density and compaction, number and size of fire rings and visible erosion; biological impacts such as ground-cover density and loss of ground cover, diversity and

composition of plant species; presence or absence of indicator species and reproduction success; and social impacts such as number of encounters, visitor perception of crowding and visitor satisfaction. Standards are established for each indicator based on the management objectives that specify acceptable limits or appropriate levels for the impact.

Factors considered in VERP include park planning statements, primary interpretation themes, visitor experience opportunities and management zones. And factors that are considered in developing indicators and standards in VAMP include visitor activity and stakeholder profiles, existing legislation and policy and interpretation theme presentation (Nilsen and Tayler 1998).

Applications

The frameworks vary in the appropriateness of their application to various contexts or settings (Nilsen and Tayler 1998) based in part on the tangible product that results from the process (Payne and Graham 1993). ROS, which yields a mapped identification of regional recreation settings which may be combined with information about demand, is appropriate for regional settings such as national parks. LAC produces wilderness area plans which can be applied to any natural area used for outdoor recreation such as scenic rivers and historic sites. While VIM does provide for the identification of a problem and its cause(s), the determination of a relevant standard to be maintained and the management response to eliminate the problem, it does not produce strategies to allocate recreation settings. VIM does, however, produce action plans which are best suited for site-specific applications, such as campgrounds or trails. Both VERP and VAMP were designed for, and are best used in, national parks. However, VAMP, which produces visitor activity profiles and concepts and a data acquisition plan may also be used for site-specific settings.

In general, ROS and VAMP operate on a broad scale with the purpose of determining appropriate recreational opportunities for an area. LAC, VIM and VERP are more concerned with site-specific ecological and social impacts caused by recreational activity. While these impacts are relevant within the ROS and VAMP frameworks, they are not the primary concern within these two strategies.

There are also differences between the three impact-related frameworks. LAC and VERP are more proactive in that they place greater emphasis on developing opportunity classes or management zones. On the other hand, VIM is somewhat reactive in nature and is the only strategy which includes an explicit step aimed at identifying the probable

causes of impacts. LAC and VERP both contain an explicit step that includes public participation in the process. Applications of VIM have tended to focus on the management of relatively localized impact problems. LAC, on the other hand, has focused more on large scale wilderness planning applications (Graefe 1990).

Conclusions

Payne and Graham (1993), who did not review VERP, concluded that ROS and VAMP are the two most effective visitor management strategies. They ranked LAC behind those two because it may face internal resistance due to its power-sharing nature. VIM ranked as the least effective of the four strategies because it treats visitors as the source of problems and seeks to regulate rather than manage them. However, Graefe (1990) stated that elements of VIM can be integrated with the other planning frameworks.

Nilsen and Tayler (1998) state that there is not enough integration of the frameworks. They suggest that each framework could benefit from a thorough review and integration of the key principles of the others. They also state that there is too much confusion surrounding the determination of which framework is appropriate for any given purpose and that more research is necessary to determine the frameworks' effectiveness in maintaining ecological integrity and in providing wilderness recreation opportunities.

2.3 Visitor Impacts

The term *impact*, meaning an effect or influence, especially when strong (Barber 1998), can be considered neutral (Lucas 1979). However, when combined with the word *ecological* it refers to the negative environmental effects of recreational use. Likewise, social impacts in the form of crowding, inappropriate behaviour and user conflicts may occur in wilderness recreation settings. Ecological impacts include undesirable changes to soil, vegetation, wildlife and water as a result of recreation. In wilderness areas, ecological impacts are regarded as more serious than in other areas because management objectives generally require high levels of natural integrity (Hammitt and Cole 1998). Most wilderness managers are also mandated to provide satisfactory visitor experience and must attempt to alleviate social impacts as well.

It is important to note that there are exceptions to the above generalization about the negative implication of ecological impacts. Some recreational impacts are intentional - some areas exist specifically for recreation and modifications are made to those areas to accommodate recreational activity (Wall 1989). Although most other impacts are

accidental, not all ecological impacts caused by recreation are negative. For example, soil compaction around the roots of trees may benefit forest viability and low intensities of trampling can stimulate plant growth. The existence of trails opens up forest cover and allows more light through the canopy, thus contributing to an enhanced recreation landscape (Pigram 1983). Furthermore, even among the recreational impacts that are ecologically damaging, while some are immediately obvious, others are only visible with microscopes. Some effects have never been identified or studied (Hammitt and Cole 1998). Therefore, the study of ecological impacts caused by recreation can be as complex and dynamic as the impacts themselves. In spite of the above, most recreational impacts *are* negative and require prevention or mitigation.

Many recreation impacts are individually small but, when assessed cumulatively, are quite substantial. These impacts have been viewed, often erroneously, as relatively benign, particularly when recreation takes place at low densities (Wall 1989). Research has shown that even lightly used areas lose 50-90% of their original ground cover by trampling which may wear out vegetation, compact soil, accelerate erosion, kill shade trees and reduce the amount of barrier vegetation (Douglass 1982; Parks Canada 1981).

The nature and severity of ecological impacts varies according to the amount and type of recreational activity and a site's tolerance for recreation. Different ecosystems respond differently to recreation impacts. Many ecosystems, including some in RMNP, rebound very well while others are more sensitive to disturbance and take longer to recover (Kunec 1986). As numbers of recreationists increase and the variety of recreational types and technologies expands, environmental stresses on recreation areas will likely intensify (Environment Canada 1996).

Graefe (1990) lists five major sets of considerations that are critical to understanding the nature of recreation impacts and that should be incorporated within any program aimed at managing visitor impacts. These considerations apply to both ecological and social impacts.

1. *Impact interrelationships* - There is no single, predictable response of natural environments or individual behaviour to recreational use.
2. *Use-impact relationships* - Most impacts do not exhibit a direct linear relationship with visitor density. Use-impact relationships vary for different measures of visitor use and are influenced by a variety of situational factors.
3. *Varying tolerance to impacts* - Not all areas respond in the same way to encounters with visitors. Some species may benefit at the expense of others

who are negatively impacted or displaced. The same holds true for various recreational user groups. Some groups may enjoy high user densities while other find such use levels unacceptable.

4. *Activity-specific influences* - Some types of recreational activity create impacts faster or to a greater degree than other types of activity. The extent of impact resulting from a given activity can vary according to such factors as type of transportation or equipment used and visitor characteristics such as party size and behaviour.
5. *Site-specific and seasonable influences* - Given a basic tolerance level to a particular type of recreation, the outcome of recreational use may still depend greatly on the time and place of the human activity.

2.4 Direct vs. Indirect Visitor Management Techniques

Techniques used by park and protected area managers to deal with visitor use and impact fall on a continuum ranging from direct to indirect. Direct management controls visitor actions and indirect management alters factors that influence visitor choices. Which management approach is appropriate depends on judgement about the amount of regulation necessary to achieve objectives and the effectiveness of various regulatory or nonregulatory actions in given situations (Lucas 1983).

Direct management emphasizes the regulation of visitor behaviour. Individual choice is restricted and there is a high degree of managerial control. Regulation is the prime example of a direct approach. Types of regulation include:

- increased enforcement (e.g. fines);
- zoning (e.g. prohibiting use at times of high damage potential, prohibiting certain types of activity in sensitive locations);
- rationing use intensity (e.g. requiring reservations); and
- restrictions on activities (e.g. disallowing campfires) (Gilbert et al. 1972).

Direct management can also include "strong suggestions". Persuasion, or "soft suggestions", involves less pressure than "strong suggestions" and bridges the gap between direct and indirect visitor management on the continuum below:

Direct Visitor Management

Enforcement
Regulations
Strong Suggestions
Soft Suggestions

	Design
Indirect Visitor Management	Education and Information (Hendee et al. 1990)

Indirect management emphasizes the influence or modification of behaviour by managing factors that influence visitor decisions. Individual visitors retain the freedom to make choices. Managers exert less control over visitors and allow more variation in use and behaviour. Indirect methods include:

- physical alterations (e.g. campsite maintenance);
- information dispersal (e.g. advertisement and education); and
- eligibility requirements (e.g. entrance fees) (Gilbert et al. 1972).

According to Hendee et al. (1990), direct management should only be used when indirect means cannot achieve management objectives regarding visitor activity and impact. For example, when indirect controls fail to redistribute use as desired, a more restrictive direct-action approach might be in order. Regulation should be used with restraint and only after careful consideration of objectives and alternative techniques and with recognition of the potential limitations on their effectiveness. General guidelines exist for the role of regulation in managing impacts and visitor experiences:

- Do not regulate if effective nonregulatory alternatives exist.
- Try to develop effective nonregulatory visitor management.
- Explain regulations to visitors.
- Regulate at the minimal level needed to solve problems.
- Regulate at the entry level rather than at the activity level within an area.
- Monitor problems and the effects of management actions (Hendee et al. 1990).

However, the notion that indirect management approaches are better than direct approaches has been debated in the literature. McCool and Christensen (1996) found the one-dimensional concept of a direct-indirect continuum to be oversimplified. In fact, some managers have been unwilling to implement direct management actions even if they are the only effective means of dealing with impacts (Cole 1995). Another exception to the notion that direct approaches are not as effective as indirect approaches is the fact that all Canadian national parks implement zoning (see section 2.4.1), a classic direct approach. Hammitt and Cole (1998) suggest that managers evaluate techniques in terms of their likely effectiveness and the burden they place on visitors.

2.4.1 Zoning

Zoning is a common direct management technique that classifies the spectrum of outdoor recreation opportunities and the kinds of facilities, management practices and visitor behaviour appropriate to each type of opportunity (Clark and Stankey 1979; Hendee et al. 1990). Zoning is meant to preserve ecological integrity by protecting park lands and resources with a minimum of human-induced change. The Recreation Opportunity Spectrum can work with zoning decisions by mapping out opportunity classes (Payne and Graham 1993). ROS is, in effect, zoning on a macro scale (Hendee et al. 1990).

In Canada, the national parks zoning system classifies land and water areas according to ecosystem and cultural resource protection requirements and includes the provision of visitor opportunities. The system consists of five types of zones that reflect resource conservation priorities and the level of visitor impact tolerated (Rollins 1993; Parks Canada 1994a):

Zone I - Special Preservation. Specific areas or features which deserve special preservation because they contain or support unique, rare or endangered natural or cultural features or are among the best examples of features that represent a natural region. Access and use will be strictly controlled or may be prohibited altogether.

Zone II - Wilderness. Extensive areas which are good representations of a natural region and which will be maintained in a wilderness state. This zone consists of limited primitive visitor facilities, limited numbers of users, dispersal of visitors and no motorized access.

Zone III - Natural Environment. Areas that are maintained as natural environments and which can sustain a selected range of low-density outdoor activities with a minimum of facilities. Non-motorized access is preferred.

Zone IV - Outdoor Recreation. Areas that can accommodate a broad range of education, outdoor recreation opportunities and facilities in ways that respect the natural landscape. Motorized access is permitted.

Zone V - Park Services. Communities in existing national parks with a concentration of visitor services, support facilities and park administration functions. Motorized access is permitted.

National park management must parallel each of these zones with the appropriate management prescriptions. Parks Canada's Guiding Principles and Operational Policies (Parks Canada 1994a) states that, consistent with maintaining ecological integrity, each national park may offer a variety of outdoor recreation opportunities which conform to the zoning determined in the park's management plan. These opportunities will serve visitors of diverse interests, ages, physical capacities and skills so they can understand and experience the park's natural environment.

2.4.2 Education, Information and Interpretation

Educating visitors is one of park management's most important roles. Providing information about park services, facilities, rules and regulations and cultural and natural heritage is a valuable management strategy that fosters awareness, appreciation, appropriate use and understanding (Parks Canada 1994a). Education should be the first management action. More direct management strategies, such as limiting use, should only be used if education fails to achieve management objectives (Jubenville et al. 1987).

The main purpose of educational programs is to teach visitors appropriate behaviour so environmental damage caused by recreational activities is minimized (Hendee et al. 1990). Visitors should be taught that park rules are not meant to merely prohibit certain activities, but rather to protect fragile or threatened resources (U.S. National Park Service 1997a).

Educating visitors can help managers achieve objectives by influencing where visitors go, what they do and how they do it (Hendee et al. 1990). Education can take the form of *information* dissemination - i.e. public relations and marketing efforts, or *interpretation* - providing essential facts about a park or protected area, its programs and facilities.

The primary purpose of information programs is to inform visitors of behavioural norms, to guide their resource use and to explain *why* certain actions are necessary (Jubenville et al. 1987). Even when these actions require regulation, education is necessary because if visitors understand regulations they are more likely to obey them (Shah 1995; Hendee et al. 1990). In fact, a former U.S. Forest Service Chief said that wilderness management is "80 to 90 percent education and information and 10 percent regulations" (Peterson 1985).

Examples of successful education programs include minimum-impact techniques and the "pack-it-in, pack-it-out" litter control program. Information should also be available to

backcountry visitors on redistributing use, wilderness values, eligibility requirements (e.g. courses in wilderness skills) and fees. It should be possible, through education, to reduce or eliminate ecological damage in campsites and on trails (Hendee et al. 1990).

Interpretation is the translation of an area's natural and cultural history into something meaningful to visitors so they can understand, appreciate and enjoy the area (Jubenville et al. 1987). In doing so, interpretation also conveys park management policies to visitors and promotes management objectives. The assumption underlying interpretation is that awareness leads to understanding which leads to appreciation (Butler 1993). Interpretation should gradually sensitize visitors to the capabilities of park resources so they can adapt their behaviour in such a way that impact is minimized (Hendee et al. 1990). Survival of natural areas is closely tied to people's attitudes, beliefs and way of life (Butler 1993).

Interpretation can take the following forms:

- personal services (involve direct contact between the interpreter and the public)
  - information (telling visitors where facilities and opportunities are located and how to make use of them); and
  - presentation (e.g. guided hikes, evening campfire programs).
- non-personal services
  - visitor centres;
  - exhibits;
  - signs;
  - interpretive trails;
  - publications; and
  - school field trips to the park (Butler 1993).

The Recreation Opportunity Spectrum framework and the Visitor Activity Management Process both automatically include an interpretive component. The Limits of Acceptable Change and Visitor Impact Management strategies can provide the opportunity for interpretive services and activities but this requires a conscious managerial decision (Pugh 1990).

Some general guidelines for the effective use of education and information include:

- Carefully organize and design the message.
- Provide clear rationale for recommended behaviour.
- Identify and understand the audience.

- Time the message delivery appropriately.
- Carefully chose the location for communication.
- Select communication methods that fit the audience, message and situation (Hendee et al. 1990).

In Canada, the Guiding Principles and Operational Policies (Parks Canada 1994a) document provides clear direction for the provision of education and interpretation. It states:

> *"The long-term success of efforts to commemorate, protect, and present Canada's natural and cultural heritage depends on the ability of all Canadians to understand and appreciate this heritage, and to personally adopt practices which are sensitive to heritage and the environment. This is encouraged through a variety of communication, interpretation and outreach programs, and demonstrated leadership at the local, national and international levels."*

Providing visitors and prospective visitors with information and education is a highly acceptable indirect management action. It does not alter the wilderness resource directly nor does it regulate or control visitors. Visitors retain the freedom to choose and their choices are made with more information (Hendee et al. 1990).

There are limits, however, to what can be accomplished through educational programs. Vegetation will still be trampled and soils will still be compacted. Education is not a panacea; instead it is a foundation on which to build a program of other actions which may include dispersal or use limits (Hendee et al. 1990). Both regulation and education can make visitors feel pressured into behaving a certain way. The main difference is that with education visitors retain the freedom to chose their actions without the threat of punishment.

2.5 Prevention

While certain ecological impacts caused by recreation are acceptable, even desirable, as in the existence of trails and campsites, most are negative and must be prevented and/or mitigated. Prevention of impacts can be achieved by careful planning and locating of sites and by good recreation management practices and administrative policies (Douglass 1982).

2.5.1 Site Selection

Since impacts will be minimized on relatively durable sites, management should strive to

locate campsites and trails accordingly. Durability is extremely site-specific and varies from region to region but generalizations can be made (Hammitt and Cole 1998). Factors that influence a site's durability include climate, microclimate (including temperature, aspect, air drainage, exposure, wind, rainfall and position on slopes), topography, soils and water (Douglass 1982).

The existence of overstory trees and the soil's erodibility, drainage and depth are important considerations when selecting a durable campsite for high use. Because tree regeneration is low on campsites, they should be located in stands of relatively young, long-living trees that are not susceptible to disease (Ripley 1965). The durability of ground cover vegetation is much less important because, with heavy use, even resistant ground cover is unlikely to survive. Sites with relatively deep soils and a wide mix of particle sizes (e.g. loams) and at least a moderate amount of organic matter should be selected because they have good drainage and less problems with flooding or excessive runoff and, therefore, less erosion potential. Primarily organic soils should be avoided. However, thick organic horizons minimize the exposure of mineral soils that results from campsite use (Leonard et al. 1981).

Important environmental factors affecting trail durability include topography and erodibility. The slope of the trail and the extent to which the trail intercepts runoff from upslope are particularly important. Trails with steep slopes are likely to deteriorate rapidly unless steps are taken to control erosion. On the other hand, trails with no slope may have drainage problems depending on soil type and the level of seasonal precipitation (Kunec pers. comm.). The best trail locations are on slight grades, on side hills where water will not be diverted onto the trail (Coleman 1981).

2.5.2 Site Construction

Where suitably durable locations cannot be found for trails, engineering techniques such as switchbacks, culverts, bridges, water bars and stepping stones prevent water from running down trails, thus avoiding potential erosion problems (Proudman 1977).

Water bars and steps control erosion and should be part of the original trail construction in order to be effective. They will be much less effective once substantial amounts of erosion have occurred. Water bars, made of wood or stone, are oriented at an angle to the trail and divert water off the tread. Steps are oriented perpendicular to the slope; they slow water down and hold soil. Both are placed closer together and become more important with increases in slope, the amount of water on the tread and soil instability.

There are also construction methods that prevent excessive impacts on campsites and picnic sites. Areas that receive concentrated use can be surfaced and facilities that shield the resource such as tent pads, shelters, fire grates and toilets can be constructed. However, the mandate of wilderness management may prevent this type of surfacing in some areas (Hammitt and Cole 1998).

Silvicultural treatments of overstory vegetation; either before, during or after site development, may improve campsites. Treatments done prior to development such as thinning, sanitation cutting or clear cutting may increase the vigour of the trees depending on the tree species and other site characteristics (Jubenville et al. 1987). It is important to note that while some species require full sun and would benefit from this practice, others require shade to germinate (Kunec pers. comm.). Successive treatments during and after development are based on need, as determined through monitoring (Jubenville et al. 1987).

Mowing trails and campsites is another site construction and maintenance technique that is used to clear vegetation. However, this practice may affect the ability of ground cover vegetation to reproduce successfully (Kunec pers. comm.).

In general, excessive engineering should be avoided in most wilderness recreation areas unless they are necessary and appropriate and meet management objectives for the area.

2.6 Monitoring

Monitoring consists of both measurements taken over time and the systematic gathering, comparing and evaluating of data to understand how things work (Hendee et al. 1990; Croze 1982). In parks and protected areas management, it fulfills both functions. Data on ecosystem structure and function are gathered, compared and evaluated for the purpose of tracking changes over time that may result in loss of ecological integrity.

In ecosystems, not everything can be monitored. Selected indicators are used to demonstrate the state of an ecosystem, including changes over time. These changes may identify trends in conditions that require new management actions depending on their causes. The effectiveness of management strategies can also be determined through this type of monitoring (Nepstad and Nilsen 1993; Hendee et al. 1990). Monitoring of natural resources takes place in most national parks for at least one of the following reasons:

- ongoing routine monitoring for management purposes;
- short-term monitoring to understand and resolve specific issues; or
- research monitoring to better understand park ecosystems (Parks Canada 1994b).

In parks and protected areas management, problems requiring management attention are best identified through systematic, objective monitoring of both ecological and social conditions (Hendee et al. 1990). A carefully designed monitoring program provides the kind of understanding that allows protected areas to be properly managed. Without it, an area is less likely to survive (Croze 1982).

The measurement of human activity is essential to ecological monitoring in parks and protected areas because ecological integrity is understood in the context of human-induced stresses (Parks Canada 1994b). Monitoring human use identifies and quantifies trends in visitor activities, management operations and activities and identifies potential ecological impacts. Monitoring thus serves as an early warning system to inspire appropriate management action and research (Tarleton et al. 1995).

Ecological monitoring of trails and campsites includes the acquisition of detailed knowledge of their locations and conditions. Specific methods include:

- visual estimates of impact (Frissell 1978; Parsons and MacLeod 1980);
- precise field measurements of conditions (Bratton et al. 1978; Schreiner and Moorhead 1979); and
- photography (to compare site conditions).

Monitoring trail and campsite conditions determines trends and whether or not management programs are working. The monitoring system should be based on written standards that describe unacceptable conditions (Hendee et al. 1990). In addition to monitoring ecological impact, quality of the visitor experience can also be evaluated by monitoring encounter levels on trails, campsite solitude and visitor satisfaction.

Management must also monitor the causes of the ecological and social impacts of visitor activity. For example, the number of visitors or motor vehicles entering the park each year or the tonnes of garbage produced each year in the park provide valuable measurements of visitation trends and associated impacts (Tarleton et al. 1995).

While the measurement of human activity in parks and protected areas is essential to ecological monitoring, management follow-up and triggers for action are necessary

(Tarleton et al. 1995). Croze (1982) states that monitoring is:

> *"... a process of data gathering which should, ultimately, produce enough information to be able to control the situation and manage wisely whatever system we happen to be monitoring."*

In parks and protected areas, managers cannot simply collect the data; they must translate the raw data on conditions and trends into the reduction or elimination of negative ecological and social impacts of both visitor and management actions.

2.7 Mitigation

Mitigation techniques are used once monitoring has determined that impact has occurred beyond the designated standard for a resource or visitor experience. Management strategies that deal with the symptoms of recreational impact through maintenance and rehabilitation, rather than those that attack the cause of impact, are generally costly and never-ending. Therefore, they should be complemented with preventative methods. However, there are situations where mitigative techniques are a required element of wilderness management.

Techniques to mitigate resource impacts include visitor management (e.g. diverting visitors) and direct physical actions on the site (e.g. strengthening the site) (Edington and Edington 1986). Social impacts can often be mitigated by the same visitor management techniques used to deal with resource impacts.

2.7.1 Visitor Management

Visitor management involves influencing or regulating visitor behaviour in recreational settings. It includes controlling the location and nature of recreational activity and educating wilderness users.

In addition to locating trails and campsites on environmentally durable sites, managers can control which sites are used at any given time or the number of users at each site. Methods include reducing or eliminating total use (e.g. limiting the number of parties entering the area, closing sites) or leaving amount of use constant while reducing the amount of impact each visitor causes. This can be accomplished in several ways:

- *Use dispersal.* Use can be spread out to avoid areas of concentrated impact.
- *Use concentration.* Conversely, use can be concentrated in space so that only a small proportion of the resource is altered.

- *Type of use.* Particularly destructive uses are minimized or eliminated. For example, recreationists can be taught low-impact camping techniques.

Dispersing use may reduce impact at highly used sites and can be achieved by:

- spreading people out on the same number of sites but with greater distance between parties;
- spreading people out on more sites with or without increasing distance between parties; and
- spreading people out in time (i.e. increasing off season use) with or without changing spatial distribution (Roggen and Berrier 1981).

Concentrating use is another tactic that can be used in campsites and other heavily used areas and can be achieved by:

- reducing distance between parties without changing the number of sites;
- concentrating use on few designated sites whereby users are required to camp on developed sites instead of using some undisturbed area; and
- concentrating use in time (Cole 1981).

In addition to visitor management, these strategies can be implemented through site manipulation. For example, use concentration can be promoted either by requiring visitors to camp at designated sites (visitor management) or by using railings or rocks and shrubbery to confine traffic flow (site manipulation). Generally, the best management approach will consist of a combination of visitor and site management (Hammitt and Cole 1998).

2.7.2 Site Manipulation

Site management involves manipulation of the site itself to influence the spatial distribution of visitor use, to make the site more durable or to mitigate impacts that have already occurred (Jubenville et al. 1987). Methods of site manipulation include modifying or treating the ground surface at concentrated use points to prevent wear or applying silvicultural techniques to replace, repair and maintain vegetation and soil (Douglass 1982). Often, a balanced approach is the better than a single method.

Soil scarification is a technique that loosens topsoil to reduce compaction. This procedure is beneficial for severely overused sites that have suffered from soil compaction, vegetation loss and/or sheet erosion. The effectiveness of other

treatments often depends on scarification so it should be one of the first treatments (Jubenville et al. 1987). However, there are varying degrees of scarification and care should be taken to chose the most appropriate method for each site to avoid damaging the lower soil horizons (Kunec pers. comm.).

Site hardening or shielding, the reinforcement of selected conditions or qualities, makes sites more tolerant of impacts. Examples include paving, fencing or reinforcing the surfaces of heavy use areas with gravel or wood chips to minimize compaction, improve drainage and prevent erosion (Parks Canada 1981; Farrell and Runyan 1991).

In actively managed sites, irrigation of soil benefits heavily deteriorated sites, especially in dry climates. Aerial irrigation is the most commonly used method on recreational sites. Adding commercial fertilizers to the soil to improve plant growth is another mitigation method, but the effectiveness of fertilization depends on soil conditions. Studies have found that the combination of irrigation and fertilization provides the most increase in ground vegetation in campsites (Beardsley et al. 1974). However, these techniques may not be suitable for wilderness campsites that typically receive little or no active management (Kunec pers. comm.)

Exotic vegetation may be used as a surfacing material, to stabilize soil or to improve aesthetics. For example, turf grasses may be planted on a picnic site to replace native vegetation that was destroyed by trampling. However, wilderness management policy often forbids the introduction of exotic species since they may change native species diversity (Jubenville et al. 1987; Kunec pers. comm.).

Once trails experience erosion, modifications can be made to improve drainage. The trail tread can be outsloped and drainage dips can be incorporated into the trail. Outsloping involves building the trail so that the outer edge is lower than the inner edge allowing water to drain off the trail. Drainage dips are short sections of trail built with a grade opposite to the prevailing grade of the trail to provide periodic interruptions of what would be a continuous down-trail channel (Hammitt and Cole 1998). Options for trail drainage and hardening specific to RMNP can be found in Kunec (1986).

The durability of vegetation can be increased through use of cultural treatments such as overstory thinning. As shade decreases, vegetation cover increases and the amount of vegetation loss caused by recreation decreases (Marion and Merriam 1985). Thinning trees may increase the quantity and hardiness of the ground cover and the vigour of the remaining overstory trees and may improve wildlife habitat (Jubenville et al. 1987).

2.7.3 Site Closure and Rehabilitation

Managers of wilderness recreation areas may choose to temporarily close sites to allow them to recover from impact. The sites can be reopened for use once they have recovered. Other recreational sites must be available until the closed sites can be reopened. This is called "rest-and-rotation" of sites and its effectiveness depends upon recovery periods of closed sites and how long it takes for impacts to occur on the open sites (Cole and Ranz 1983). If recovery takes much longer than deterioration, there must be many closed sites for each open site or the number of users in the area must be reduced. Deterioration of sites that have received at least a moderate level of use may take approximately two years. However, recovery periods are much more variable and depend upon such factors as length of the growing season and moisture regime (DeBenedetti and Parsons 1979; Thorud and Frissell 1976). The unintended result of rest-and-rotation may be an increase in the areal extent of impact and, therefore, total impact (Cole 1994).

The permanent closure of some sites may be required to allow complete rehabilitation. Reasons for permanent closure include excessive site damage that cannot be controlled with continued use or a decision to relocate the site to a more durable or desirable location. Cultural treatments such as watering, fertilizing, seeding or mulching can be used to rehabilitate closed sites. However, introducing exotic, trampling-resistant vegetation or overstory thinning to encourage ground cover are not necessary if the site is no longer to be used (Hammitt and Cole 1998). There are five basic steps in rehabilitating closed sites:

1. Keep recreationists off closed sites.
2. Control drainage and erosion on the sites.
3. Prepare the soil to reduce compaction and improve the organic matter content, fertility and moisture content.
4. Plant the sites, where necessary, by transplanting nursery-grown plants or plants from neighbouring areas or by seeding.
5. Maintain the plantings, if necessary, by fertilizing and watering (Hammitt and Cole 1998).

There is a lot of literature and many manuals available on site rehabilitation. Much of this information is tailored to specific ecosystems and should be referred to prior to considering site closure and rehabilitation to ensure that the proper techniques are applied.

2.7.4 Mitigating Social Impacts

Many of the factors causing ecological impacts in recreational wilderness areas also negatively affect visitor experience. Similarly, many of the mitigative techniques applied to reverse the effects on resources may also help alleviate unsatisfactory visitor experiences such as user conflict or feelings of crowding.

Limiting use in wilderness areas is an often used strategy, dating back to the time when the carrying capacity concept led managers to conclude that reducing use would have a proportional affect on reducing both ecological and social impacts. However, recent research has demonstrated that this is not necessarily the case because the relationship between recreational use and ecological and social impacts involves more complex factors than simply amount of use. Causal factors include type of recreational activity, individual visitors' behaviour and desired experience, and durability of the site.

Managers must be sensitive to the many variables that affect the use/impact relationship and must clearly determine causal factors of impact prior to implementing management action. Given the diversity of these factors, limiting use may only rarely be effective in reducing or eliminating impacts. In fact, McCool (1990b) describes limiting use as an intrusive action that contradicts some of the very values of recreation itself. He states that limiting use should only be used as a last resort when all other tactics have failed to mitigate impacts. However, Hammitt and Cole (1998) provide various tactics for limiting use when that is the only remaining alternative:

- Limit entry to an area but allow visitors free choice to move about and change their routes and activities. This can be achieved through trailhead quotas.
- Issue a limited number of permits for specific campsites or zones throughout the area. Spontaneous movement is then hindered because visitors are required to stick to destinations they agreed upon before entering the area. However, administrative costs may increase because wardens must patrol more widely to ensure compliance.
- Require reservations. Visitors tend to accept this widely used method because it allows them to plan ahead. A reservation system can be combined with a first-come first-served technique (queuing) which benefits visitors who live nearby.
- Issue limited permits sold through a lottery system.
- Limit party size. This tactic can reduce potential for social conflicts since large parties can dominate recreational facilities and can therefore contribute to crowding problems.
- Citations and fines for visitors who deviate from their itineraries.

- Limit length of stay by limiting the amount of time visitors can spend in an area. This allows access to more parties.

2.8 Summary

Most literature on managing environmental impacts caused by wilderness recreation is quite current and reflects the principles of ecosystem-based management. It provides several basic frameworks which can be assessed individually or in combination. Referring to these frameworks has proved valuable in developing a backcountry visitor impact management strategy for RMNP. A review of ecological and social conditions in RMNP and management objectives pertaining to those conditions will also be necessary for this purpose and this is done in Chapter 3.

The above review of literature related to this study represents only a partial summary of the current literature. In future chapters, the literature will be reviewed more thoroughly, particularly park-specific documents from various parks and protected areas pertaining to visitor impact management strategies. Findings were integrated when determining an appropriate backcountry visitor impact management strategy for RMNP.

Chapter 3: Backcountry Visitor Impact Management in Riding Mountain National Park

3.0 Introduction

The first part of this chapter presents the current visitation conditions in Riding Mountain National Park as identified in park-specific literature and through discussions with park staff and management. This is followed by a discussion of the policies and management objectives governing and guiding management of the park and the various visitor management actions taken in the park. The final part of this chapter discusses the park's current ecological conditions.

3.1 Visitor Activity

RMNP is a major year-round prairie tourism and recreation area. Approximately 425,000 people visit the park annually. The majority of visitors are from Manitoba and Saskatchewan, but the park is considered an international tourist destination. There is year-round access to RMNP but the majority of visitors come to the park between May and September. A provincial trunk highway and a secondary road and trail system provide vehicle, hiking, cycling and horse access throughout the park (RMNP Round Table 1996).

Wasagaming townsite is the most highly used area of the park and provides numerous developed visitor services (RMNP Round Table 1996). The park's natural environment offers the following visitor opportunities.

Summer:

- picnicking;
- backcountry hiking;
- backcountry camping;
- horseback riding;
- horse-drawn wagon riding;
- cycling;
- swimming;
- fishing; and
- boating.

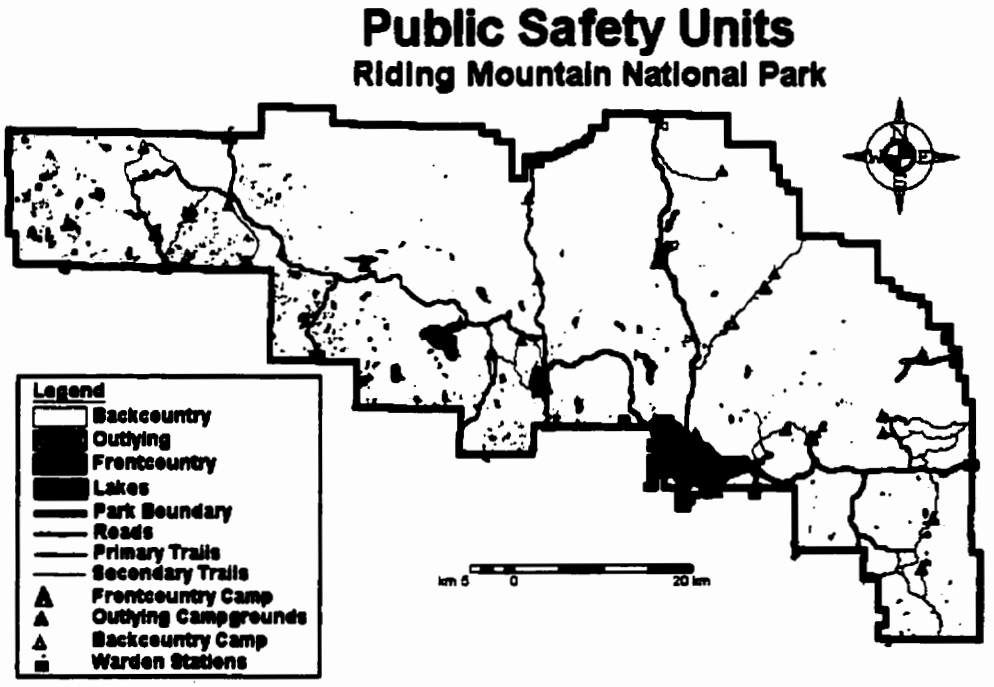

Figure 3.0: RMNP Public Safety Units map showing trails and campsites (Source: RMNP).

Figure 3.1: Facilities provided at the Minnedosa Backcountry Campsite (picnic tables, fire pit, firewood supply).

Figure 3.2: Privy at the Minnedosa Backcountry Campsite.

Figure 3.3: Water supply at the Minnedosa Backcountry Campsite.

Figure 3.4: Bear-proof food storage boxes at the Minnedosa Backcountry Campsite.

Figure 3.5: Hitching rail at the Minnedosa Backcountry Campsite.

Figure 3.6: Horse corral at the Whitewater Lake Backcountry Campsite.

Winter:

- snowshoeing;
- cross-country skiing; and
- alpine skiing (RMNP Round Table 1996).

3.1.1 Backcountry Visitor Activity

RMNP offers visitors more than 50 trails, including 20 backcountry trails. All backcountry trails allow hiking. All but one also allow horse riders and all allow cycling except for two that restrict cycling on some portions of the trail. The unique experience of horse-drawn wagons is allowed on nine trails. There are 15 trails that allow winter skiing. Figure 3.0 is a map of RMNP showing trails and campsites.

There are 21 backcountry campsites which are provided with picnic tables, fire pits, a firewood supply, privies, water pumps and bear proof food storage boxes (see Figures 3.1-3.4). Many also have horse hitching rails and/or corrals (see Figures 3.5 and 3.6). Backcountry campsite users can register to camp in groups. There can be up to 25 horses in one group and up to three wagons. There are currently eight campsites that allow wagons, 12 that allow horses, 19 that allow cyclists and 19 that allow hikers. Two of the campsites were developed for horse users. The combined capacities for the various backcountry campsites for 1998 and the changes to be implemented during the 1999 season are as follows:

	1998	1999
Wagons	24	19
Groups	72	63
Horses	210	170
People	430	420

The reductions in campsite capacities were recommended by RMNP backcountry wardens and approved by the Backcountry Working Group with the intent to improve visitor experience by reducing the number of people at each campsite and to reduce damage caused to sites by horses. In particular, the wardens recommended allowing fewer horses to camp overnight in campsites that have hitching rails but no corral. Horses sometimes chew the hitching rails and paw the ground when tied to the rails. Also, horse users sometimes tie horses to trees rather than tie them to a rail next to another horse. The wardens recommended eliminating wagons on one trail which is

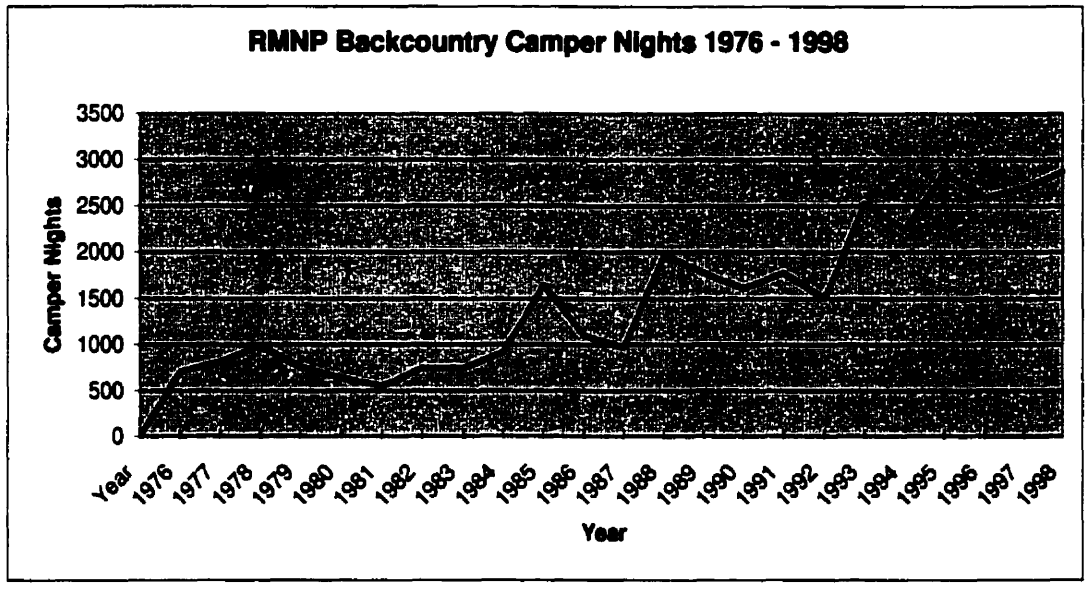

Figure 3.7: RMNP backcountry camping trend from 1976 to 1998 (Source: RMNP).

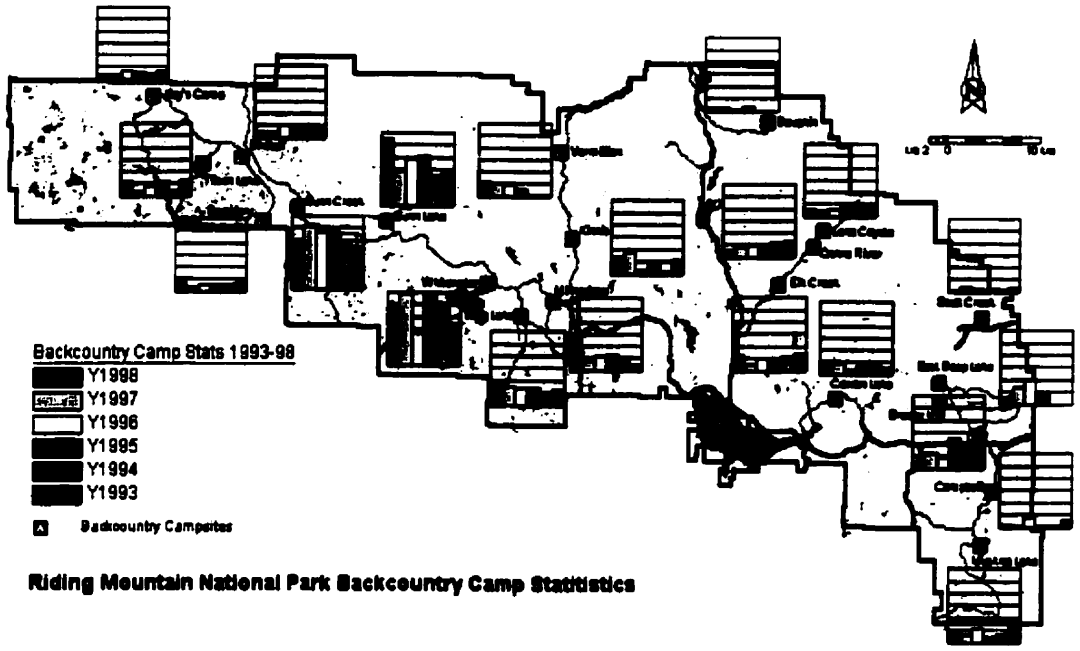

Figure 3.8: RMNP backcountry campsite use from 1993 to 1998 (Source: RMNP).

virtually impassible when wet and the wagons tend to cause ruts on the trail (Kilfoyle pers. comm.).

All backcountry campers must register by completing a Park Use Permit which details the campers' itinerary. The permit indicates the number of people in the party and the number of horses, wagons or bikes if applicable. Campers must also indicate what type of equipment they are using and whether they are first time users or not. The information provided on the Park Use Permit can be used by park management to keep detailed visitor use statistics. This information can also be used to gauge the nature of the activities users are engaging in to determine which activities may be causing impacts.

Beginning with the 1999 season, RMNP backcountry users are required to pay a fee (Riding Mountain National Park 1998). RMNP is one of the last national parks to implement a backcountry user fee (Schmidt pers. comm.).

Figure 3.7 depicts the trend in backcountry campground visitation rates in RMNP over a 22-year period. The trend shows a lot of variations in visitation rates over the years. Some of the lower numbers can be explained by poor weather while some are unexplained. Unfortunately, this data is not entirely reliable because of changes in reporting methods. Backcountry registration used to be done through the warden stations and was less reliable. Currently, all registration is done through a call centre (Schmidt pers. comm.).

Backcountry camping has increased significantly in RMNP in the last 20 years, from under 1000 person nights during the late 1970s and early 1980s to as high as 3000 during 1997. While the person nights per year may rise or fall significantly from year to year due to weather or other unknown factors, the trend in backcountry camping has been steadily increasing. Park permit statistics show that in 1998 there were 2,877 backcountry camper nights in the park. The breakdown between different user types (e.g. hikers, cyclists, horse users, wagons) indicates that horse use is the most popular method of travelling the backcountry, followed by hiking and cycling. Figure 3.8 depicts levels of use of various backcountry campsites from 1993-1998.

People living near the park have expressed a desire for random or primitive camping (i.e. camping in non-designated sites). However, while random camping has not traditionally been allowed in the park, it will be allowed in RMNP's wilderness areas in 1999 on a trial basis (Kilfoyle pers. comm.; Schmidt pers. comm.).

3.1.2 Visitor Profiles

Visitors are a primary cause of impacts to parks and protected areas resources and research suggests that such impacts are a function of visitor behaviour (i.e. activities, spatial and temporal use patterns) in addition to resources characteristics (Hammitt and Cole 1998).

Visitor profiles are available for various backcountry user groups in Canada as well as more specific information for users in RMNP. These profiles provide information on the numbers, preferences and typical behaviour of these users. While this information is somewhat dated and incomplete, it may prove valuable for park managers who are mandated to provide a satisfying backcountry experience to these users while protecting ecological integrity.

Visitor Profiles for Canada

Hikers
Research has shown that most hikers:

- are well-educated and receptive to new ideas;
- prefer little regimentation and limited facility development yet dislike deteriorated facilities;
- dislike excessively crowded areas and encountering large groups of horses;
- dislike hiking for a long time to reach a site easily accessible by other means of transportation;
- prefer areas with scenic views and a variety of terrain and vegetation; and
- dislike a full canopy of trees, very dense vegetation.

It is well known that conflict exists between hikers and horse users. This conflict appears to be at least partially related to trail conditions in that most hikers will accept a certain level of horse use if trails are well maintained (Beswick 1983; D'Amore 1985; Haliburton 1985).

Trail Cyclists
Trail cyclists can be divided into two groups:

1. Hikers wishing to increase their access into wilderness areas; and
2. Bicycle tourists wishing to increase their recreational experiences as well as their geographic range.

Figure 3.9: Hikers on the Manitoba Escarpment (Source: RMNP).

Figure 3.10: A group of horse users travelling together (Source: RMNP).

The first group appears to be the largest (Hollingshead 1984; Bronson 1985; Parks Canada 1986b).

Horse Users
Most horse users:

- are over the age of 22;
- have their own horse; and
- have an annual income of over $12,000 (Iles 1981).

Visitor Profiles for RMNP

Surveys and visitor statistics in the mid 1980s and the 1990s provide information that can be used to develop profiles of the various backcountry user groups in RMNP (Parks Canada 1987; Harris 1998). Results indicated that RMNP backcountry visitors are motivated more by nature and wilderness experiences than by the physical and social aspects of the experience. While users appear to be satisfied with trail conditions, they are less than completely satisfied with the cleanliness of campsites, an attribute most consider very important. Figures 3.9-3.12 depict the main visitor activities occurring in RMNP's backcountry.

Hikers
A 1982 survey of overnight backcountry users (D'Amore 1985) determined that:

- 88% were male;
- 69% were between 25 and 44 years of age;
- 32% had some post graduate education;
- 71% resided in Manitoba; and
- 82% were repeat visitors to the park.

Survey responses to questions on what motivated these users to come to the park's backcountry indicate that the users want a solitary and safe wilderness experience. They are not seeking an adventure. Also, since 96% of the respondents indicated that they would be willing to return to the park, it could be concluded that users were quite highly satisfied with their park experience.

Horse Users
Both private and commercially outfitted riders use the park for day rides and overnight trips. However, the number of outfitters in the park has decreased in recent years as it

Figure 3.11: Mountain biker on Central Trail, an old logging trail (Source: RMNP).

Figure 3.12: Cyclists crossing a log bridge (Source: RMNP).

has become difficult for them to make money (Kilfoyle pers. comm.).

Commercial Horse Users

Surveys results (Parks Canada 1987) determined that most riders using commercial outfitters in RMNP:

- are from outside the local area;
- are inexperienced riders; and
- appreciate certain facilities in the backcountry such as privies, fire boxes and picnic tables.

Most commercial outfitters prefer:

- using backcountry campsites for rest stops on both day and overnight trips;
- hitching rails or corrals for short stops;
- corrals for overnight use, especially if several groups of riders are using the same campsite;
- access to water at campsites; and
- clearing of more existing trails (e.g. warden patrol trails).

Some commercial outfitters would prefer separate horse camps so riders could set up their gear without worrying about infringing on other, non-horse groups in camp.

Private Horse Users

Surveys results (Parks Canada 1987) determined that most private horse users in RMNP:

- are local residents;
- do not have to trailer their horses far (if at all) to enjoy park trails;
- go on day rides rather than overnight rides; and
- view riding as a social activity.

Local riders tend to know the park area nearest to them and their personal history is often attached to the park's history. However, because many of the old trails are no longer cleared for use, some see the park as being closed to local horse use.

Trail Cyclists

Similar to the profile for Canada, there appears to be two groups of trail cyclists at RMNP - those using a bicycle for easier access to backcountry wilderness experiences

and those whose main enjoyment is related to the challenge of the bicycle on the trail. This latter group consists mainly of those who use bicycles in other ways for recreational enjoyment or sport. They may or may not have used backcountry trails for other activities before trail cycling. However, according to questionnaire replies, the majority of overnight users hike as well as cycle in the backcountry (Parks Canada 1987).

The number of day cyclists on backcountry trails is unknown because day users are not required to register before using trails.

A look at use patterns of overnight cyclists during 1986 shows that more cyclists base camp and spend their day cycling in the surrounding area than actually travel in a linear pattern, using a different campsite each night. The present trail system provides long distance alternatives for cyclists. However, the lack of loop trails creates a problem of transportation to and from trailheads and limits some users to return trips rather than longer, one way excursions (Parks Canada 1987).

RMNP Backcountry Survey

A survey of RMNP backcountry users was conducted in 1997 (Harris 1998) to gather information on users' demographic characteristics, priorities, satisfaction levels and willingness to pay for backcountry use. Results included:

- Most backcountry users are between the ages of 35 and 54.
- Backcountry campers appear to be loyal visitors who return often.
- Hiking appears to be the preferred mode of transportation, followed by cycling.
- Reasons for the visit generally relate to nature and the wilderness environment. Physical and social aspects of the experience are less important. The chance to meet new people is considered the least important aspect of visiting the backcountry.
- Few backcountry campers encountered serious problems during their visit. However, the most common complaint was campsite cleanliness. Some users reported conflict between horse users and hikers. The percentage of users reporting these problems was less than 25%.
- Most users reported various campsite attributes (e.g. cleanliness, wilderness appearance, condition, location) as very important to their trip.
- Most users viewed their visit as a fun, enjoyable trip and a recreational experience. Less than half reported that their visit was a learning experience.
- Most users were very satisfied with all aspects of their visit.

Backcountry vs. Day-Use Profile

In 1993, in Colorado's Rocky Mountain National Park, researchers conducted a study comparing the attitudes of backpackers and casual day users towards park management actions, wildlife, and human impacts on natural resources (Flick and Taylor 1998). The study derived the following differences between the two user groups:

- Both groups highly value natural features.
- Backpackers do not appreciate management features that make parks easily accessible (such as paved roads and buildings) while day users do value these features.
- Many more backpackers than day users value campgrounds.
- More day users than backpackers value well-maintained trails. Backpackers are more likely to be satisfied with primitive, narrow or unimproved trails whereas day users are more likely to prefer wide and flat trails.
- Backpackers do not appreciate management features that intrude on wilderness. Conversely, day users prefer improved trails, paved roads and lookouts, various buildings and any other feature that helps them view large areas of the park easily and in physical comfort.
- Viewing human-habituated, roadside wildlife is not an important part of the backpackers' experience whereas day users enjoy the experience and feel that they are seeing animals in what they consider a relatively natural habitat.
- Backpackers have a greater desire for pristine nature and solitude than day users.
- Backpackers are bothered by human impacts whereas day users, who generally spend more time in impacted areas, are somewhat desensitized to impacts such as litter and horse manure and accept these conditions as part of their experience in a wilderness park.
- Backpackers, because of their higher expectations, have more negative impressions during park visits than day users do. This is likely because people who visit a park casually and briefly, spending much of their time driving or taking short day hikes, may enjoy their visit more than people who want an active, wilderness experience.

This information may prove valuable to backcountry visitor management in RMNP in that it provides an insight into the motivations, preferences and expectations of backcountry users.

3.2 Management Objectives

Management objectives are at least partially based on current ecological conditions and visitor activity. They also depend on national park legislation and policy. The National Parks Act, which was last amended in 1998, governs park management. Parks Canada's Guiding Principles and Operational Policies (Parks Canada 1994a) document provides policy guidance for all national parks and includes direction for many different aspects of visitor management. In particular, the policy states:

> *"Parks Canada will use a variety of direct and indirect strategies for managing public use. Examples of direct strategies include zoning, rationing use intensity, restricting activities, and law enforcement. Examples of indirect strategies include facility design, information dispersal, and cost recovery mechanisms."*

The National Parks Act requires all national parks to prepare a park-specific management plan and to review that plan every five years. A management plan guides Parks Canada in the protection, management and operation of a national park. RMNP's Management Plan, completed in 1996, contains a requirement to review the park's Ecosystem Conservation Plan (ECP). This process was completed in 1997 with an updated version of the ECP which identifies specific objectives, resource management actions and specific priorities for maintaining the park's ecological integrity and managing cultural resources as components of the health of the larger ecosystem.

RMNP's Management Plan (RMNP Round Table 1996), ECP and other management documents provide comprehensive guides to the policies and procedures to be followed in the park. For example, the following objectives relate to aspects of visitor management including education, zoning and tourism/marketing.

3.2.1 RMNP's General Objectives

RMNP's vision statement reinforces the park's general objectives and states:

- RMNP should remain representative of Canada's southern boreal plains and plateaux natural region.
- RMNP should be a place where people go to experience wilderness - leaving it unimpaired for future generations.
- Evidence of past use of the Riding Mountain area found within the park should be preserved (RMNP Round Table 1996).

In addition, RMNP's management objectives are framed by the following ten principles

outlined in Guiding Principles and Operational Policies (Parks Canada 1994a):

- ecological and commemorative integrity;
- leadership and stewardship;
- new protected heritage areas;
- education and presentation;
- human-environment relationship;
- research and science;
- appropriate visitor activities;
- public involvement;
- collaboration and co-operation; and
- accountability.

3.2.2 RMNP's Specific Objectives

RMNP's Ecosystem Conservation Plan (Parks Canada 1997a) outlines several specific objectives. The ECP lists a number of long-term ecosystem management goals for the park as well as the management actions and objectives necessary to achieve those goals. These objectives include:

- To produce a Law Enforcement Plan that deals with public safety and ecosystem protection issues. Action required in meeting this objective includes a visitation and visitor activity trend analysis.
- To produce a Backcountry Management Plan that improves both ecosystem protection and visitor management and experience. The Plan will establish methods and processes for collecting trail and campsite condition information and assign responsibility for monitoring. It will set standards for ecologically acceptable levels of visitor use for all trails, campgrounds and day-use sites and will detail mitigation techniques to attain those standards. Action required in meeting this objective includes setting standards, determining trigger levels and data collection.
- To systematically record and monitor the conditions of trails, campsites and picnic sites (e.g. soil compaction, erosion, littering, trampling).
- To assess and deal with the impact of roadways, trails and utility corridors on ecological integrity.
- To contain or eliminate invasive alien vegetation through a Vegetation Management Plan.
- To contribute to ecological integrity by effective communication of policies, principles and plans through a Heritage Communications Plan.

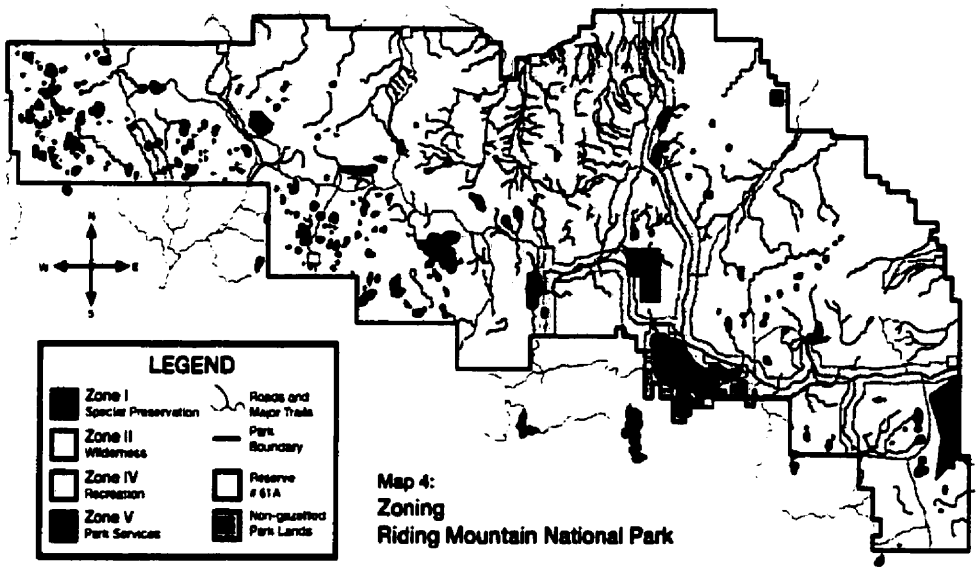

Figure 3.13: RMNP Zoning map (Source: RMNP).

- To enhance tourism benefits in the region surrounding the park.
- To ensure adequate public access into the park.

3.3 Management Action

3.3.1 Education

RMNP is involved in many forms of education, interpretation and presentation of park heritage. Park management intends to use the current programs and to develop new ones to provide residents and visitors with the tools needed to behave sustainably within the regional ecosystem. As previously mentioned, education is a vitally important component of managing visitor impacts on park and protected area ecosystems. The Round Table states in the park's 1996 Management Plan that

> *"RMNP should be a place where people go to experience wilderness - leaving it unimpaired for future generations. It should be a place where the mysteries of nature, of wild lands and wild animals can be studied and explored. These living communities constitute a significant educational resource."*

3.3.2 Zoning

Zoning is an important management strategy used by Parks Canada to maintain ecological integrity and to direct visitor activities to the appropriate areas within the park. Of the five zoning classifications in the national park zoning system, four are represented in RMNP. Their objectives range from full protection through to intensive visitor use. The zoning system sets limits on park usage and provides a statement of management objectives and practices (RMNP Round Table 1996). RMNP's zoning map is depicted in Figure 3.13.

RMNP has four Zone I - Special Preservation areas, constituting approximately 4% of the park. These include remnant stands of fescue prairie, the Shoal Lake Marsh Community, the Manitoba Escarpment and the snake hibernacula. Approximately 91% of the park is represented by Zone II - Wilderness. The perpetuation of ecosystems with minimal human interference is the key consideration of this zone. While motorized access is not permitted, an extensive trail system exists throughout this zone (Riding Mountain National Park 1998). There are currently no Zone III areas in the park. Zone IV - Outdoor Recreation, approximately 4% of the park, is applied to limited areas capable of accommodating a broad range of visitor opportunities. Essential services and facilities are provided in this zone, but consideration is given to reducing impact on ecological integrity. This zone includes roads, campgrounds, picnic sites, trailheads and

three lakes that allow motor boat access. Zone V - Park Services includes the Wasagaming townsite and comprises less than 1% of the park.

The *National Parks Act* (Parks Canada 1998b) provides for the designation by regulation of wilderness areas within a park, consistent with Zone II boundaries. Because wilderness designation requires an Order in Council, any subsequent land use changes in the designated areas would undergo a rigorous review process prior to authorization. RMNP management has expressed concern that certain wilderness areas that are currently classified as Zone I or II should undergo such a designation in order to enhance protection of those areas.

3.3.3 Study Groups

In order to meet management objectives pertaining to visitation, the RMNP Round Table recommended the creation of two Study Groups - a Recreation Study Group (RSG) and a Tourism/Marketing Study Group (TMSG). The Study Groups' roles are to assist the Round Table in completing aspects of the management plan related to recreation and tourism/marketing opportunities in the park area, respectively.

The RSG will gather sufficient information to provide a complete picture of the park's recreation facilities and programs and analyze the recreation opportunities currently available in order to discover any deficiency of opportunity or experience. The RSG will then develop and advise the Round Table on the long- and short-term goals for the provision of recreational opportunities to park visitors and the monitoring and mitigation of potential impacts. The RSG's vision statement states:

- There will continue to be a wide range of appropriate recreation activities in the park. The impact of these facilities and activities will be mitigated so the ecosystem is unimpaired.
- There will be opportunities for people to recreate in a natural setting to gain a feeling and respect for the environment.
- There will be optimal preservation of cultural and visual experiences so as to maintain a sense of continuity for the enjoyment of repeat visitors and newcomers who seek the park's unique character.

The TMSG is mandated to pay special attention to the possible effects of future RMNP tourism/marketing initiatives on the integrity of the park's ecosystems. The group will review, discuss and analyze existing tourism/marketing strategies and develop a plan that includes ecotourism opportunities.

3.3.4 Backcountry Management

In RMNP's Ecosystem Conservation Plan (Parks Canada 1997a), the development of a strategy for monitoring the condition of the park's trails and campsites is listed as a management objective. The trails and campsites are currently monitored on an operational basis for such impacts as soil compaction, erosion, littering and trampling. In 1987, the RMNP Backcountry Trail Plan outlined methodologies for systematic recording of trail conditions. However, this plan was never fully implemented. A Backcountry Campsite Monitoring Framework was developed in 1994 and last revised in 1996 (Collen 1996). However, the park has yet to perform any formal campsite monitoring (Vanderschuit pers. comm.; Malcolm pers. comm.).

Backcountry Trail Plan

This plan (Parks Canada 1987) develops trail standards and maintenance requirements for each type of trail and campsite in RMNP in order to ensure visitor safety and satisfaction and protection of natural resources. While each type of trail and campsite (e.g. hiking, horse use, cycling) will have different standards and maintenance guidelines, most are used by more than one user group. Therefore, the appropriate standards are those for the activity demanding the highest level of maintenance. For example, due to the nature of the activity, the requirements for cycling trails are more restrictive than those for hiking and riding trails.

Hiking and Horse Use Trails

- Original minimum cleared width should be 8-10 feet (2-3 metres) with a regularly maintained minimum width of 5 feet (1.5 metres), particularly in areas of deciduous forest cover and hazel understory. Maximum width may be reduced to 5 feet (1.5 metres) in meadow areas and through stands of coniferous forest.
- Mowing practices should limit the trail narrowing that results from hazel regrowth by mowing to one side of the trail centre on each pass.
- Trail tread should be well-drained and consist of a natural or hardened surface.
- Water running across or along trail surfaces should be eliminated by using log, wood or stone water bars or ditching.
- Corduroy, culverts, bridges or boardwalks will be used to create a dry surface tread in unavoidable areas of poor drainage.
- Maximum grade should be less than 15%.
- Avoid grades of 25% or more.

- Adequate signage (in accordance with Parks Canada's Sign Manual) will indicate direction and distances of trails and campsites.
- Pit privies should be installed no less than 30 metres from a body of water.
- Carrying capacity (i.e. maximum number of campers per night) for existing backcountry campsites will be reviewed periodically by the Warden Service.
- Prior to any major rerouting of a trail or initial trail construction, consideration will be given to providing a minimum line of sight in dense forest or bush to reduce the number and severity of unexpected bear encounters.

Hiking Trails

- Corduroy should be constructed from logs on site to provide a dry crossing in large areas of poor drainage.
- Raised and secured split log bridges should be placed to one side of the trail to allow for the passage of trail maintenance equipment through smaller areas.

Developed Hiking Trails and Campsites

- Campsite facilities will include privy, fire box, wood supply, wood shed, well or natural water source and picnic tables.
- Creek crossings will consist of bridges or culverts depending on maintenance requirements and the nature of the water body. Sites where natural crossings are safe may not require any structures.
- Trails and campsites will be mowed and brushed as needed.
- Trails will be checked and campsites will be maintained at least three times per season.

Primitive Hiking Trails and Campsites

- Campsite facilities will include privy and natural water source, fire box, wood supply and wood shed.
- Creek crossings will be located where no structure is required.
- Areas where vegetation regrowth inhibits use of facilities will be mowed and brushed every two years.
- Trails will be checked and campsites will be maintained once per season.
- Trailhead and junction signage and blaze markers will be used where necessary to ensure that trail users can identify trail locations.

Horse Use Trails

- Upward clearance should be 10 feet (3 metres).
- Corduroy will be constructed to provide a dry surface in large areas of poor

drainage or where horses have widened the trail to avoid poor surface conditions.

- Corduroy will be built from pressure-treated planks or logs and secured to stringers.
- Logs will be covered with fill to provide a flat surface for horses and to increase their life span. Pressure-treated planks may be covered or not, depending on the availability of fill and how easily it can be delivered to the site.
- A soil separation blanket or textile should be used to ensure the corduroy or surface remains dry.
- Natural creek crossings are preferred, followed by culverts and bridges.

Developed Horse Use Trails and Campsites

- Campsite facilities will include privy, fire box and wood supply, wood shed, well or natural source of water, picnic tables and corrals (preferred) or hitching rails.
- Trails and campsites will be mowed and brushed as needed.
- Trails will be checked and campsites will be maintained at least three times per season.

Primitive Horse Use Trails and Campsites

- Campsite facilities will include privy, natural water source, fire box and wood supply. Riders will be required to hobble or picket their horses.
- Trails will be checked and campsites will be maintained once per season.
- Trails and campsites will be mowed and brushed every two years in areas where vegetation regrowth inhibits use of facilities.
- Trailhead and junction signage and blaze markers will be used where necessary to ensure that trail users can identify trail locations.

Backcountry Cycling Trails

- No new trails will be provided for the sole purpose of cycling.
- Cyclists should be able to pedal at least 80% of any designated trail.
- Overall grade should be 5-7%. Short pitches of 15-20% are acceptable.
- Maximum elevation gain for a full day ride should be 700 metres.
- Cleared and maintained width should be 8 feet (2.5 metres) to allow for passing and avoiding obstacles.
- Trail tread should be well-drained and consist of small gravel or compacted soil. A trail should not have more than 20% of its length composed of mud, large gravel, eroded or rutted soils, exposed roots or rocky material.

- Corduroy will be used to provide a dry surface tread in areas of poor drainage or mud. Corduroy can be made of pressure-treated planks (with or without fill) or logs covered with fill.
- Culverts or bridges should be provided at creek crossings.
- Water running across or along trail surfaces will be eliminated through the use of log, wood or stone water bars or ditching.
- Visibility should be such as to prevent a high number of accidents with other trail users.
- Length for an average day trip should be 15-20 kilometres, but the opportunity to travel as far as 50 kilometres should be provided.

Developed Cycling Trails and Campsites

- All backcountry cycling trails are classified as developed.
- Campsite facilities will be the same as those for developed hiking campsites.
- Trails will be checked and campsites will be maintained at least three times per season.
- Trails and campsites will be mowed and brushed as required.

Trail and Campsite Maintenance Guidelines

- Trails with saturated surface conditions will not be maintained until they have dried out enough to allow maintenance vehicle passage without causing damage to the trail tread.
- Major clearing and brushing of primitive trails will be done after freeze-up. Major backcountry ski trails will be brushed out annually.
- Day use trails will receive the most intensive maintenance, followed by overnight trails. Primitive trails will receive the least intensive maintenance.
- Maintenance vehicles allowed on backcountry trails and roads will be limited to those not licensed for road travel.

Monitoring

- Backcountry facilities will be monitored on an ongoing basis by the trail crew.
- Environmental conditions along backcountry trails and campsites will be monitored by the Warden Service.

At the time of this plan, several trails and campsites were added or removed to the park's backcountry trail system. Also, the backcountry roads were in the process of being permanently closed to vehicular use.

Monitoring the Riding Mountain Bio-Region

In 1995, a report on monitoring in the RMNP bio-region was developed (Dubois 1995). The report provided monitoring goals pertaining to ecological integrity and data collection and discussed approaches to monitoring for ecological integrity using various indicators. The report listed the following desirable properties of ecological integrity indicators:

- valued ecosystem components;
- conceptual frameworks (e.g. stress/response ecosystem model);
- externalities (e.g. climate, air pollution);
- early warning capability; and
- reproducibility and objectivity.

The report also listed the following criteria for selecting indicators for monitoring:

- clarity;
- scientific credibility;
- technical feasibility;
- early warning capability/responsiveness to change;
- spatial representation;
- flexibility;
- issue orientation; and
- multidimensional assessment: individual > population > species composition > trophic structure.

Backcountry Campsite Monitoring Framework

This framework (Collen 1996) was developed for RMNP when it became evident that backcountry campsite conditions were unacceptable and that monitoring and management action were required. It is a tool to aid park management in maintaining both the natural and cultural integrity of the park's backcountry campsites. The framework consists of the following stages:

- Review the current policies for backcountry campsite conditions.
- Set backcountry campsite standards.
- Establish criteria for backcountry campsite evaluation.
- Select factors and indicators that reflect backcountry campsite conditions.
- Conduct campsite evaluation and data collection.

- Recommend and implement remedial action.
- Monitor campsite conditions and remedial action.
- Develop a communications strategy.

When the framework was developed, the intention was to evaluate backcountry campsite conditions and the effectiveness of remedial action for two years in order to determine the scope of the program. The monitoring program was to eventually evolve into an ongoing process. While this plan was never implemented, components will be incorporated into the backcountry visitor impact management strategy developed in this study.

Backcountry Management Strategy

The Backcountry Management Strategy (Riding Mountain National Park 1998) will provide for both ecosystem protection and visitor activity management and will include the following:

- methods and processes for collecting trail and campsite condition information;
- assignment of responsibility for monitoring;
- standards for ecologically acceptable levels of visitor use for all trails, campgrounds and day use sites; and
- mitigation techniques to attain those standards.

The Backcountry Working Group is a sub-group of the Recreation Study Group with a mandate to provide recommendations and input into the development of RMNP's Backcountry Management Strategy and into backcountry operational issues. The group, consisting of park wardens and managers and members of external stakeholder groups, advises the park on the following issues pertaining to the Backcountry Management Strategy:

- backcountry use standards;
- limits of acceptable use;
- monitoring user impact;
- ensuring quality visitor experiences;
- communication with backcountry users;
- volunteer backcountry maintenance and research programs;
- user needs forecasting; and
- trail maintenance.

The Backcountry Management Strategy will focus on permitted human activities in Zones II and IV. The locations of these activities include all backcountry trails, campsites, staging areas, parking lots, trail heads and the park boundary which may be used as a trail. The Strategy's Mission Statement is as follows:

> *"The Backcountry Management Strategy will address and recommend solutions to backcountry issues in order to provide meaningful, enjoyable and safe backcountry opportunities to visitors of Riding Mountain National Park with a minimal impact on the ecology of the area."*

The Backcountry Management Strategy will deal with the following backcountry issues:

Ecological Integrity

- trail maintenance standards;
- all-terrain vehicles;
- impacts of wood supply provision and trail maintenance; and
- ecological monitoring .

Provision of a quality recreation experience

- reviewing the trail system;
- camping opportunities (i.e. random camping);
- fishing opportunities;
- pets;
- dog sledding;
- facilities (i.e. cabins, shelters, picnic tables);
- user conflicts;
- trail signs and information;
- reservation/quota system;
- camping fees; and
- communication (Riding Mountain National Park 1998).

The Backcountry Management Strategy has identified the following specific concerns:

- Some campsites are overused and are suffering environmental damage. A method of restoring these sites while still allowing some amount of use is required in order to minimize ecological impact, maintain aesthetic appeal and allow continued use of the campsites. This issue ranked 1st out of 21 identified issues.
- Concurrent camping groups often lead to campsite degradation and a reduced camping experience. Appropriate limits at each campsite are the recommended

solution to this problem which ranked 2nd out of 21 identified issues.

- RMNP needs a monitoring system to assess and record the amount of damage over time at each backcountry campsite to prevent campsites not already suffering impacts from becoming degraded. This issue ranked 3rd out of 21 identified issues.
- Backcountry user groups require better access to information on correct methods of backcountry use in order to reduce conflicts among different user groups. This issue ranked 5th out of 21 identified issues.
- The current backcountry permitting system needs improvement. Backcountry campers should be informed of the use limits at each site before registering. This issue ranked 6th out of 21 identified issues.

The backcountry visitor impact management strategy developed during this study will address many of these issues and the BWG will be involved in implementing the strategy.

3.4 Ecological Conditions

RMNP's Ecosystem Conservation Plan (ECP) describes the park and its surrounding region as a biologically diverse area. The park's size allows many - but not all - normal ecological processes to function, while the surrounding agricultural lands retain enough remnants of their original habitat to harbour some wildlife and native vegetation (Parks Canada 1997a).

RMNP's current ecosystem structure was shaped by millions of years of climatic and geological forces, particularly glaciation. The region's dominant topographic feature is the Manitoba Escarpment - the abrupt transition from the Manitoba Lowlands to the first prairie level, the Saskatchewan Plain. The greatest change in elevation, approximately 365 metres (1200 feet) over a distance of six kilometres, occurs in the northeast corner of the park. Glacial action, meltwater and subsequent erosion have produced a hummocky landscape with many small lakes and some deeply-cut stream channels (Parks Canada 1997a). Features such as meltwater channels, morainal ridges, rounded depressions and the relict beach lines that mark the ancient shorelines of glacial Lake Agassiz illustrate the work of Quaternary glaciers and fluvial processes in sculpting the landscape.

3.4.1 Species Composition

The overlap of three life zones - grasslands, aspen-oak and mixed wood ecosystems -

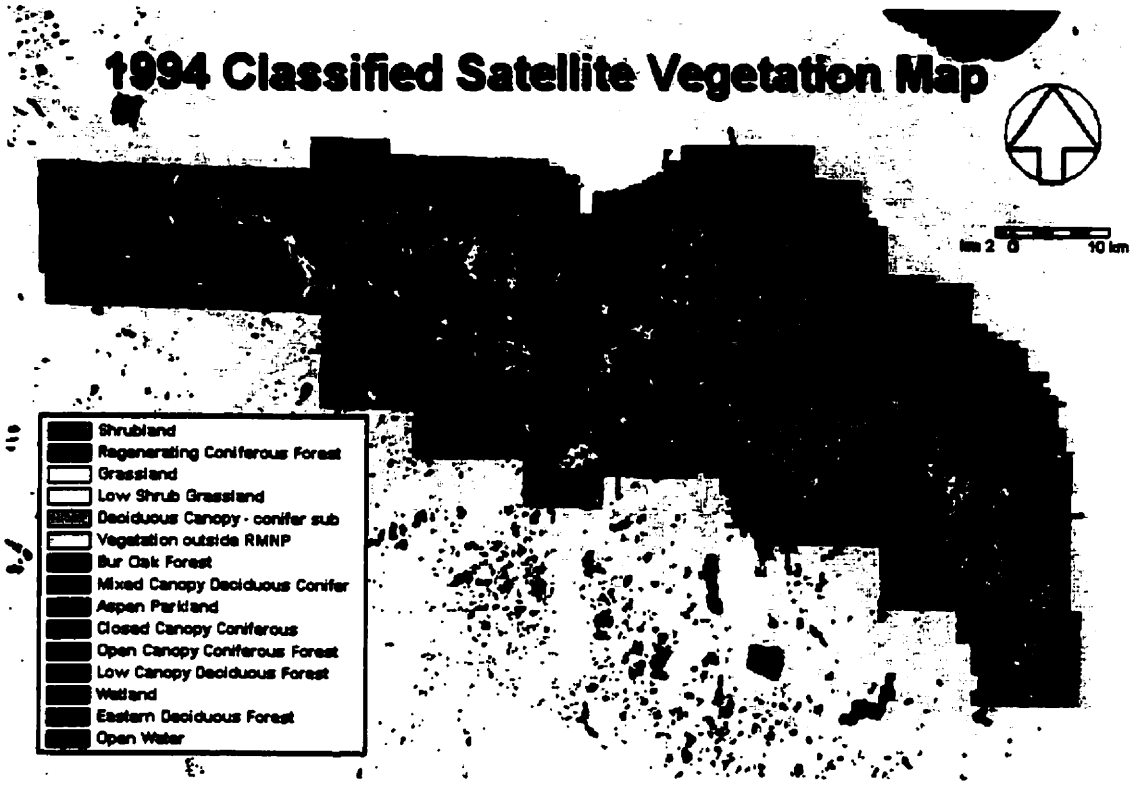

Figure 3.14: Satellite image of vegetation communities at RMNP (Source: RMNP).

occurs in the park. These life zones produce a unique and diverse assemblage of plants and animals. An essentially complete natural food chain is present in the park. Summit carnivores such as wolf, fox and lynx prey on species such as ungulates and small mammals. Scavengers, invertebrates and bacterial agents of decomposition and nutrient recycling complete the food web (RMNP Round Table 1996).

There are 57 known mammal species in RMNP. All but two of these are native species. The house mouse and the Norway rat are exotic species. There are 6 known amphibian species, 27 known fish species and 4 known reptile species. RMNP and the surrounding region are home to over 250 bird species (Parks Canada 1998c).

As depicted in Figure 3.14, there are a variety of vegetation types in RMNP ranging from grasslands and shrublands to various deciduous and coniferous communities, bur oak forest and aspen parkland. There are over 700 known species of vascular plants in the park (Parks Canada 1998c).

The lowlands and the escarpment slopes consist of a plant community dominated by a variety of deciduous trees, particularly trembling aspen. Hardwood mixes of elm, green ash and Manitoba maple with some aspen, bur oak, birch and balsam poplar are characteristic of this community. The warm, moist microclimate and uneven-aged stands promote a lush understory of herbs and shrubs.

The aspen-white spruce association of the boreal mixed wood forest, at various stages of succession, covers most of the park. White birch and balsam poplar share the even-aged aspen stands while balsam fir and bur oak occupy north and south-facing slopes respectively. Black spruce and tamarack grow in the wet bogs and jack pine persists over a limited drier, better-drained area in the east-central portion of the park. The understory is dominated by beaked hazel shrubs. Remnant grasslands are found in the east and west portions of the park. The rough fescue prairie vegetation communities in the central and western areas of the park constitute the more easterly distribution of rough fescue in Canada. While some sites are resistant to succession, a lack of fire converts many grassland areas to the shrub and forest communities of aspen parkland.

The park's ecosystems are made up of various landforms such as rock outcrops, valleys, slopes, lowlands and highlands which combine with soils and climate to create the region's unique species composition and ecological processes. This diversity gives each of the park's ecosystems the ability to maintain itself and to adapt to changes in other components of the environment (Parks Canada 1997a).

RMNP is home to several rare or threatened species. However, the status of most plants and animals in the park is sketchy because there is a shortage of inventories for many species and a lack of monitoring for those for which park management does have basic information (Parks Canada 1997a).

Park management does not believe that any species of plant or animal have ever been extirpated from the park since its founding. However, several species were eliminated through hunting or trapping that occurred between the time the area was settled and when the park was established. These included bison (*Bison bison*), plains grizzly (*Ursus arctos*), pine marten (*Martes americana*), fisher (*Martes pennanti*) and possibly woodland caribou (*Rangifer tarandus).* RMNP has reintroduced some of these species to the park. A captive bison herd, consisting of approximately 30 animals, is located in a fenced-in enclosure near Lake Audy. Pine marten and fisher were also successfully reintroduced (Parks Canada 1997a).

Some of the RMNP region's bird species are at risk of extinction.

- *Birds that are endangered in Manitoba and/or Canada that may be found in RMNP*
  Loggerhead Shrike (*Lanius ludovicianus*) eastern population
  Baird's Sparrow (*Ammodranus bairdii*)

- *Birds considered threatened in Manitoba and/or in Canada and found in RMNP*
  Loggerhead Shrike (*Lanius ludovicianus*) prairie population

- *Birds considered vulnerable in Manitoba and/or in Canada and found in RMNP*
  Eastern Bluebird *(Sialia sialis)*
  Short-eared Owl *(Asio flammeus)*

3.4.2 Threats to Ecological Integrity

The 1997 State of the Parks Report (Parks Canada 1998a), in assessing the various stressors reported by RMNP management, assigned RMNP's overall ecological integrity a ranking of four on a scale of five (with one being least stressed and five being the most). RMNP management, therefore, faces numerous challenges in its mandate to maintain ecological integrity while also providing for a reasonable and sustainable level of social and economic vitality in the park (Parks Canada 1997a). Challenges may originate externally or from within park boundaries.

Figure 3.15: Evidence of trampling at the Long Lake Backcountry Campsite.

Figure 3.16: Damage to vegetation at the Kinnis Creek Backcountry Campsite.

Regional Context

RMNP is part of a larger regional setting which consists of various land uses and activities such as agriculture, hunting and forestry. This creates a challenge for park management who must maintain ecological integrity within a system that physically interacts with the region outside its boundaries. For example, bears, elk, moose, wolves, coyotes and other fur bearers regularly wander outside park boundaries where they are no longer protected from hunters (Parks Canada 1997a).

A 1992 Parks Canada survey questioned the parks on the state of their regional ecosystems, particularly stresses that have significant impact on ecological integrity. RMNP, including the surrounding region, reported stresses from the following sources:

- visitor/tourism facilities;
- exotic vegetation, fish and invertebrates;
- utility corridors;
- urbanization;
- dams;
- agriculture, pesticides;
- sport fishing and hunting, poaching;
- acidic precipitation;
- mining, heavy metal pollution;
- vehicle/animal collisions; and
- solid waste (Parks Canada 1997a; RMNP Round Table 1996).

To meet regional challenges to species that are important to RMNP's ecological integrity, park management participates in co-operative management with neighbouring jurisdictions, agencies and landowners (Parks Canada 1997a).

Park Visitors

While humans have lived in the Riding Mountain region for over 11,000 years, they have not caused significant stress to the region's ecosystems until the last century. The number of people in the region has increased and the type of land use has changed (Parks Canada 1997a). The influx of people to the park creates a need for infrastructure and facilities to service cottagers and visitors to the frontcountry (i.e. roads, the townsite and nearby facilities, day-use trails). Popularity of backcountry use creates a need for trail and campsite maintenance. Figures 3.15 and 3.16 depict backcountry campsites in RMNP that exhibit signs of trampling and vegetation

destruction caused by a high level of use.

Visitors to both the frontcountry and the backcountry may cause varying levels of damage to the integrity of ecological and cultural resources. However, visitors are only one of the groups of people of concern to park managers. Others include park staff, people working in park communities, local residents and cottagers, interest groups and ultimately, society at large (Manning and Wang 1998).

RMNP management has cited the following potential ecological stresses that may be caused by visitor activity in the park's backcountry:

- vegetation destruction by trampling;
- soil compaction;
- trail bed erosion;
- trails incising into cultural deposits;
- displacement or deterioration of surface remains;
- wear and tear on built heritage and cultural resources;
- ground disturbance caused by land and facilities development;
- littering; and
- vandalism or looting of structures or artifacts (Parks Canada 1997a; RMNP Round Table 1996).

Park managers have indicated that some of the park's backcountry trails have deteriorated due to unsuitable original trail alignment, poor design, levels and types of use and inadequate maintenance. Sites of trail deterioration can be identified by such readily visible characteristics as trail widening beyond the original trail cut, the presence of ruts and parallel trails, the loss of plant cover from the trail surface and erosion of the trail surface that exposes rocks or tree roots (Kunec 1986).

Various literature on ecological impacts cites, in addition to the above-mentioned stresses, the following impacts caused by backcountry recreation:

Soil

- Burning campfires may destroy organic matter and change soil chemistry (Fenn et al. 1976).

Vegetation

- Campers building campfires may remove large pieces of wood which play an important ecological role (Hammitt and Cole 1998).

- Trees may be scarred by axe marks, lantern burns, and nails and limbs or bark may be removed to use as kindling (Cole 1982).

Wildlife

Direct Impact

- disturbance or harassment of animals (Hendee et al. 1990)

Indirect Impact

- habitat modification (Hammitt and Cole 1998)

The results of both direct and indirect impact of backcountry users on wildlife may result in changes in animal physiology, behaviour, reproduction, population levels, and species composition and diversity (Foster 1985).

Types of Users

The nature, severity and distribution of impacts in the backcountry depend on the amount and type of use and a site's tolerance for recreation (Environment Canada 1996). Hendee et al. (1990) state that the following groups can be ranked in order of decreasing environmental impact:

1. Large parties of horse users;
2. Small parties of horse users;
3. Large parties of overnight campers;
4. Small parties of overnight campers using wood fires;
5. Large parties of day hikers;
6. Small parties of overnight campers using camp stoves and not building wood fires; and
7. Small parties of day hikers.

This list demonstrates that the potential to cause impact varies with party size (large vs. small), type of user (overnight campers vs. day hikers), behaviour (using wood fires vs. camp stoves) and mode of travel (horse users vs. hikers).

While travel on mountain bikes is popular in RMNP, little information exists on the ecological impacts of mountain bike use (Ramthun 1995). Trail erosion and expansion are the most common type of resource impact caused by mountain bikes (Hammitt and Cole 1998).

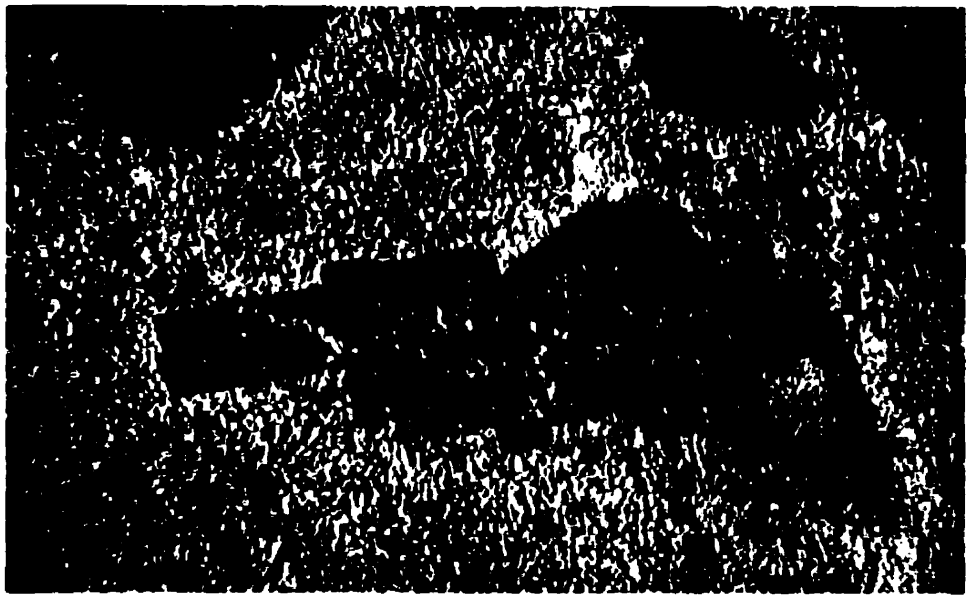

Figure 3.17: Infrared Satellite Image of RMNP (Source: RMNP).

Figure 3.18: The Central Trail demonstrates how large trails can contribute towards habitat fragmentation.

In RMNP, the use of horses, horse-drawn wagons and vehicles have contributed to the deterioration of trail conditions more than the current level of hiker use, particularly under moist soil conditions (Kunec 1986). Recreational impacts on ground vegetation by grazing and trampling by horses are more severe than those caused by human trampling for several reasons. First, horses weigh much more than humans and their weight is concentrated on a small bearing surface. Second, shod hooves substantially gouge and rip the ground. Finally, stock are often tied to trees where they will paw up the ground and cause erosion and tree root exposure. Rope burns on tree trunks leave scars and can kill small trees. These impacts exert a great deal of pressure on both vegetation and soil. Grazing can therefore lead to loss of vegetation cover and changes in species composition (Cole 1981). However, while horse and wagon users generally cause more impact than hikers or cyclists, there are individual differences within each group (i.e. there are horse users that are sensitive and hikers that cause a lot of impact).

To prevent and mitigate the stresses caused by backcountry visitors, RMNP has revised the backcountry trail and campsite system and maintenance practices and the Warden Service is currently developing a Backcountry Management Plan (Parks Canada 1987; Riding Mountain National Park 1998).

Habitat Fragmentation

Park management is concerned about the effects of habitat fragmentation which results from natural processes (e.g. fire) or human activities. Fragmentation causes many plants and animals to become isolated from the next nearest populations of those species and may result in species extinction. Landscape fragmentation caused by land use and infrastructure is recognized as one of the most serious threats to biodiversity (Noss 1992). However, the edge conditions created by habitat fragmentation may attract some species thus resulting in increased biodiversity. Habitat fragmentation will ultimately result in a shift in species composition as some species will be lost, some will remain and some will be gained (Smith 1992).

RMNP's Ecosystem Conservation Plan (Parks Canada 1997a) cites both large and small scale habitat fragmentation as a management concern. The RMNP region has experienced large scale fragmentation and is often called an island of wilderness within a sea of agriculture. This is starkly evidenced in satellite images of the park (see Figure 3.17). The park is also vulnerable to small scale fragmentation caused by roads, trails, golf courses and other human developments which isolate portions of the natural landscape from other similar habitats (see Figure 3.18).

There are approximately 200 kilometres of roads in RMNP. They directly affect less than 1% of the park area. However, the effects of roads (e.g. habitat fragmentation, chemical and noise pollution, drainage alterations) are known to exceed the physical dimensions of the immediate roadway. Therefore, the impacts on surrounding flora and fauna may be extensive. However, these impacts and their causes are difficult to determine (Riding Mountain National Park 1998).

There are over 500 kilometres of maintained trails in the park's frontcountry and backcountry. The trails are used for hiking, cycling and horse travel. Over 200 kilometres of trails are maintained in the winter for cross-country ski use. There are 21 backcountry campsites along the trail system (Riding Mountain National Park 1998).

RMNP management, in its Ecosystem Conservation Plan, outlines a plan to determine and to mitigate the impact of roadways, trails and utility corridors on the park's ecological integrity. There are no current plans to expand these facilities within the Park (Parks Canada 1997a).

Invasive Alien Plants

Another management concern in RMNP is the existence of invasive alien plant species - those that are not native to the area and have been introduced by human activity. The term 'invasive' indicates that a species can move into a habitat, aggressively reproduce and displace some original components of the ecosystem. Alien plants and seeds are introduced and spread by activities such as importing soil, gravel and rock materials for road and trail maintenance; backcountry hiking; trail mowing; and horse use by wardens and park visitors (Parks Canada 1997a).

The 1997 State of the Parks Report (Parks Canada 1998a) states that 107 exotic plants have been introduced to RMNP's ecosystems. Kentucky bluegrass and smooth brome grass were introduced to the park when cattle and horses grazed on the park's native prairies prior to the late 1960s. These invasive plants still displace native plants and reduce the prairie's overall diversity. Leafy Spurge is another problematic alien plant that presently covers more than 50,000 hectares in Manitoba and is present on agricultural lands surrounding the park. Park management is attempting to find a method to control the outbreak of this invasive plant. Several other alien species are of concern in and around the park, including scentless chamomile, caragana and a variety of tree species (Parks Canada 1997a).

RMNP's proposed Vegetation Management Plan will contain an inventory of invasive

alien plants and methods to identify the pathways of plant invasions and to monitor and mitigate these species (Parks Canada 1997a).

3.5 Conclusion

Existing information on RMNP's current ecological and visitation conditions and the related management objectives and actions provide the background for the development of a visitor impact management strategy for the park's backcountry. Park staff can also provide additional information that is not currently available in park-related literature but will be invaluable in the application of the backcountry visitor impact management strategy.

Chapter 4: Methods

4.0 Introduction

Various methods were used in this study including a literature review and informal interviews with the management and staff of RMNP and of other parks and protected areas. The following is an overview of the steps that were followed. Detailed descriptions of the process and outcomes of each method are provided in Chapter 5.

1. Existing RMNP documents (e.g. the Park Management Plan, the Ecosystem Conservation Plan, Backcountry Survey results, the draft Backcountry Management Strategy) were reviewed and RMNP staff and management were consulted. The objective was to establish existing management objectives and to extract information relevant to visitor behaviour and preference and ecological conditions in the backcountry.

2. A determination of which parks and protected areas to review was made by consulting with RMNP staff and management and conducting a literature search. For example, the literature review revealed that several U.S. national parks have implemented visitor impact management strategies such as LAC, VIM and VERP or modified versions of these strategies (see Section 4.2 Initial Review Criteria). Much information on park-specific strategies is readily available on the Internet. Furthermore, a draft report on human use management initiatives in parks and protected areas throughout Canada and the rest of the world, particularly in Parks Canada, provided a valuable starting point in selecting areas for review (Kachi 1999).

3. A description of visitor impact management methods was derived through a library and Internet search and a review of recent parks' and protected areas' documents and plans. Information collected on parks and protected areas included:

    - the nature of the park or protected area's management structure (e.g. U.S. national park, Canadian national park, provincial or state park, other protected area);
    - the nature of the park or protected area's mandate (e.g. ecological integrity, high intensity visitation);
    - number of visitors;
    - main visitor activities;

- type of landscape/ecosystem;
- type and severity of visitor impacts; and
- type of visitor impact management strategy.

In addition to park-specific literature, various academic literature sources on visitor impact management methods including prevention, monitoring and mitigation techniques were reviewed.

4. A comparison of a selected sample of parks' and protected areas' visitor impact management methods was conducted in order to reveal alternatives available to RMNP. Generally, only parks and protected areas with similar mandates; numbers of visitors; and types of visitor activities, landscapes/ecosystems and impacts were compared. However, strategies used in other parks and protected areas were considered if they could be modified to fit RMNP's situation. The result of the comparison was a compilation of possible strategies and methods that may be used in RMNP.

5. An overall visitor impact management strategy was developed for the RMNP backcountry as a result of the above assessment which included discussions with RMNP staff and management. The strategy will allow managers to:

   - derive management objectives for the backcountry campsites and trails;
   - prevent impacts from occurring;
   - monitor to determine if the management objectives are being met at each campsite and trail;
   - determine at what point impacts are unacceptable; and
   - mitigate impacts that do occur.

4.1 Justification of Methods Used

The methods for this study were developed in a logical procession derived from the purpose and objectives of the study. Methods used are within the norms of what other researchers have done in similar reviews.

An interactive, adaptive approach to research is described by Nelson (1991) who recognizes that research objectives and methods often change mid-stream for a variety of reasons and encourages researchers to include information on lines of inquiry that were not followed and why.

This study was interactive in that the final outcome is a product to be used by a client with a variety of concerns, particularly legislative and policy considerations and stakeholder interests. The study was also adaptive in that both the objectives and methods conceived in the original research proposal were modified during the course of the research.

The original proposal called for a rigorous comparison of various components of parks and protected areas, such as those described in section 4.2 below. However, discussion with RMNP staff and management and the author's initial review of the park-specific literature revealed that a rigorous review was unnecessary. Instead, a more informal review of the park-specific literature and comparison with RMNP was conducted. The focus of the study switched from the comparison to the final product, the development of a backcountry visitor impact management strategy for RMNP.

4.2 Initial Review Criteria

Due to the limitations of available time and resources to conduct this study, only those areas with certain things in common with RMNP were looked at in depth. For example, parks and protected areas had to have a significant visitor component and similar types of visitor activities, landscapes/ecosystems and visitor impacts to be considered for this study. Northern and other remote or seldom visited parks did not have much to offer this study. Likewise, parks and protected areas used in this study had to have a formal visitor impact management process in place. It was also necessary that the mandate of the other parks and protected areas be similar to that of RMNP as it relates to visitation and visitor activity. By comparing parks and protected areas that are similar to RMNP in these and other areas, this study was able to assess the relevance of other methods of visitor impact management to RMNP and its conditions and objectives.

Chapter 5: Results, Analysis and Discussion

5.0 Introduction

A great deal of park-specific, agency and academic literature was reviewed for this study. In addition, Riding Mountain National Park management documents and staff were consulted while developing the backcountry visitor impact management strategy. The results of each step in the process of developing the final strategy are detailed below and include the analysis of the data collected. This is followed by a discussion of specific issues raised by RMNP management and a general discussion of the study results.

5.1 Results and Analysis of Data Generated from Each Method

5.1.1 Review of Current RMNP Conditions and Management Objectives (Method 1)

Review existing RMNP documents and consult with RMNP staff and management in order to establish existing management objectives and to extract information relevant to visitor behaviour and preference and ecological conditions in the backcountry.

The results of this review are summarized in Chapter 3. The management documents provided an overview of the park's characteristics and management objectives. Discussions with park staff and management provided more specific information on backcountry use such as the number of visitors and their activities and a sense of how visitors behave and what they want and expect from their experience in the park's backcountry. Staff consulted included the backcountry wardens involved in developing the park's Backcountry Management Strategy. These wardens have the intimate knowledge of the backcountry and are familiar with the opinions of users and other stakeholders through their involvement with the Backcountry Working Group. Other park staff consulted included those involved in land use planning, frontcountry operations and ecosystem-based management.

5.1.2 Parks and Protected Areas Selection (Method 2)

Determine which parks and protected areas to review by consulting with RMNP staff and management and conducting a literature search.

Much of the information on various parks' and protected areas' visitor impact management strategies was found on a random basis through Internet searches. Parks

chosen for review included:

- Canada's four mountain parks (Banff, Jasper, Kootenay, Yoho). These parks have done much to implement visitor management methods, including impact management, because of the high level of visitation occurring there.
- Various other national parks and other protected areas in Canada have piloted projects on LAC, ROS, VIM and other site-specific monitoring strategies.
- The U.S. NPS pioneered the VERP strategy and implemented it in at least two national parks - Arches and Zion.
- Other Canadian and U.S. parks or protected areas have implemented ROS, LAC, VIM or combinations of these strategies.

While the author attempted to review a sufficient number of parks and protected areas, there may be other parks with visitor impact management strategies that were unintentionally overlooked.

5.1.3 Review of Various Visitor Impact Management Strategies (Method 3)

Conduct a library and Internet search of various visitor impact management methods and review recent parks' and protected areas' documents and plans. Include the following information:

- *the nature of the park or protected area's management structure (e.g. U.S. national park, Canadian national park, provincial or state park, other protected area);*
- *the nature of the park or protected area's mandate (e.g. ecological integrity, high intensity visitation);*
- *number of visitors;*
- *main visitor activities;*
- *type of landscape/ecosystem;*
- *type and severity of visitor impacts; and*
- *type of visitor impact management strategy.*

In addition to park-specific literature, review various academic literature sources on visitor impact management methods including prevention, monitoring and mitigation techniques.

The academic literature pertaining to visitor impact management in parks and protected areas was reviewed prior to the park-specific literature and is discussed in Chapter 2. This large body of literature is found in documents prepared by federal departments and agencies responsible for land management and by academic researchers. In addition, much has been written about various techniques for preventing visitor impacts, monitoring to determine if the visitor management strategy is effective and techniques to restore damage caused by visitors. Much of this information will be incorporated into

the backcountry visitor impact management strategy developed for RMNP in Method 5. However, not all visitor management frameworks are applicable to this study and this is discussed below.

Recreation Opportunity Spectrum (ROS)

While the Recreation Opportunity Spectrum (ROS) is commonly used throughout the U.S. and to a limited extent in Canada, it does not directly lend itself to the task of managing visitor impacts on a site-specific basis. ROS largely exists to derive recreation opportunities for visitors to parks and protected areas by defining a variety of physical, social and managerial settings. RMNP already has a zoning system and an established backcountry trail and campsite system in place. In addition, the Recreation Study Group and Tourism/Marketing Study Group are tasked with analyzing recreation and tourism/marketing opportunities in the park. While ROS may prove valuable to the mandates of these study groups, its focus is beyond the scope of this study.

Visitor Activity Management Process (VAMP)

While the VAMP framework was developed by Parks Canada, many Canadian national parks are no longer applying this strategy to their planning processes as it was originally conceived. Many park managers are using other planning frameworks to achieve the goals that VAMP was designed for (Nilsen pers. comm.).

A Visitor Activity Services Plan, in the VAMP framework, was prepared for RMNP in 1988 (Kunec 1988). The plan was approved and some issues were addressed (Vanderschuit pers. comm.). However, during the 1990s, RMNP management moved away from visitor activity planning and towards a more streamlined approach (Penny pers. comm.).

Like ROS, VAMP deals with providing visitor opportunities in national parks. It does not directly focus on visitor impact management. For the purposes of this study, RMNP management are looking for a site-specific, easy-to-use strategy for managing visitor impacts.

Limits of Acceptable Change (LAC)

Unlike ROS and VAMP, LAC focuses more directly on visitor impacts. It provides a step-by-step process for comparing current conditions to standards representing acceptable conditions and taking action when there is a discrepancy. LAC also relies on

public involvement in decision making regarding backcountry use, a concept very important in RMNP. However, LAC largely focuses on a regional perspective and RMNP management has indicated that they require a process that focuses on individual trails and campsites within the park's backcountry. Despite this one discrepancy between the framework and RMNP management's needs, LAC does have a lot to offer RMNP's backcountry visitor impact management strategy.

Visitor Impact Management (VIM)

The VIM strategy is very similar to LAC in that it follows many of the same steps leading to management action. In some respects, VIM is more suited to visitor impact management in RMNP's backcountry in that it provides for very site-specific analysis and attempts to determine the causes of impacts. This causal analysis is a tool to help managers prevent future impacts. However, VIM does not incorporate public involvement as does LAC. This is a shortcoming for RMNP's purposes in that public involvement is a large part of decision making in the park.

Visitor Experience and Resource Protection (VERP)

VERP is largely a synthesis of LAC and VIM. It attempts to manage visitor impacts at a site-specific level and incorporates public input in the process. VERP was developed specifically for national parks experiencing ecological and social impacts caused by visitors. While the visitor impact problem in RMNP may not be as bad as in the U.S. national parks or the Canadian mountain parks, a strategy such as VERP may help RMNP management prevent visitor impacts in the park from reaching that level. VERP is a simple, easy-to-use strategy that incorporates prevention, monitoring and mitigation of impacts.

Of the five strategies discussed here, LAC, VIM and VERP contain the criteria for developing a backcountry visitor impact management strategy for RMNP. It is important to note that much of the protected area planning in the U.S. is conducted based on these strategies. The U.S. Forest Service uses the LAC strategy in the majority of its protected area planning and the National Park Service has adopted VERP to guide General Management Planning of U.S. national parks (McCool 1996). Components of these three strategies will be further discussed when developing RMNP's backcountry visitor impact management strategy in Method 5.

Park-Specific Literature

Many parks and protected areas with various strategies in place or in development were reviewed. However, based on the above analysis of the five primary visitor management strategies, parks and protected areas who have implemented ROS or VAMP will not be considered for further review. Parks and protected areas that have used LAC, VIM, VERP or other similar strategies will be reviewed further. In addition, various technical reports such as monitoring strategies will also be considered. The following list presents the strategies considered in the preliminary review and includes strategies which were subsequently dismissed as irrelevant to this study.

Parks Canada (National Parks, National Park Reserves):

- Recreation Impact Monitoring of Coastal Campsites in Gwaii Haanas National Park Reserve/Haida Heritage Site
- Managing for Wilderness Conditions on the West Coast Trail Area of Pacific Rim National Park
- Lake O'Hara Trail Monitoring Program in Yoho National Park
- Understanding Transboundary Effects on Visitor Opportunities in Two Canadian National Parks (Yoho National Park and Pukaskwa National Park)
- Kootenay National Park Backcountry Management Plan
- Banff National Park Backcountry Management Plan
- Banff National Park Management Plan Summary
- Minnewanka Area Plan, Banff National Park
- Banff -Bow Valley Study, Banff National Park
- Touchstone Tourism Destination Model, Banff National Park
- Jasper National Park Management Plan
- Monitoring Human Use Impacts in Auyuittuq and Ellesmere Island National Park Reserves
- Defining, Monitoring and Managing Valued Components of Experiences in the Kingsmere Wilderness Area of Prince Albert National Park

Other Parks or Protected Areas in Canada:

- Kelso Conservation Area, Ontario

National Park Service, U.S.:

- VERP in Zion National Park
- VERP Implementation Plan for Arches National Park
- Shenandoah National Park Backcountry/Wilderness Management Planning Framework

- Grand Canyon National Park Draft Wilderness Management Plan

Other Parks or Protected Areas in the U.S.:

- Glennallen Field Office

Parks or Protected Areas in Australia:

- Tourism Optimisation Management Model (TOMM) on Kangaroo Island

5.1.4 Comparison of Various Visitor Impact Management Strategies (Method 4)

Compare a selected sample of parks' and protected areas' visitor impact management methods in order to reveal alternatives available to RMNP. Generally, compare only parks and protected areas with similar mandates; numbers of visitors; and types of visitor activities, landscapes/ecosystems and impacts. However, consider strategies used in other parks and protected areas if they may be modified to fit RMNP's situation. The result of the comparison is a compilation of possible strategies and methods that may be used in RMNP.

The following broad criteria, originally discussed in Chapter 4, were used to determine which parks' and protected areas' visitor impact management strategies are possible alternatives for RMNP's backcountry:

- Parks and protected areas whose strategies may be used in this study must have a formal visitor impact management strategy and/or monitoring plan in place. Furthermore, this strategy must provide for managing impacts at a site-specific level rather than a park-wide or regional level.
- Their mandate must be similar to that of RMNP as they relate to visitation and visitor activity. That is, the protected area must provide opportunities for backcountry visitor activity, but protecting ecological integrity must be its primary goal.
- The nature of recreational impacts - ecological and social - must be similar to those in RMNP's backcountry. For this to occur, the type of activities allowed and the type of ecosystem must be similar to that found in RMNP.

The following matrix states whether or not the strategies mentioned above meet these criteria. Since all of these areas have a similar mandate to RMNP, this criteria will not be assessed in this matrix. A particular park or protected area that does not meet all three criteria will be considered for further review only if components of the strategy may still be applicable to RMNP.

Table 5.0 Assessment of the applicability of various visitor impact management strategies to RMNP

Strategy	Formal Visitor Management Strategy (Y/N)	Site-Specific Focus (Y/N)	Similar Activities and Impacts (Y/N)
Gwaii Haanas National Park Reserve/Haida Heritage Site	Y	Y	N
Pacific Rim National Park	Y	Y	N
Yoho National Park - Trail Monitoring Program	Y	Y	Y
Yoho National Park - ROS Pilot Project	Y	N	Y
Pukaskwa National Park - ROS Pilot Project	Y	N	Y
Kootenay National Park	Y	Y	Y
Banff National Park	Y	Y	Y
Jasper National Park	Y	Y	Y
Auyuittuq and Ellesmere Island National Park Reserves	Y	Y	N
Prince Albert National Park	Y	Y	Y
Kelso Conservation Area	Y	Y	Y
Zion National Park	Y	Y	Y
Arches National Park	Y	Y	Y

Strategy	Formal Visitor Management Strategy (Y/N)	Site-Specific Focus (Y/N)	Similar Activities and Impacts (Y/N)
Shenandoah National Park	Y	Y	Y
Grand Canyon National Park	Y	Y	Y
Glennallen Field Office	Y	Y	N
Kangaroo Island	Y	Y	?

Based on the above matrix, the following parks' and protected areas' strategies have been eliminated from further review:

- Gwaii Haanas National Park Reserve/Haida Heritage Site is visited mostly by people travelling by boat, canoe or kayak who then camp on or near the shoreline. There is very little inland hiking. Visitors are encouraged to camp at sites that show little or no impact from previous campers; that is, random, dispersed camping is the norm. Therefore, the nature of impacts on this coastal ecosystem are much different than in RMNP where camping is allowed in designated sites only. In addition, campsite monitoring at Gwaii Haanas requires extensive use of an existing Geographic Information System (GIS) designed specifically for the reserve (Peregoodoff 1998a; 1998b; Parks Canada 1999). The technology involved in campsite monitoring at Gwaii Haanas is not currently in use at RMNP for this purpose.
- While management of Pacific Rim National Park is similar in focus to that of RMNP, the majority of the park's visitor activities and impacts are located on coastal areas. Therefore, management focuses on the unique nature of visitor experiences and impacts on this ecosystem (Rollins 1998).
- A pilot project was conducted at Yoho and Pukaskwa National Parks to employ the ROS framework to assess visitor opportunities in a spatial, regional context. The result was a set of opportunity areas for the two parks, ranging from frontcountry to wilderness. In addition, the project attempted to demonstrate the key roles played outside park boundaries by human presence, modifications and infrastructures in determining the nature of recreation opportunities within both parks (Payne et al. 1997; Payne and Nilsen 1998). Since RMNP management will not be developing opportunity areas in the park at this time, the ROS

framework is not applicable in developing a site-specific backcountry visitor impact management strategy.

- Auyuittuq and Ellesmere Island National Park Reserves are located in Canada's far north. As such, they receive few visitors (Ellesmere Island receives 65-100 hikers per year; Auyuittuq receives 400-500 hikers per year) and there are few formal hiking trails (Sahanatien 1998). In addition, the arctic ecosystem found in these two reserves is vastly different from RMNP's ecosystem. The basic framework used to monitor human use in these two reserves is not unlike processes used in other parks and protected areas that are more similar to RMNP.
- Kangaroo Island in Australia was used to develop the Tourism Optimisation Management Model (TOMM). While this model was based on the Limits of Acceptable Change framework, it operates at too broad a focus to be useful for this study. The TOMM framework "describes how the most favourable economic, marketing, visitor experience, social/cultural and environmental situation for the community and the tourism industry can be achieved" (Crinion and McArthur year unknown). While TOMM does incorporate monitoring and management action to achieve desired conditions for impacted sites, the information available on TOMM does not add to what other frameworks provide. In addition, there was little available information on the TOMM framework.

The following strategy does not meet all the criteria but has components that still have something to offer a backcountry visitor impact management framework for RMNP:

- The Glennallen Field Office has implemented the LAC strategy on a wild and scenic river (U.S. Department of the Interior 1999). While the type of recreational activity and the nature of impacts differ from RMNP, the plan provides valuable information on defining desired future conditions for an area. Examples are provided in section 5.1.5 that RMNP management can use to derive desired future conditions for RMNP's backcountry.

Conversely, the following parks have strategies that meet the applicable criteria and were reviewed, but it was found that their strategies were lacking in the structure desired in this study. In particular, the four mountain parks in the Canadian Rockies were given an initial review but did not add any value to the development of a site-specific backcountry visitor impact management strategy for RMNP. As well, the ecosystems found in these parks differ from those in RMNP.

Canada's Four Mountain Parks

Canada's four Rocky Mountain national parks - Banff, Jasper, Yoho and Kootenay - are a designated UNESCO World Heritage site and are the most heavily visited parks in Canada. While there are differences in visitor management in the four parks, there is a move towards consistency and harmonization. There are several aspects to visitor management in these parks, including:

- Backcountry Management Plans;
- Minnewanka Area Plan;
- Banff-Bow Valley Study;
- Heritage Tourism Strategy;
- Human Use Management Plan; and
- Lake O'Hara Trail Monitoring Plan, Yoho National Park.

Because of the wide recognition that these parks are experiencing severe visitor-related impacts, it was expected at the beginning of this study that the four mountain parks would have a formal backcountry visitor impact management strategy and would therefore provide a certain level of guidance in developing a strategy for RMNP. However, the parks as a whole are not currently using a systematic strategy for managing impacts at the site-specific level.

The Minnewanka Area Plan (Parks Canada 1993) incorporates the LAC framework into the area's largely frontcountry and aquatic areas as well as its cultural resources. This plan used the existing zoning scheme to reflect the opportunity classes called for in the LAC process as well as adding sensitive ecological areas.

Currently, a single backcountry management plan is being developed for all four mountain parks. However, this plan is still under development and is not available for public distribution at this time. While the parks are currently relying on their existing backcountry management plans, it is too soon in the process of developing the new plan to determine what will change from the former plans which are almost a decade old (Gorrie pers. comm.). These plans make reference to such visitor impact management concepts as standards and monitoring and state that trails and campgrounds will be monitored to compare conditions with standards which vary for different levels and types of use. Where standards are not being maintained, mitigative actions are implemented through backcountry maintenance. However, these plans do not provide an easy-to-use framework to achieve management objectives regarding visitor impacts.

The Banff-Bow Valley Study was conducted during the mid 1990s to address issues of human use in the ecologically significant Bow Valley. The Task Force that conducted the study concluded that both a heritage tourism strategy and a Human Use Management Plan be developed for the park. The tourism strategy, known as the Touchstone Tourism Destination Model, focuses on providing visitor opportunities that emphasize education, understanding and appreciation while preserving ecological integrity (Belland and Zinkan 1998). It involves partnership with the tourism industry and does not address site-specific visitor impact management. This is to be addressed in the Human Use Management Plan currently in development (Banff-Bow Valley Task Force 1996; Parks Canada 1997b).

Currently, the only component of visitor management in the four mountain parks that will be given further consideration in this study is the trail monitoring program in the Lake O'Hara area in Yoho National Park. This will be discussed in the following section.

The following strategies provide useful information that will be considered in developing RMNP's backcountry visitor impact management strategy. However, there is a caveat in that these strategies are still in various stages of development and minimal information on their successes and/or failures in implementation is available.

Yoho National Park

Photodocumentation was used to monitor trail conditions in the Lake O'Hara area of Yoho National Park (Abbott 1997). Thus far, data has been gathered for over ten years. The process began with developing an accurate yet reproducible system of baseline data. Eighty seven photo stations were scattered over 70 kilometres of trails. Pictures were taken at all photo stations between 1983 and 1986 then again between 1992 to 1994. The intervening ten years is evidenced by each stations' photo-pair - a set of black and white photographs taken from the same vantage point.

In addition to the photographic database, five of the photo stations are further monitored by transect profiles - a cross-section technique measuring trail surface wear. These methods provide managers with detailed information regarding how trail conditions, including level of compaction, material loss, tread shift and trail widening have changed in the intervening ten years. Once the data has been analyzed, trails are classified as degrading, stable, reworked properly, reworked poorly or rehabilitating. Information on required improvements in also included in the analysis.

To preserve the visitor experience during the monitoring process, the transecting

technique involves a system of countersunk pins to mark station locations. Nothing is visible from above ground and the station is built up from the ground for each monitoring event. To save time and money, only a small percentage of the stations also undergo the transecting procedure.

While this monitoring system was used mainly in treeless alpine environments, users of this method state that it has also worked well on heavily forested trails. In addition to the resource condition data, socioeconomic data is also collected to fully document trail conditions.

Prince Albert National Park

Prince Albert National Park in Saskatchewan has been described as having much in common with RMNP in terms of size, ecology and visitation. A number of visitor and management surveys were conducted to determine what visitors to the park's Kingsmere Lake area felt were important parts of their experience and what managers felt were important issues in managing this area. The survey results were used to develop indicators and standards which were incorporated into a modified LAC framework for managing the area. The author of the study felt that the LAC strategy developed for the Kingsmere Lake area is consistent with Parks Canada's policy and management directions. The research also resulted in a monitoring program to monitor changes in conditions of each indicator (Tucker 1998).

The LAC strategy developed for the Kingsmere Lake area contains a number of modifications from the original framework:

- The original LAC strategy suggests that a variety of wilderness conditions may be acceptable within larger wilderness areas. These opportunity classes were not used in this study since the study area was located within Zone II Wilderness. Each campground within the study area was treated equally and expected to have similar resource and social conditions. RMNP management has also indicated that it will not apply opportunity classes to the park's backcountry.
- The author of the Kingsmere Lake study felt that the initial step of the original LAC strategy - identifying area concerns and issues - was a managerial step that did not include public input. The study included both the public and management in this step.
- The author of the Kingsmere Lake study felt that managing for different standards for various sites within a wilderness area is not feasible.

- One of the main goals of the original LAC strategy is to have users define the point at which the condition of various indicators would begin to affect their experience. However, the author felt that managers' views of the acceptable resource conditions should be given higher regard as they are better able to determine when resource conditions are at a detrimental level. Users may not be as likely to recognize the seriousness of particular resource conditions. However, users are more likely to be able to define acceptable conditions for social indicators as they are directly influenced by the social conditions during their visit. The author therefore concluded that user surveys should be used to determine social indicators and knowledgeable managers should select resource indicators.

The steps followed in the modified LAC framework for the Kingsmere Lake area were:

1. Define the study area both in terms of geography and guiding policy.
2. Identify values for the area specified by both users and managers.
3. Define acceptable social and resource conditions suggested by both managers and users.
4. Inventory current conditions.
5. Recommend a monitoring strategy.

The results of the user and manager surveys were used to describe five measurable values and associated indicators:

Quiet and solitude
- group size
- number of encounters
- noise from other users
- noise from motors

Natural landscape
- vegetation damage
- natural scenery

Range of opportunities
- range of activities

Access
- level and character of access

- time required

Facilities and level of service
- public safety
- campground conditions
- facilities provided

A social inventory was conducted by reviewing registration data such as group size, activity and camping location. A resource inventory was conducted by surveying the vegetation pattern in the area's campsites and campgrounds using a transect method.

The monitoring plan states that the park's Warden Service will monitor resources using the same methodologies used in the resource inventory and Visitor Services will monitor social conditions by collecting user data and conducting visitor surveys (Tucker 1998).

RMNP may wish to consider components of this strategy to aid in developing indicators and standards, to determine methods of conducting resource and social inventories and to develop a monitoring plan.

Kelso Conservation Area

The Kelso Conservation Area, located near Milton, Ontario, receives over 100,000 recreational visitors every summer and approximately the same amount of people use the Conservation Area's downhill ski facilities. The area, largely owned by the Halton Region Conservation Authority, is approximately 400 hectares of mostly forested escarpment land and includes 14 kilometres of escarpment trails for hikers and mountain bikers.

One significant difference exists between this recreational area and RMNP in that Kelso management strives to increase visitation to the area and to expand the recreational opportunities provided there. They are conducting an aggressive marketing strategy.

Kelso management uses the VIM strategy to manage and protect the site's natural resources from overuse caused by recreational activity. Several zones have been established with the goal of dispersing recreation use throughout the area while protecting resources and visitor experience. Kelso's VIM strategy is oriented towards encouraging the rehabilitation, linking and re-establishment of habitat areas to encourage flora and fauna diversity and distribution. The application of the plan to the Kelso area is still underway (Kelso 1998). Therefore, no information exists on the plan's

successes or failures.

Arches and Zion National Parks

Arches was the first park to develop and implement the VERP strategy (U.S. National Park Service 1995) which has since been adopted by the U.S. NPS as a standard visitor impact management strategy. Zion soon followed with its own VERP plan (U.S. National Park Service 1997b). As previously mentioned, VERP is a site-specific impact management strategy. The framework was described briefly in Chapter 2 and many details are included in Section 5.1.5 and will not be repeated here.

Arches National Park's 1989 General Management Plan required that a visitor use management plan be completed when visitation exceeds the projected visitation for the year 2005. This occurred in 1991 and the VERP implementation plan was developed in response. The Arches VERP process started in 1992 and was developed with considerable public input as was the Zion plan. While Arches is very different ecologically than RMNP and the visitor experience may be quite different, the VERP strategy was developed to deal with many of the same problems that RMNP managers face or wish to be prepared to face regarding excessive visitor impacts on resources and visitor experiences.

Shenandoah National Park

Shenandoah National Park (U.S. National Park Service 1998) uses a combination of the LAC and VIM strategies for management and planning in the park's backcountry. The park's strategy incorporates the following six steps:

1. *Determine prescriptive management objectives.* In this step, the park described the specific physical, biological and social conditions that park management seeks to create, restore or maintain within backcountry areas. Opportunity classes and their corresponding management objectives were described using the ROS model.
2. *Describe indicators of change.* The ROS model was used to identify and describe biophysical and social indicators which provide an evaluation of the specified management objectives. Indicators were selected based on such criteria as reliability, feasibility and expense of measurement.
3. *Formulate standards.* Public input was used to develop these subjective value judgements which specify the limits of acceptable change and establish a measurable reference point to which future conditions can be compared. Where

possible, management intends not only to define the standards as a static number but to identify the rate of change that is not to be exceeded. The standards, developed using the ROS model, were derived from the management objectives and are quantifiable.

Prior to implementing Step 4, Shenandoah management conducted social and resource inventories. A survey of backcountry visitors was planned in order to collect a variety of sociological information. Prior to completion of the survey, previous survey information was used. Resource baseline conditions for campsites were obtained through previously conducted surveys and a trail survey was planned.

Management has indicated that the standards must remain flexible because they may be revised pending completion of the social and resource inventories. Management states that they will strive to keep conditions from deteriorating to the level of the standards.

4. *Monitor conditions.* The park will develop and implement standardized monitoring programs to compare current conditions with each indicator. Monitoring methods will include sociological surveys, impacted campsite monitoring and trail condition monitoring.
5. *Compare biophysical and sociological conditions to standards.* Monitoring data will periodically be compared with standards. If monitoring detects negative changes in conditions, appropriate preventative management actions will be taken. If the standards are exceeded, management may consider more drastic actions. The underlying causes of the problem must be identified and appropriate corrective actions will be selected.
6. *Implement management action.* Once actions are selected, they will be implemented. Continued monitoring will be essential to determine the relative effectiveness and success of the implemented actions.

The park will conduct an ongoing cycle of steps 4 through 6 which will provide the basis for managing backcountry recreational use.

Shenandoah's LAC/VIM framework is still under development and, therefore, no indication of its success or failure is yet available. However, the steps in the process provide an interesting synthesis of the two site-specific frameworks while also incorporating some aspects of the ROS model.

Grand Canyon National Park

The Draft Wilderness Management Plan for Grand Canyon National Park (U.S. National Park Service 1999) incorporates aspects of LAC. While the nature of the Grand Canyon ecosystem and its recreational opportunities differs from RMNP and the annual number of visitors to the park's backcountry exceeds 15,000, several of the techniques used at Grand Canyon can be considered viable alternatives for RMNP.

Minimum Requirement Decision Process

This management plan includes a commitment to minimize management action whenever possible through a "minimum requirement decision process" which determines the minimum tool or administrative practice necessary to successfully and safely accomplish the management objective with the least adverse impact on wilderness character and resources. This decision process provides park management and staff with a framework to guide the decision-making process while triggering consideration of specific variables which may affect wilderness values, resources and experiences. The minimum requirement rule applies to methods of transporting personnel and equipment to sites, selecting types of tools required for successful implementation and selecting materials needed for restoration projects.

Leave No Trace Principles

The Grand Canyon plan includes a list of the following leave-no-trace principles for minimum-impact camping:

- Plan ahead and prepare.
- Camp and travel on durable surfaces.
- Pack it in; pack it out.
- Properly dispose of what you can't pack out.
- Leave what you find.
- Minimize use and impacts of fires.

Campsite Monitoring

The current method of campsite monitoring at Grand Canyon is called Rapid Campsite Assessment (RCA). It was adapted from the ecological studies done by Cole (1985; 1989). Its goal is to provide basic data on campsite location, distribution and condition. It was designed so that inventories are repeatable and the campsite monitoring program

can continue on a long-term basis.

The methodology includes an assessment of several indicators culminating in a campsite condition rating. The overall condition is rated on the type and level of impact to each campsite. The standards describe the relative amount of impact or the "Condition Class" of each campsite which is the overall descriptor used to evaluate management objectives for desired campsite conditions. Standards are also described for the total amount of impacted ground or barren core in any square mile within the use area. Barren core is an area devoid of vegetation and organic litter, with compacted soil and trampled perimeter vegetation.

Sociological Monitoring

The park conducted a sociological study of backcountry users and used the results to develop management objectives that describe desired social conditions regarding the acceptable number and duration of contacts an overnight user may have while hiking and at campsites. The objectives of the study were:

- to identify the overnight users of the park's backcountry;
- to determine user motivations, expectations and preferences;
- to measure user levels of satisfaction with their experience;
- to evaluate user reaction to the reservation and permit system;
- to develop a sociological monitoring system to be used by park staff; and
- to suggest management actions that best meet social needs of visitors.

Two monitoring programs were developed from this sociological study. One program was established to collect data on the actual number of encounters an overnight hiker may have. A random sampling of hikers were asked to complete a short survey form by recording the number of people and groups they encountered during the day and at their camp and to rate their level of satisfaction associated with each contact. Analysis of the data determined the number of contacts made and at what level the number of contacts became unacceptable. The results were measured against the management objectives. The second monitoring program involved a mail-back survey which was completed by overnight hikers who had recently camped in the park. The results provided park management with feedback on management actions and policies as well as basic demographic information and user skill levels. The resulting data was considered for determining changes in group size limits.

Rehabilitation and Restoration of Impacted Sites

Grand Canyon National Park's main objective in its revegetation program is to restore native vegetation cover in impacted areas. This effort consists of four aspects:

- rehabilitating and restoring impacted sites to a natural condition;
- establishing a dependable seed and propagule source for restoration efforts;
- educating the public and workforce; and
- monitoring the program's effectiveness.

In rehabilitating impacted sites, the first step is to identify the area of concern and determine why the impacts occurred. The second step is to determine the nature of the impacted site requiring rehabilitation and devise an appropriate mitigation plan. The goal of this process is to restore and maintain natural processes and viable populations of all native species in natural patterns of abundance and distribution.

The restoration of small-scale sites resulting from recreational impacts usually consists of returning impacted sites to the vegetative composition and aesthetic conditions of the area. Rehabilitation consists of returning an impacted site or area to a specified level of soil conditions and biological productivity. Aesthetic considerations are also important. Since complete restoration is a long-term process, the steps taken by managers generally constitute a sequence of rehabilitation actions which anticipate eventual restoration to a natural condition.

Rehabilitating high-use sites is a difficult task because long recovery periods are required. Rest-and-rotation of sites may not have the desired effect because it will likely result in an increase in total impact as users impact the new sites. The Grand Canyon plan advocates dealing with these impacts through preventative techniques such as selecting durable sites and confining use to as small an area as possible. In contrast, reducing use in low-use, relatively undisturbed sites may minimize total impact. The plan also advocates the following strategies:

- controlling type of use;
- avoiding use during seasons when soil and vegetation are particularly vulnerable to disturbance;
- confining use in popular places; and
- dispersing use widely in lightly used places. However, the plan states that this is a risky strategy that requires close monitoring of conditions.

Components of the above strategies are used in the next section which describes in detail the steps of RMNP's backcountry visitor impact management strategy.

5.1.5 Backcountry Visitor Impact Management Strategy for RMNP (Method 5)

Develop an overall visitor impact management strategy for the RMNP backcountry as a result of the above assessment and discussions with RMNP staff and management. The strategy will allow managers to:

- *derive management objectives for the backcountry campsites and trails;*
- *prevent impacts from occurring;*
- *monitor to determine if the management objectives are being met at each campsite and trail;*
- *determine at what point impacts are unacceptable; and*
- *mitigate impacts that do occur.*

The LAC, VIM and VERP strategies all provide direction in managing visitor impacts at a site-specific level. McCool (1990a; 1996), in writing about the LAC framework, states that the steps can be modified to fit a particular protected area's situation provided it follows the general principles and systematic basis of LAC and the rationale behind each step and its sequence in the overall process. These eleven principles are recognized as fundamental components of any systematic planning system for parks and protected areas management:

Principle 1: Appropriate management depends upon objectives.
Principle 2: Diversity in resource and social conditions in protected areas is inevitable and may be desirable.
Principle 3: Management is directed at influencing human-induced change.
Principle 4: Impacts on resource and social conditions are inevitable consequences of human use.
Principle 5: Impacts may be temporally or spatially discontinuous.
Principle 6: Many variables influence the use/impact relationship.
Principle 7: Many management problems are not use density dependent.
Principle 8: Limiting use is only one of many management options.
Principle 9: Monitoring is essential to professional management.
Principle 10: The decision-making process should separate technical decisions from value judgments.
Principle 11: Consensus among affected groups about proposed actions is needed for successful implementation of protected area management strategies.

In an attempt to derive the most useful components of LAC and the other two LAC-based processes for the purpose of developing a tailor-made strategy for RMNP, the following list of steps is a synthesis of the various components of these three frameworks as they relate to RMNP's situation.

1. Assemble an interdisciplinary project team.
2. Develop a public involvement strategy.
3. Develop statements of purpose, significance and primary interpretive themes for the backcountry; identify backcountry planning objectives, issues and concerns.
4. Inventory current resource and social conditions at each site or a chosen sample of sites.
5. Identify key indicators of resource and social conditions for the backcountry.
6. Develop standards for key impact indicators which define the limits of acceptable change.
7. Develop a monitoring plan.
8. Monitor resource and social indicators to compare standards and existing conditions. If a discrepancy is found, the following steps are taken:
9. Identify probable causes of impacts.
10. Identify strategies for management action.
11. Implement the chosen strategies.
12. Continue to monitor.

Steps 2, 6, 7 and 8 of the LAC framework refer to the identification of opportunity classes. Likewise, steps 5 and 6 of the VERP framework refer to prescriptive management zones which are similar to opportunity classes. Discussions with RMNP backcountry managers resulted in the conclusion that further subdividing RMNP's backcountry into zones or classes is an unnecessary step for managing visitor impacts and would be too complex and time consuming. The opportunities provided in RMNP's backcountry, and therefore management objectives, are similar throughout the entire backcountry. Similar indicators, standards and monitoring methods may be used in all backcountry trails and campsites in RMNP.

For these reasons, the steps related to opportunity classes or prescriptive management zones have been eliminated in the above synthesis. However, the general purpose of creating opportunity classes - to define the park or protected area's desired future conditions for park resources and visitor experiences is still an important concept that should not be ignored at RMNP but may be incorporated in Step 3 above.

The three strategies all contained steps referring to backcountry management planning

objectives, indicators, standards, inventory of current resource and social conditions, strategies for management action, implementation and finally, monitoring. These components are all found in the above revised strategy. In addition, while LAC is well known for its public involvement component, it was not explicitly stated in the steps of the LAC strategy. The VERP framework referred to public involvement in its first two steps. These have also been incorporated above. Finally, VIM is the only framework of the three that explicitly refers to determining the causes of impacts when current conditions exceed allowable standards for a site. This should be done prior to developing strategies for management action.

Step 1 *Assemble an interdisciplinary project team.*

For the purpose of developing RMNP's Backcountry Management Strategy, a Backcountry Working Group (BWG) was developed as a sub-committee of the Recreation Study Group. The BWG consists of park wardens, managers and representatives of external stakeholder groups. This group can be involved in future steps such as developing indicators and standards and in guiding management actions when conditions exceed standards.

Step 2 *Develop a public involvement strategy.*

The BWG may wish to determine in advance how it will involve public input into the process. The group already includes external stakeholders in discussions and decisions regarding backcountry issues. However, the group may want to discuss further involvement such as public meetings or surveys.

Step 3 *Develop statements of purpose, significance and primary interpretive themes for the backcountry; identify backcountry planning objectives, issues and concerns.*

There is a vision statement for the park as a whole. The Recreation Study Group developed a vision statement for recreation in the park. Both the park-wide and recreation visions address broad goals for the park's role in preserving the park's resources and in providing rewarding visitor experiences. The BWG is mandated to deal with ongoing backcountry planning and management and with individual issues and concerns.

Future backcountry planning and management should always be framed by the purpose and significance of the park's backcountry as well as the legal and regulatory framework. As well, discussions and planning activities should keep in mind the management objectives or desired future conditions for RMNP's backcountry which describe the ideal resource conditions and visitor opportunities. Without these explicitly

stated objectives, it will be difficult to determine if backcountry visitor management is successful in meetings its goals.

The LAC strategy used in the Glennallen Field Office, which is responsible for managing a large, multi-jurisdictional protected area in southern Alaska, provides several examples of desired future conditions (U.S. Department of the Interior 1999). These examples illustrate how issues, concerns and values may be translated into desired future conditions:

Wildlife

- Genetically diverse populations of native wildlife species are maintained.
- Human disturbance does not displace wildlife from crucial areas such as wintering and calving areas.

Recreation Experience

- Visitors are able to find solitude with few encounters with groups.
- Visitors feel like they are in a remote, relatively undisturbed area where they must rely on their own skills.
- Visitors are courteous to each other and take personal responsibility to reduce their impact on other visitors' experiences.

Camping Conditions

- Campsites show little evidence of past human use.
- Vegetation is lost only around the fire ring or center of activity.
- The number and distribution of sites is such that campers may only occasionally hear another group in the distance.

The managers of the Glennallen Field Office state that the best way to develop statements of desired future conditions is to blend visitors' values, scientific information and perspectives of managers who are charged with carrying out laws that govern the protection and use of the area.

However, other authors prefer that desired future conditions be framed as explicit, measurable and action-oriented objectives for the backcountry. For example, while "increase visitor satisfaction" or "protect resource quality" are legitimate goals, they do not allow for measurement of success or failure. An example of a useful objective is "Achieve two encounters or less per day for at least 90% of visitors during the month of July on the Sugarloaf Trail" because it generates a targeted outcome that is measurable and time-bound and can be documented (Knopf 1990).

Step 4 *Inventory current resource and social conditions at each site or a chosen sample of sites.*

The objective of this step is to understand as fully as possible park resources and existing visitor use and experience. Data gathered during this step will serve as a baseline for future monitoring and for measuring management performance and determining management actions. Attributes to consider when gathering information may include:

- relative abundance of the particular resource or visitor experience inside and outside the park;
- the sites' ability to conceal the evidence of visitor use;
- types of activities occurring at the sites;
- spatial and temporal distribution of activities;
- the sites' ability to support or sustain visitor use;
- potential interest of the sites to visitors; and
- the sites' relative importance to the park purpose, significance and primary interpretive themes.

During the inventory, the appropriateness and current location of sites that are deemed sensitive to visitor activity should be reassessed with the ultimate goal of resource protection.

This analysis should be documented, usually through a combination of maps, matrixes and text.

Note: Steps 4 and 5 may be reversed if managers have enough existing information to select indicators prior to Step 4 and wish to use those indicators when conducting the baseline assessment.

Step 5 *Identify key indicators of resource and social conditions for the backcountry.*

LAC, VERP and VIM define indicators as specific and measurable physical, ecological or social variables that reflect the overall condition of the area they are applied to. Indicators are essentially a restatement of management objectives in quantitative terms. Resource indicators measure visitor impacts on the biological, physical and cultural resources of a park. Social indicators measure impacts on visitor experience.

The VERP Handbook (U.S. Department of the Interior 1997) states that social and resource indicators and standards can be derived by consulting the scientific literature,

conducting original research, consulting public opinion and/or applying management judgment. To be useful, the Handbook suggests that indicators should have the following characteristics:

- *specific* (e.g. "number of encounters per day" rather than "solitude");
- *objective* (e.g. "the number of campsites that exceed 20 square metres of bare ground" rather than "the number of severely impacted campsites");
- *reliable and repeatable* (i.e. measurements should yield similar results under similar conditions);
- *related to at least one of the following visitor use attributes*: levels, types, timing or location of use or visitor behaviour;
- *sensitive* to visitor use over a relatively short period of time in order to serve as an early warning indicator (i.e. indicators should respond in the same proportional degree as changes in use levels);
- *resilient* (i.e. respond quickly to changes in management action);
- *nondestructive* (i.e. indicator measurement and monitoring should not result in destructive resource impacts or significantly detract from the quality of the visitor experience); and
- *significant* (i.e. address important issues and management concerns).

In addition to the above desirable characteristics, the VERP Handbook lists several criteria that may be used to select the best indicators when several have been identified. Selected indicators should meet the following criteria:

- *easy to measure* (i.e. the less expertise, time, equipment and number of people required to measure the indicator the better);
- *easy to monitor* (i.e. little training should be required to learn how to monitor the indicator);
- *cost effective* (i.e. monitoring should require a relatively low expenditure of park funds);
- *minimally variable* (i.e. Indicators with less natural variation will be more sensitive to visitor impacts and more useful than those with more natural variability);
- *responsive over a range of conditions* (i.e. show a gradient in conditions, either due to the impacts of visitors or management actions);
- *large sampling window* (i.e. can be monitored for a large time frame such as throughout the year or visitor use season); and
- *availability of baseline data.*

RMNP management may wish to use a matrix to rate potential resource and social

indicators such as the example in Table 5.1. The cells in the matrix can be checked when the indicator meets the condition or the indicators can be rated as to how well they meet the criteria.

Table 5.1 Indicator selection matrix

Potential Indicators	**Primary Criteria**								**Secondary Criteria**						
	Specific	Objective	Reliable and repeatable	Related to visitor use	Sensitive	Resilient	Low-impact	Significant	Easy to measure	Easy to monitor	Cost-effective	Minimally variable	Responsive over a range of conditions	Large sampling window	Availability of baseline data
Indicator 1															
Indicator 2															
Indicator 3															
Indicator 4															
Indicator ...															

Source: VERP Handbook (U.S. Department of the Interior 1997)

A report on monitoring in the Riding Mountain bio-region (Dubois 1995) listed a number of potential indicators for ecological integrity monitoring. While many of these indicators refer to broad scale monitoring of such things as climate, resource harvest or ecological processes, some of these indicators may be applicable to the backcountry visitor impact management strategy:

- condition of trails and campsites (e.g. soil compaction, erosion, littering, trampling);
- wildlife/human interactions (e.g. sightings - positive encounters, campsite disturbance - negative encounters);
- number of visitors/unit of time or cumulative;

- number of backcountry permits issued; and
- number of people/unit of time on trails.

This report states that desirable properties of ecological integrity indicators are:

- valued ecosystem components;
- conceptual frameworks (e.g. stress/response ecosystem model);
- externalities (e.g. climate, air pollution);
- early warning capability; and
- reproducibility and objectivity.

The report also cites several indicator selection criteria:

- clarity;
- scientific credibility;
- technical feasibility;
- early warning capability/responsive to change;
- spatial representation;
- flexibility;
- issue oriented; and
- multi-dimensional assessment: individual > population > species composition > trophic structure.

Step 6 *Develop standards for key impact indicators which define the limits of acceptable change.*

LAC, VERP and VIM define standards as the minimum acceptable condition for each indicator variable. Standards should not represent existing, unacceptable conditions nor should they represent objectives to be attained. Standards provide a means for deciding when and where management actions are needed. Characteristics of useful standards include:

- *quantitative* (e.g. "10% ground cover of exotic species" rather than "low cover of exotic plants");
- *temporally or spatially bounded* (i.e. expresses how much of an impact is acceptable and how often such impacts can occur) (e.g. "three encounters per day"; "four social trails per kilometre");
- *expressed as a probability* (e.g. "no more than three encounters with other groups per day along trails for 80% of the days in the summer use season");
- *impact oriented* (i.e. focus directly on the impacts that affect the quality of the

visitor experience or resource condition, not the management action used to keep impacts from exceeding the standards); and
- *realistic* (i.e. must reflect conditions that are attainable).

Examples of resource indicators and their standards include:

- *Indicator:* the number of exposed tree roots exceeding 5 centimetres in diameter, measured within 2 metres of a trail edge for 30 metres of a trail
- *Standard:* no more than 20% of tree roots are exposed relative to a control area

- *Indicator:* the amount of bare ground at a campsite
- *Standard:* no more than 30% of the total campsite area is bare ground

Examples of social indicators and their standards include:

- *Indicator:* number of encounters with other users along a trail per day
- *Standard:* no more than 3 encounters per day

- *Indicator:* the percentage of parties that can camp out of the sight or sound of other parties in the backcountry
- *Standard:* at least 70% of parties report that they could camp out of the sight and sound of other parties

Step 7 *Develop a monitoring plan.*

Monitoring should be *systematic* (i.e. a formal, explicit strategy) and *periodic* (i.e. a predetermined temporal interval). The monitoring plan should accomplish three things:

- help park managers understand the status of resource and social conditions (i.e. if conditions are changing and their proximity to the appropriate standards);
- enable park managers to assess the effectiveness of management actions; and
- provide a defendable basis for management actions that are implemented through thorough documentation of monitoring data and results of management actions.

There are three criteria for a successful monitoring plan:

- *feasible* (i.e. people and equipment are available to monitor and analyze the

data);

- *objective* (i.e. data are recorded in an objective, scientifically valid manner); and
- *timely* (i.e. data provide information when park managers need it).

The monitoring plan should include the following components:

- *description of the monitoring procedures* (i.e. the frequency, timing and location of measurement activity, specific instructions such as what equipment is required and how it is to be used);
- *description of how monitoring data will be analyzed, displayed and interpreted* (e.g. campsite encounters might be displayed as the mean number of groups camped within sight or as the proportion of group nights where more than two other groups within sight or sound are encountered, depending upon how the indicator and standard for campsite encounters are defined); and
- *personnel identification* (i.e. explicitly identify the individual(s) responsible for measuring indicators, analyzing data and preparing an annual monitoring report).

The monitoring plan should determine where and when monitoring should occur. It may not be necessary or practical to monitor all of the trails and campsites nor to monitor the same sites every year. Management should select a reasonable number of sites on which to conduct monitoring. The following criteria will help managers select sites to monitor.

- Monitor where or when conditions are close to violating the standard or have already violated the standard.
- Monitor where or when conditions are changing rapidly.
- Monitor where or when specific and important values are threatened by visitation.
- Monitor where or when the effects of management action are unknown (e.g. without monitoring, it may not be clear what effect closing a campsite and reseeding native plants will have on site condition) (U.S. Department of the Interior 1997).
- Monitor in an unimpacted control area that is off limits to visitor use.
- Monitor in control sites and impacted sites that are representative of the area's main habitats (Brosnan et al. 1994).

A two-tier indicator monitoring system may be desirable. Some indicators will be monitored on a regular basis (e.g. once per season) while other will only be monitored once every few years. This would likely prove to be a more cost effective way of monitoring. The VERP Handbook states that managers may want to consider

monitoring different parts of a park using a rotation or tiered system. Immediate and annual monitoring may be required on those areas close to or out of standard. Other areas that may be approaching a standard or have other emerging needs (but not as pressing as the first tier) may be monitored every two or three years. A third tier of areas that appear to be in good shape and are not experiencing rapid change may be monitored on a less frequent schedule, perhaps every five years. Alternatively, if managers can realistically monitor conditions only in a fourth of the park each year, then a four-year monitoring rotation may be a good starting point.

There are many existing detailed campsite and trail monitoring processes. The trail monitoring system used in Yoho National Park is briefly discussed in Section 5.1.4. However, it is beyond the scope of this study to discuss the technical details of monitoring. These will be developed by RMNP staff with the necessary technical expertise. Several monitoring frameworks have been proposed for RMNP. The Backcountry Monitoring Framework, the Backcountry Trail Plan and Monitoring the Riding Mountain Bio-Region were discussed in Chapter 3. In addition, Kunec (1986) describes a backcountry trail monitoring plan for RMNP.

RMNP has many options regarding who will conduct the monitoring. Since the number of field staff at RMNP has been reduced in recent years, there is a need for innovative ways to conduct backcountry work. RMNP staff have indicated that there is a possibility for partnerships with ecotourism outfitters and other stakeholders to conduct monitoring. Other possibilities include hiring overseas students, organizing users so they are managers as well or organizing research vacations (for more information on research vacations refer to Parks Canada's 1997 State of the Parks Report). Boo (1990) states that there are increasing numbers of nature tourists who enjoy participating in some aspect of park improvement during their stay such as helping with trail repair, litter collection or inventories.

Step 8 *Monitor resource and social indicators to compare standards and existing conditions.*

The VERP Handbook states that monitoring and analyzing monitoring data may identify one of two situations that should trigger corrective actions. These situations are:

- *deterioration* (i.e. a trend is identified that shows conditions are moving toward the standard); and
- *out of standard* (i.e. resource or social conditions are unacceptable).

The Shenandoah National Park Backcountry/Wilderness Management Planning

Framework (U.S. National Park Service 1998) states that trends that indicate that conditions are deteriorating should result in preventative management actions while conditions that exceed the standard may require more drastic management actions.

If implementation of this step does not reveal a discrepancy between conditions and standards, no direct management intervention is necessary because the area is currently providing the resource conditions and visitor experience that has been defined as appropriate. However, continued monitoring is necessary to detect potential future changes in the conditions.

The following steps should be implemented if monitoring reveals that conditions have exceeded the applicable standards.

Step 9 *Identify probable causes of impacts.*
It is important to clearly identify the most significant or root causes of deteriorating conditions before taking any corrective action. This task can be approached by examining the relationship between visitor use patterns and the impact indicators that have exceeded their respective standards.

Numerous factors may be responsible for deterioration including the type, level, concentration and timing of visitor use; length of stay; frequency of high use periods; behaviour of visitors; park management and existing infrastructure (e.g. trail design, information programs, the location of visitor centers). Use-impact relationships may be affected by site-specific characteristics and may vary for different times and places.

Sometimes the root causes of unacceptable conditions may underlie more obvious symptoms. For example, it may appear obvious that the cause of a trail encounter standard being exceeded is that too many people are using a particular trailhead. However, the root cause may be the design of the access road and parking areas that funnel people onto this trail or a park brochure that publicizes this trailhead and not others. If the root causes of existing conditions are not accurately identified, management action may be misdirected and have less than satisfactory results.

Step 10 *Identify strategies for management action.*
The VERP Handbook indicates that the U.S. National Park Service is currently developing a decision-making handbook for addressing visitor use related problems. This handbook, which is not yet available, identifies five general management strategies that managers can use to address recreational use impacts:

- Increase the supply of recreational opportunities, areas and facilities to accommodate increased demand.
- Reduce use at specific sites or throughout the backcountry.
- Modify the character of visitor use by controlling where the use occurs, when the use occurs, what type of use occurs or how visitors behave.
- Alter visitor attitudes and expectations.
- Modify the resource base by increasing the durability of the resource or by maintaining or rehabilitating the resource.

These strategies must be tailored to specific management objectives and conditions. Managers are encouraged to consider employing as many strategies as possible to address specific impacts. Using a combination of strategies provides managers with greater flexibility and allows them to address the multiple dimensions and the causes of undesired impacts. Reducing use may appear to be the obvious solution to visitor use impacts, but managers should remember that a less restrictive strategy may work as well and have fewer repercussions to visitors and park management. Graefe (1990) suggests focusing on the probable causes of the impacts rather than on the impact conditions themselves.

Within the five strategies mentioned above, there are many specific management actions which fall into five general categories:

- *site management* (e.g. vegetation barriers, site hardening, site closure);
- *rationing and allocation* (e.g. reservations, queuing, lotteries, eligibility requirements, pricing);
- *regulation* (e.g. number of people or stock, activity, visitor behaviour, equipment);
- *deterrence and enforcement* (e.g. signs, sanctions, personnel); and
- *visitor education* (e.g. promote appropriate behaviour, encourage/discourage certain types of use, provide information regarding use conditions).

The Shenandoah National Park Backcountry/Wilderness Management Planning Framework (U.S. National Park Service 1998) states that planners and managers are responsible for involving the public in determining what kinds of management actions will be appropriate to take when conditions are deteriorating (but remain within standard), and what actions will be appropriate when conditions are out of standard.

The following matrix, used in the VIM process, aids park and protected area managers in deciding which strategy best achieves their goals. The various management strategies presented in this matrix are examples and can be replaced with the

appropriate alternative strategies for RMNP. Also, the criteria for assessing the various strategies are basic examples that can be expanded upon if management desires.

Table 5.2: Indirect and direct management strategies

	Management Strategy	Consistency with Management Objectives	Difficulty to Implement	Probability of Achieving Desired Outcome	Effects on Visitor Freedom	Effects on Other Impact Indicators
INDIRECT	Physical Alterations					
	Information Dispersal					
	Economic Constraints					
DIRECT	Enforce-ment					
	Zoning					
	Rationing Use					
	Restricting Activities					

Source: Adapted from Graefe 1990

When deciding which type of management action to implement, managers may wish to ask the following questions which help to assess the trade-offs or the costs of competing actions:

- Does the action adequately address the underlying cause of the impact?
- How effective will the action be in resolving the impact in question?
- Will the action create new problems?
- Will visitors be aware that they are being managed?
- Is the action direct or indirect in terms of how it impacts or influences visitor behaviour?
- Does the action preserve visitor freedom of choice?

- Does the action affect a large or small number of visitors?
- Does the action affect an activity to which some visitors attach a great deal of importance?
- Are visitors likely to resist the management action?
- What are the costs to managers in implementing and administering the action?

In addition, the minimum requirement decision process used at Grand Canyon National Park (U.S. National Park Service 1999) provides a list of considerations that, when addressed by management during selection of appropriate management actions, achieves the management objective while minimizing the ecological and social impacts. This process addresses the following considerations:

1. Is this an emergency? If yes, act according to approved emergency strategies. If not:
2. Determine if the proposed action is essential to achieve planned objectives. If not, do not continue with the action. If so:
3. Can the desired action be accomplished through visitor and staff education? If yes, proceed with the action. If not:
4. Decide if the action can be accommodated elsewhere (i.e. outside the backcountry). If so, proceed with the action in the chosen location. If not:
5. List alternatives appropriate for backcountry management.
6. Evaluate the alternatives to determine which has the least impact on resources. Can the desired action be accomplished safely and effectively with primitive skills? If yes, select appropriate primitive tools and skills. If not, select appropriate mechanized tools.
7. Select the appropriate minimum tool or action.

This process also suggests considering the following:

- What is the best group size to complete this action with the least impact on resources and visitor experience?
- What is the best time of year to complete action while minimizing impact of resource and visitor experience?
- If mechanized equipment is selected, how often will it be used and how long will the project last?
- If this action cannot be accomplished through visitor education alone, how can education contribute to the accomplishment/enhancement of this action?

After considering these and other questions and weighing the trade-offs, management

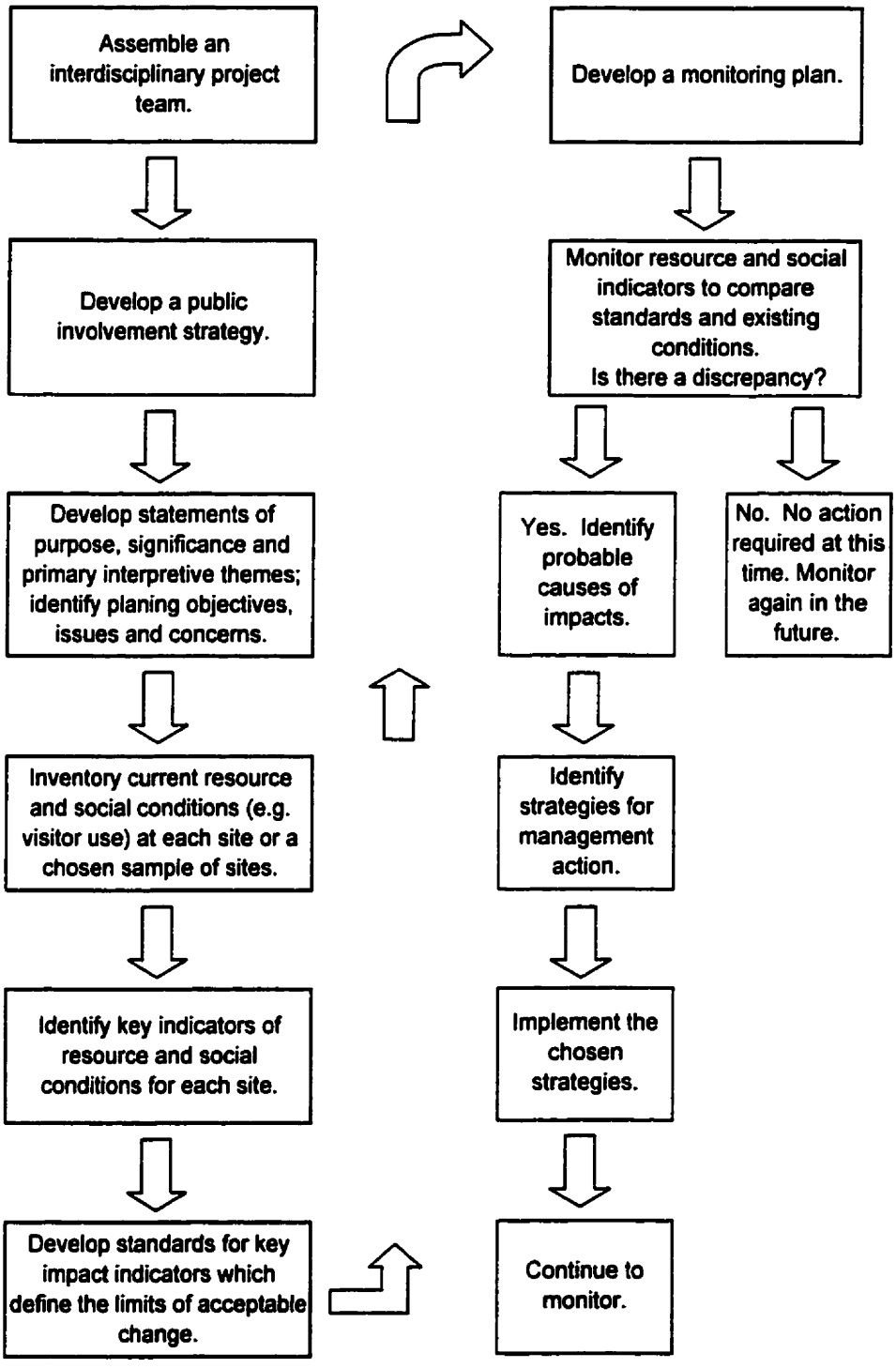

Figure 5.0: Work plan for RMNP's backcountry visitor impact management strategy.

should select the strategies and actions that best suit the situation and that will effectively address visitor impacts while minimizing total economic, social and ecological costs. Finally, Managing Wilderness Recreation Use: Common Problems and Potential Solutions (Cole et al. 1987) is a useful guidebook which provides alternative management solutions for several of the problems which may occur in RMNP's backcountry such as trail and campsite deterioration, horse use impact and visitor conflicts.

Once an action plan has been developed, it should be publicized so visitors are aware that management is caring for the ecosystem and that there may be site closures or other management actions as a result (Brosnan et al. 1994).

Step 11 *Implement the chosen strategies.*
The selected management strategies should be implemented as soon as the necessary resources are available. Because the nature and causes of visitor impacts are highly variable, management programs designed to deal with these impacts should be flexible and quick to respond to changing conditions.

Step 12 *Continue to monitor.*
The task of managing visitor impacts is not over when a management program has been implemented. Future monitoring of indicators is a critically important component of this process.

Finally, it is important to note that, according to the VERP Handbook, developing indicators, standards and a monitoring plan can be highly technical tasks, requiring knowledge about sampling design and data analysis. If the planning team does not have this expertise, the team may need to consult with experts to ensure that these components of the strategy are valid, reliable and useful.

Figure 5.0 is a flow chart that represents the basic outline of the steps derived in Method 5.

5.2 Considerations

Two additional issues that RMNP management has concerns about are providing random camping opportunities and reducing or eliminating user conflicts. A review of the literature provided the following discussion.

Random Camping

Some parks and protected areas allow backcountry campers to select their own campsites rather than camp only in designated sites. This practice - known as random camping - has not been allowed in RMNP prior to 1999 but some users have expressed an interest in having this opportunity in the park's backcountry. The park is allowing random camping on a trial basis for the 1999 season.

Random camping is allowed in Jasper's relatively undisturbed and trailless wildland areas. The park's 1988 Management Plan (Parks Canada 1988) states that the environmental impact of this practice is negligible given the low use levels in wildland areas. Use is restricted to types and levels which do not result in noticeable site degradation (e.g. horse use is strictly controlled and monitored to ensure that it does not occur where it may result in significant impacts). The management plan states that visitor education about minimum-impact camping techniques should further reduce the potential for impact.

The Banff National Park Backcountry Management Plan (Parks Canada 1990) also allows for random camping in remote wildland areas. Camps must be at least 5 kilometres from any public highway, must be set back 50 metres from the trail or watercourse and must be moved to a new site every three days to allow trampled plants to recover. Discussion with a backcountry warden in Banff determined that management and staff opinion on random camping vary. He states that random camping only works where user numbers are low enough and terrain and vegetation varied enough to permit multiple camping opportunities without impacting campsites beyond a state from which they can quickly regenerate. Often there are locations within a random camping area that, through frequent use or lack of alternatives, become defacto campsites. In fact, Banff backcountry management has had to provide minimal facilities in some locations designated for random camping because those particular sites received a high level of use. He states that it is unknown at this time if random camping will be allowed to continue in Banff (Gorrie pers. comm.).

Gwaii Haanas National Park allows visitors to camp randomly but encourages them to avoid sites where there is evidence of previous camping activities. The objective is to disperse use so that no sites become significantly impacted (Peregoodoff 1998a; 1998b; Parks Canada).

Grasslands National Park does not maintain any designated campgrounds so only primitive, random tent camping is available. Campers must abide by regulations

designed to maintain the ecological health of the park. Campsites must be at least one kilometre off roads and away from old ranch yards. Open fires are not permitted (Parks Canada 1997c).

Grand Canyon National Park currently allows random camping (known as at-large camping) in over 90% of its wilderness use areas. However, users must adhere to minimum-impact camping techniques and are limited to an overnight stay of seven nights per use area per trip. The park superintendent may approve an extended stay due to a research or resource-monitoring project. The overall trip length, both in numbers of days and miles, is not limited. Camping in designated campsites is more strictly limited to two nights per trip in any one campsite or campground (U.S. National Park Service 1999).

Random camping is not allowed in Kootenay National Park (Parks Canada 1991) because its wildland areas are limited in size and contain fragile natural resources.

In determining if random camping is a feasible option for RMNP's backcountry, managers must determine how many people are likely to engage in random camping and if the park's resources are durable enough to handle this type of activity. With the proper limitations such as those imposed in the other parks that allow random camping, it may work at RMNP. However, the warnings issued from Banff National Park should be considered. Even with low user numbers and proper limitations, people may still end up impacting random campsites beyond an acceptable level.

Visitor Conflicts on Multi-Use Trails and Campsites

There is a great deal of literature on dealing with conflicts between visitors on wilderness trails and campsites. Conflict can occur among different user groups (e.g. hikers vs. horse users) or among different users within the same user group. Conflict may be related to activity style (i.e. mode of travel, level of technology, environmental dominance), focus of trip, expectations, attitudes toward and perceptions of the environment, level of tolerance of others and different norms held by different users. Conflict can even result when there is no actual contact among users, such as viewing resource impacts caused by other users. Conflict is often asymmetrical in that one group resents another group but the reverse is not true (Moore 1994). Research has shown that most overnight hikers are more sensitive to being within sight or sound of others while at camp, compared to when they are hiking (Hendee et al. 1990).

Managers of trails and campsites, who often face staffing and budgetary constraints,

must attempt to ensure user safety, protect natural resources and provide quality visitor experiences. These tasks can become more difficult when user conflict occurs. Moore (1994) documents the following twelve principles for minimizing conflicts on multiple-use trails and improving sharing and co-operation among users:

1. Recognize conflict as goal interference attributed on another's behaviour, not as an inherent incompatibility among different trail activities.
2. Provide trails with sufficient distance and a variety of experiences. This will reduce congestion and allow users to choose the conditions that are best suited to the experiences they desire.
3. Minimize the number of contacts in problem areas because each contact among trail users or evidence of the presence of other users has the potential to result in conflict. This is especially true in congested areas and trailheads. Disperse use and provide separate trails where necessary and appropriate. However, providing separate trails should be a last resort because it will eliminate opportunities for communication and co-operation among users.
4. Involve users as early as possible in the process of avoiding and resolving conflicts, preferably before conflicts occur. Possible conflicts on proposed trails and their solutions should be addressed during the planning and design stage with the involvement of prospective users. New and emerging uses should be anticipated and addressed as early as possible with participant involvement. Existing and developing conflicts on present trails must be faced quickly and addressed with participant involvement.
5. Understand user needs by determining their motivations, desired experiences, norms and preferred settings. This should include both present and potential future users of each trail.
6. Identify the actual sources of conflict by helping users get beyond emotions and stereotypes as quickly as possible and get to the root causes of the conflict.
7. Work with all affected parties to reach mutually agreeable solutions to these specific issues. Users who are not involved as part of the solution are more likely to be part of the problem, now and in the future.
8. Promote trail etiquette and responsible trail behaviour. Use existing educational materials or modify them to better meet local needs. Get this information into users' hands as early as possible and present it in interesting and understandable ways.
9. Encourage positive interaction among different users. Trail users are usually not as different from one another as they believe. Providing positive interactions both on and off the trail will help break down barriers and stereotypes and build understanding, good will and co-operation. This can be accomplished through a

variety of strategies such as sponsoring user swaps (i.e. users trying each others' trail activity), joint trail-building or maintenance projects, showing trail-sharing videos and forming trail advisory councils.

10. Favour the most light-handed management approaches that will achieve area objectives while allowing freedom of choice and still providing the natural environments that are so important to trail-based recreation. Intrusive design and coercive management are not compatible with high-quality trail experiences. Research has shown that both users and managers prefer information and education over regulation and enforcement.
11. Plan and act locally whenever possible when addressing issues regarding multiple-use trails. This allows greater sensitivity to local needs and provides better flexibility for addressing difficult issues on a case-by-case basis. Local action also facilitates involvement of the people who will be most affected by the decisions and most able to assist in their successful implementation.
12. Monitor the ongoing effectiveness of all decisions made and programs implemented. Conscious, deliberate monitoring is the only way to determine if conflicts are being reduced and what program changes might be needed. This is only possible within the context of clearly understood and agreed upon objectives for each area.

Management strategies for dealing with user conflict can be grouped into two broad categories: physical responses and management responses. Physical responses include proper trail design, layout and maintenance. Management responses can involve information and education, user involvement, regulations or enforcement. Information and education programs to promote trail sharing should have one or more of the following objectives:

- Communicate why the trail is shared.
- Communicate that co-operation can benefit all.
- Determine and communicate the similarities among different user groups and document the extent to which trail users participate in multiple-trail activities.
- Communicate the consequences of problem behaviours (e.g. impact on other users, loss of access for those who disregard regulations).
- Build consideration and trust.
- Teach trail ethics, including the following:
  - courtesy toward other trail users and concern toward the environment;
  - who should yield to whom and why;
  - respect and tolerance for others;
  - responsibility for resource protection; and

    - what interferes with other activities.
- Communicate physical and social trail conditions such as:
    - difficulty (e.g. grade, length, tread);
    - trail length and location; and
    - what types and numbers of users might be encountered.
- Teach what causes resource impacts and how to minimize them.
- Reach users as early as possible. Conflicts may be most severe near trailheads since users tend to be most congested there. Focus education efforts at trailheads and in the first mile or two of trail.

Other specific actions managers can take to reduce conflicts include:

- publish relevant information in brochures, newsletters or newspaper articles;
- volunteer trail patrols;
- giving cyclists bicycle bells;
- develop speed limits for mountain bikes;
- inform visitors about the number of hikers, campers, cyclists or horses they may encounter;
- encourage quiet behaviour;
- encourage use of less popular access points and backcountry areas;
- encourage off-season or weekday use;
- designate trails for different types of visitor use; and
- encourage visitors to use natural-coloured equipment and clothing (Moore 1994).

Despite the potential for conflict inherent in multiple-use trails such as those in RMNP's backcountry, research has shown that most trail users are satisfied, have few complaints and return often. The 1987 Backcountry Trail Plan and the 1997 Backcountry Survey indicate that this applies to RMNP as well although some cyclists have indicated that they do not enjoy having horses at campsites. However, it is important for managers to try to eliminate or reduce conflict because visitors who experience conflict may not return. All of the above mentioned responses to user conflict have been tried to varying degrees of success (Moore 1994). Finding the right choice for RMNP may involve some experimentation.

5.3 Discussion of Results

The above analysis represents a synthesis of the literature on managing visitor impacts and RMNP management considerations. One overriding theme found when reviewing park-specific literature was that, with the exception of the VERP strategy in Arches and

Zion National Parks, most parks and protected areas modified the existing frameworks such as LAC, VIM, VERP and even ROS to obtain the desired strategy to fit the management objectives and particular conditions of that park. The strategy derived for RMNP is no exception. It represents the basic framework of the three site-specific strategies while purposely excluding opportunity class allocation.

Another theme discovered in the park-specific literature is that most parks and protected areas are in the process of implementing these strategies. In all cases, those responsible for developing the strategies were aware of the fact that components of the strategies such as indicators or standards or even the basic systematic framework may need to be reworked once the strategy has been field tested for at least one or two seasons.

Finally, one expert on the LAC framework issues a warning to those responsible for implementing LAC or a similar strategy (Knopf 1990). He states that, while LAC is a conceptual process that embraces time-tested principles of planning, the potential may exist for feeding a misanthropic attitude that abounds in outdoor recreation resource management. This common attitude is that the primary goal of resource management is to prevent humans from causing deterioration of environmental quality. While this may be technically correct, this attitude views humans as objects that impede quality resource management. Managers may focus less on the initial step of identifying issues and concerns and more on setting standards for resource conditions. Likewise, a criticism of the VIM framework is that it views people as part of the problem.

This expert states that the LAC framework carries clear potential for feeding the disposition that people are a problem rather than an opportunity in recreation management. Instead, wilderness recreation managers should realize that unleashing human potential by providing people with life-enriching, perhaps even life-changing, experiences is an equally important part of their jobs. However, this expert concludes that LAC's strengths overshadow this possible weakness which does not necessarily reside in the process itself but in the dispositions of those who might employ it.

Chapter 6: Summary, Conclusions and Recommendations

6.0 Summary

At the time this study was proposed, RMNP management was developing a Backcountry Management Strategy and needed a component that allowed them to prevent irreversible/irreparable damage to backcountry resources and to eliminate or reduce user conflicts. Although the park had developed a backcountry monitoring framework, it was not yet being formally implemented. The goal of this study was to develop an easy-to-use, systematic strategy that would allow managers to achieve their goals in the long-term.

The study involved a review of the academic literature, park-specific literature and RMNP management documents and discussions with RMNP management and staff. The literature provided valuable information regarding visitor impact management methods that have been developed by academics and others with significant experience in outdoor recreation in parks and protected areas. The methods and strategies found in the literature and in park-specific documents contained the components necessary to develop a strategy for RMNP.

Despite the valuable information found in the literature, it would have been impossible to develop a strategy for RMNP without the input of park staff and management. The backcountry wardens involved in developing the Backcountry Management Strategy provided direction and feedback in addition to specific information regarding current ecological and visitation conditions and management practices in the park. Other managers and staff contributed knowledge of related studies and reports produced in other national parks. These individuals provided the necessary expertise regarding the park's ecology, visitors, management objectives, issues and concerns. They shared their sense of desired future conditions for the park's backcountry as well as their experience with the park's stakeholders. The staff and management of RMNP continually demonstrated their affection for the park and their dedication for achieving the goals of the National Parks Act, Parks Canada's Guiding Principles and Operational Policies, the RMNP Management Plan, the RMNP Ecosystem Conservation Plan, the RMNP Backcountry Management Strategy and other, often more personal, goals regarding the park's resources and visitors.

The knowledge obtained from the literature and from park staff was combined into a collection of information regarding visitor impact management and a series of steps to guide the process of managing visitor impacts in RMNP's backcountry. Unfortunately,

the scope of this study did not allow for implementation or field testing. This will be conducted by RMNP over the next one or two seasons and will be modified as necessary based on how well the steps translate into an effective strategy in the field.

6.1 Conclusions

The work conducted in this study culminated in a visitor impact management strategy for RMNP's backcountry. This strategy, described in detail in Chapter 5, is appended as a stand-alone document. Conclusions drawn during the process of developing the strategy include the following.

1. The existing literature on visitor impact management methods and strategies provided ample information to develop a strategy for RMNP's backcountry. While no one strategy provided all of the components required to fit RMNP's situation, combining the necessary steps from all of the existing strategies proved effective. Specific details on how to conduct the steps in the process were derived from various strategies. However, the specific methods of implementing these steps will ultimately be derived by those who are employing this strategy and should involve considerable public input.

2. The concept of developing a site-specific visitor impact management strategy is fairly new. Many of Canada's national parks do not yet have a formal strategy in place and many of those that do have not yet fully implemented their strategy. Therefore, the successes, failures or shortcomings of these strategies as yet are not widely known. RMNP management will have to discover this for itself while field testing the strategy.

3. The strategy derived for RMNP in this study is flexible in that objectives, indicators, standards and management actions may change over time. This coincides with the required flexibility inherent in the three considerations outlined in Chapter 1 - ecological integrity, visitor satisfaction and budget. While it is possible to derive indicators, standards and management actions to fully preserve ecological integrity in the park's backcountry, this would likely require site closures and other management actions that would seriously threaten visitor opportunities and experiences. Likewise, full and complete monitoring of all trails and campsites every year is likely to be fiscally unfeasible. A balance must be struck between the three considerations in developing these components of the strategy. However, it is important to recall that maintaining ecological integrity is Parks Canada's primary mandate. The balance must not be shifted in such a

manner that results in an unacceptable compromise to resources or visitor experience.

4. Implementing this strategy will likely result in overall improvements to the resource conditions and visitor experiences in RMNP's backcountry trails and campsites. Currently, some resource deterioration and visitor conflict exists in RMNP but not at levels considered severe. As well, these conditions will be prevented from deteriorating to the level experienced at many other popular parks and protected areas.

6.2 Recommendations

RMNP management must begin implementing this strategy as soon as possible through one or two years of field testing. The first three steps in the strategy have largely been completed but will likely need some fine tuning prior to advancing to subsequent steps.

Provisional indicators, standards and measurement techniques should be developed first and field tested for one or two seasons to determine, through analysis of monitoring results, if they are valid, feasible to monitor and have the effect that was desired when they were developed. If not, management is advised to revisit the strategy and adjust, eliminate or replace the necessary components. After this testing period, the remaining indicators and standards may be considered more or less permanent.

More data collection must occur before this strategy is likely to become fully operational. In particular, park managers will have to conduct further sociological research to obtain information on the following:

- day users (because they are not required to register);
- current demographic information on users; and
- users' expectations and attitudes towards issues affecting backcountry management.

Despite the need for further data, management is encouraged to begin testing and implementing this strategy using existing ecological and sociological data.

Clearly, much work remains for RMNP to implement the backcountry visitor impact management strategy developed in this study. However, now is the time to do so in order to prevent ecological and social impacts from occurring to the extent that they do in other popular parks and protected areas. Strategies to manage visitor impacts have

been implemented in other parks and protected areas as a result of the recognition that backcountry resources and visitor experiences have degraded to unacceptable levels. By developing and implementing such a strategy, future generations may enjoy the park's beautiful and challenging backcountry, while it remains largely unimpaired, for years to come.

Literature Cited

Banff-Bow Valley Task Force. 1996. Banff-Bow Valley: At the Crossroads, Summary Report. Parks Canada.

Barber, K. (ed.). 1998. The Canadian Oxford Dictionary. Toronto: Oxford University Press.

Beardsley, W.G., R.B. Herrington and J.A. Wagar. 1974. Recreation site management: how to rehabilitate a heavily used campground without stopping visitor use. Journal of Forestry 72:279-281.

Belland, G. and C. Zinkan. 1998. Heritage Tourism in Canada's Rocky Mountain Parks: A Case Study in Education and Partnership. In: N.W.P. Munro and J.H.M. Willison (eds.) Linking Protected Areas with Working Landscapes Conserving Biodiversity: Proceedings of the Third International Conference on Science and Management of Protected Areas/12-16 May 1997. Wolfville, NS: Science and Management of Protected Areas Association.

Beswick, B.C. 1983. The Management Implications of Factors Affecting Trail Choice in Jasper National Park. Calgary: Parks Canada, Western Regional Office.

Boo, E. 1990. Ecotourism: the Potentials and Pitfalls. Washington, D.C.: World Wildlife Fund.

Bratton, S.P., M.G. Hickler and J.H. Graves. 1978. Visitor impact on backcountry campsites in the Great Smokey Mountains. Environmental Management 2:431-442.

Bronson, D. 1985. Trail Bicycling in National Parks: Summary Report for the Activity Assessment. Ottawa: Parks Canada, Interpretive and Visitor Services Division.

Brosnan, D.M., J. Elliot, T. Grubba and I. Quon. 1994. Guidelines for Monitoring and Detecting Visitor Impacts. Portland: Sustainable Ecosystems Institute.

Brown, Jr., J.H., S.P. Kalisz and W.R. Wright. 1977. Effects of recreational use on forested sites. Environmental Geology 1:425-431.

Bury, R.L. 1976. Recreation carrying capacity - hypothesis or reality? Parks and Recreation 11(1):22-25, 56-57.

Butler, J.R. 1993. Interpretation as a Management Tool. In: P. Dearden and R. Rollins (eds.) Parks and Protected Areas in Canada: Planning and Management. Toronto: Oxford University Press.

Catton, W. 1986. Carrying Capacity and the Limits to Freedom. Paper prepared for Social Ecology Session 1, XI World Congress of Sociology, New Delhi, India.

Clark, R.N. 1987. Recreation Management: A Question of Integration. Western Wildlands 13(1).

Clark, R.N. and G.H. Stankey. 1979. The recreation opportunity spectrum: a framework for planning, management, and research. Gen. Tech. Rep. PNW-98. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station.

Cole, D.N. 1995. Wilderness management principles: science, logical thinking or personal opinion? Trends 32:6-9.

Cole, D.N. 1994. Backcountry impact management: lessons from research. Trends 31(3):10-14.

Cole, D.N. 1989. Wilderness campsite monitoring methods: a sourcebook. Gen. Tech. Rep. INT-259. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Cole, D.N. 1985. Management of ecological impacts in wilderness areas in the United States. In: N.G. Bayfield and G.C. Barrow (eds.) The ecological impacts of outdoor recreation on mountain areas in Europe and North America. R.E.R.G. Report No. 9. Wye, England: Recreation Ecology Research Group.

Cole, D.N. 1982. Wilderness campsite impacts: effect of amount of use. Gen. Tech. Rep. INT-288. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Cole, D.N. 1981. Vegetational changes associated with recreational use and fire suppression in the Eagle Gap Wilderness, Oregon: some management implications. Biological Conservation 20:247-270.

Cole, D.N., M.E. Petersen and R.C. Lucas. 1987. Managing wilderness recreation use: common problems and potential solutions. Gen. Tech. Rep. INT-230. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Cole, D.N. and B. Ranz. 1983. Temporary campsite closures in the Selway-Bitterroot Wilderness. Journal of Forestry 81:729-732.

Coleman, R. 1981. Footpath erosion in the English Lake District. Applied Geography 1:121-131.

Collen, W. 1996. Backcountry Campsite Monitoring Framework. Unpublished report. Parks Canada, Riding Mountain National Park.

Crinion, D. and S. McArthur. Year Unknown. TOMM: a new supermodel, tourism optimisation management model. South Australia Tourist Commission.

Croze, H. 1982. Monitoring within and outside protected areas. In: J.A. McNeely and K.R. Miller (eds.) National Parks, Conservation, and Development: The Role of Protected Areas in Sustaining Society, Proceedings of the World Congress on National Parks, Bali, Indonesia. Washington, D.C.: Smithsonian Institution Press.

D'Amore, L.J. and Assoc. Ltd. 1985. National Activity Profile for Day Hikers. Parks Canada, Interpretive and Visitor Services Division.

DeBenedetti, S.H. and D.J. Parsons. 1979. Mountain meadow management and research in Sequoia and Kings National Parks: a review and update. In: R.M. Linn (ed.) Proceedings of the Conference on Scientific Research in the National Parks. U.S. Department of the Interior, National Park Service Transactions and Proceedings Series 5. Washington, DC: U.S. Government Printing Office.

Douglass, R.W. 1982. Forest Recreation (3rd edition). New York: Pergamon Press.

Driver, B.L. 1990. Recreational opportunity spectrum: basic concepts and use in land management planning. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

Dubois, J. 1995. Monitoring the Riding Mountain Bio-region. Unpublished report. Parks Canada, Riding Mountain National Park.

Edington, J.M. and M.A. Edington. 1986. Ecology, Recreation and Tourism. Cambridge: Cambridge University Press.

Environment Canada. 1996. The State of Canada's Environment: 1996. Environment Canada.

Farrell, B.H. and D. Runyan. 1991. Ecology and tourism. Annals of Tourism Research 18:26-40.

Fenn, D.B., G.J. Gogue and R.E. Burge. 1976. Effects of campfires on soil properties. Ecological Service Bulletin No. 5. U.S. Department of the Interior, National Park Service.

Flick, S. and J. Taylor. 1998. Attitudes of backpackers and casual day visitors in Rocky Mountain National Park. Park Science: Integrating Research and Resource Management 18(1). U.S. Department of the Interior, National Park Service.

Foster, D. 1985. Travel and Tourism Management. London: MacMillan.

Frissell, S.S. 1978. Judging recreation impacts on wilderness campsites. Journal of Forestry 76:481-483.

Gilbert, G.C., G.L. Peterson and D.W. Lime. 1972. Toward a model of travel behaviour in the Boundary Waters Canoe Area. Environment and Behaviour 4(2):131-157.

Graefe, A.R. 1990. Visitor impact management. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

Graefe, A.R., F.R. Kuss and J.J. Vaske. 1990a. Visitor Impact Management: A Review of Research (Volume 1). Washington, D.C.: National Parks and Conservation Association.

Graefe, A.R., F.R. Kuss and J.J. Vaske. 1990b. Visitor Impact Management: The Planning Framework (Volume 2). Washington, D.C.: National Parks and Conservation Association.

Graefe, A.R., J.J. Vaske and F.R. Kuss. 1984. Social carrying capacity: an integration and synthesis of twenty years of research. Leisure Sciences 6:395-431.

Graham, R. 1990. Visitor management and Canada's national parks. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

Graham, R., P. Nilsen and R.J. Payne. 1988. Visitor management in Canadian national parks. Tourism Management 9(1):44-62.

Haliburton, K. 1985. Summer Backcountry National Activity Profile. Parks Canada, Interpretive and Visitor Services Division.

Hammitt, W.E. and D.N. Cole. 1998. Wildland Recreation: Ecology and Management. New York: John Wiley & Sons.

Harris, J. 1998. Riding Mountain National Park Backcountry Survey 1997. Unpublished report. Parks Canada, Riding Mountain National Park, Client Research Unit.

Hendee, J.C., G.H. Stankey and R.C. Lucas (eds). 1990. Wilderness Management (2nd Edition). Golden, CO: North American Press.

Hof, M. 1993. Special Report - VERP: A Process for Addressing Visitor Carrying Capacity in the National Park System. Working draft. Denver: U.S. Department of the Interior, National Park Service, Denver Service Center.

Hollingshead, D. 1984. An Activity Profile of Trail Bicycling in the National Parks. Parks Canada.

Iles, L. 1981. Visitor Activity Profiles, Recreational Land Based Activities and National Parks. Parks Canada, Interpretive and Visitor Services Division.

Jubenville, A., B.W. Twight and R.H. Becker. 1987. Outdoor Recreation Management: Theory and Application. State College, PA: Venture Publishing Inc.

Kachi, N. 1999. Status of Human Use Management Initiatives in Parks Canada. Unpublished report. Parks Canada.

Knight, R.L. and K.J. Gutzwiller (eds.). 1995. Wildlife and Recreationists: Coexistence Through Management and Research. Washington, D.C.: Island Press.

Knopf, R.C. 1990. The limits of acceptable change (LAC) planning process: potentials and limitations. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

Kunec, D.L. 1988. Riding Mountain National Park Visitor Activities Service Plan. Unpublished report. Parks Canada, Riding Mountain National Park.

Kunec, D.L. 1986. Investigating Trail Deterioration in Riding Mountain National Park. Unpublished master's thesis. University of Manitoba, Winnipeg.

Kuss, F.R. 1986. Impact ecology knowledge is basic. In: R.C. Lucas Proceedings - national wilderness research conference: current research, Fort Collins, Colorado. Gen. Tech. Rep. INT-212. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station:

Leonard, R.E., E.L. Spencer and H.J. Plumley. 1981. Backcountry Facilities: Design and Maintenance. Boston: Appalachian Mountain Club.

Liddle, M.J. 1975. A selective review of the ecological effects of human trampling on natural ecosystems. Biological Conservation 7:17-36.

Lindberg, K., S. McCool and G. Stankey. 1997. Rethinking carrying capacity. Annals of Tourism Research 24(2):461-465.

Lucas, R.C. 1983. Low and variable visitor compliance rates at voluntary trail registers. Res. Note INT-326. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Lucas, R.C. 1979. Perceptions of non-motorized recreational impacts: a review of research findings. In R. Ittner, D.R. Potter, J.K. Agee and S. Anschell (eds.) Recreational Impacts on Wildlands. Conference Proceedings, No. R-6-001-1979. U.S. Department of Agriculture, Forest Service. .

Manning, R.E. and B. Wang. 1998. Social science in the national park system: an assessment of visitor information. Park Science: Integrating Research and Resource Management 18(1). U.S. Department of the Interior, National Park Service.

Marion, J.L. and L.C. Merriam. 1985. Recreational impacts on well-established campsites in the boundary waters canoe area. Bulletin AD-SB-2502. St. Paul: University of Minnesota, Agricultural Experiment Station.

McCool, S. 1996. Limits of acceptable change: a framework for managing national protected areas, experiences from the United States. Paper presented at Workshop on Impact Management in Marine Parks. Kuala Lumpur, Malaysia: Maritime Institute of Malaysia.

McCool, S. 1990a. Limits of acceptable change: evolution and future. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

McCool, S. 1990b. Limits of acceptable change: some principles. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

McCool, S.F. and N.E. Christensen. 1996. Alleviating congestion in parks and recreation areas through direct management of visor behavior. In: Congestion and Crowding in the National Park System. Minnesota Agricultural Experiment Station Miscellaneous Publication 86-1996.

Miles, J.C. 1995. Guardian of the Parks: a History of the National Parks and Conservation Association. Washington, D.C.: Taylor & Francis.

Moore, R. L. 1994. Conflicts on Multiple-Use Trails: Synthesis of the Literature and State of the Practice. Raleigh, NC: North Carolina State University, Department of Parks, Recreation and Tourism Management.

Nelson, J.G. 1991. Research in human ecology and planning: an interactive, adaptive approach. The Canadian Geographer 35(2):114-127.

Nepstad, E. and P. Nilsen. 1993. Towards a Better Understanding of Human/Environment Relationships in Canadian National Parks. Occasional Paper No. 5. Canadian Parks Service.

Nilsen, P. and G. Tayler. 1998. A comparative analysis of human use planning and management frameworks. In: N.W.P. Munro and J.H.M. Willison (eds.) Linking Protected Areas with Working Landscapes Conserving Biodiversity: Proceedings of the Third International Conference on Science and Management of Protected Areas/12-16 May 1997. Wolfville, NS: Science and Management of Protected Areas Association.

Noss, R.F. 1992. The Wildlands Project Land Conservation Strategy. In: T. Butler, J. Davis, K. Fitzgerald, D. Foreman, D. Johns, R. Mondt and R. Noss (eds.) The Wildlands Project, Special Issue of Wild Earth.

Parks Canada. 1998a. State of the Parks 1997 Report. Parks Canada.

Parks Canada. 1998b. *National Parks Act* (Amendment). Parks Canada.

Parks Canada. 1997a. Riding Mountain National Park Ecosystem Conservation Plan. Parks Canada, Riding Mountain National Park, Ecosystem Conservation Plan Team.

Parks Canada. 1997b. Banff National Park Management Plan. Parks Canada, Banff National Park.

Parks Canada. 1994a. Guiding Principles and Operational Policies. Parks Canada.

Parks Canada. 1994b. State of the Parks 1994 Report. Parks Canada.

Parks Canada. 1991. Kootenay National Park Backcountry Management Plan. Parks Canada, Kootenay National Park.

Parks Canada. 1990. Banff National Park Backcountry Management Plan. Parks Canada, Banff National Park.

Parks Canada. 1988. Jasper National Park Management Plan. Parks Canada, Jasper National Park.

Parks Canada. 1987. Riding Mountain National Park Backcountry Trail Plan. Parks Canada, Riding Mountain National Park.

Parks Canada. 1986a. In Trust for Tomorrow: a Management Framework for Four Mountain Parks. Parks Canada, Western Region.

Parks Canada. 1986b. Backcountry Trail Bicycling Management Bulletin. Parks Canada, Visitor Activities Branch.

Parks Canada. 1981. Site Rehabilitation Manual. Parks Canada, Prairie and Northern Region, Natural Resource Conservation.

Parsons, D.J. and S.A. MacLeod. 1980. Measuring impacts of wilderness use. Parks 5(3):8-12.

Payne, R.J. and R. Graham. 1993. Visitor planning and management in parks and protected areas. In: P. Dearden and R. Rollins (eds.) Parks and Protected Areas in Canada: Planning and Management. Toronto: Oxford University Press.

Payne, R.J. and P. Nilsen. 1998. Understanding transboundary effects on visitor opportunities in two Canadian national parks. In: N.W.P. Munro and J.H.M. Willison (eds.) Linking Protected Areas with Working Landscapes Conserving Biodiversity: Proceedings of the Third International Conference on Science and Management of Protected Areas/12-16 May 1997. Wolfville, NS: Science and Management of Protected Areas Association.

Peregoodoff, G. 1998a. Recreation impact monitoring of coastal campsites in Gwaii Haanas. Gwaii Haanas Currents 1(1).

Peregoodoff, G. 1998b. Recreation impact monitoring of coastal campsites in Gwaii Haanas National Park Reserve/Haida Heritage Site. In: N.W.P. Munro and J.H.M. Willison (eds.) Linking Protected Areas with Working Landscapes Conserving Biodiversity: Proceedings of the Third International Conference on Science and Management of Protected Areas/12-16 May 1997. Wolfville, NS: Science and Management of Protected Areas Association.

Peterson, R.M. 1985. National forest dimensions and dilemmas. In: M. Frome (ed.) Issues in Wilderness Management. Boulder, CO: Westview Press.

Pigram, J. 1983. Outdoor Recreation and Resource Management. New York: St. Martin's Press.

Proudman, R.D. 1977. AMC Field Guide to Trail Building and Maintenance. Boston: Appalachian Mountain Club.

Pugh, D.A. 1990. Decision frameworks and interpretation. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

Ramthun, R. 1995. Factors in user group conflict between hikers and mountain bikers. Leisure Sciences 17(3):159-169.

Riding Mountain National Park. 1998. Backcountry Management Strategy, Draft, October 1998. Unpublished report. Parks Canada, Riding Mountain National Park.

Ripley, T.H. 1965. Rehabilitation of forest recreation sites. Proceedings, Society of American Foresters 61:35-36.

RMNP Round Table. 1996. Management Plan for Riding Mountain National Park: a Partnership Approach for Managing the Park and its Resources. Parks Canada, Riding Mountain National Park.

Roggen, J.W. and D.L. Berrier. 1981. Communications to disperse wilderness campers. Journal of Forestry 79:295-297.

Rollins, R. 1998. Managing for wilderness conditions on the West Coast Trail Area of Pacific Rim National Park. In: N.W.P. Munro and J.H.M. Willison (eds.) Linking Protected Areas with Working Landscapes Conserving Biodiversity: Proceedings of the Third International Conference on Science and Management of Protected Areas/12-16 May 1997. Wolfville, NS: Science and Management of Protected Areas Association.

Rollins, R. 1993. Managing the national parks. In: P. Dearden and R. Rollins (eds.) Parks and Protected Areas in Canada: Planning and Management. Toronto: Oxford University Press.

Rollins, R. 1990. Practical application of decision frameworks to camping. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

Sahanatien, V. 1998. Monitoring human use impacts in Auyuittuq and Ellesmere Island National Park Reserves. Research Links 6(2).

Schreiner, E.S. and B.B. Moorhead. 1979. Human impact inventory and management in the Olympic National Park backcountry. In: R. Ittner et al. (eds.) Recreational Impact on Wildlands: Conference proceedings. R-6-001-1979. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region.

Shah, A. 1995. The Economics of Third World National Parks: Issues of Tourism and Environmental Management. Aldershoot, U.K.: Edward Elgar.

Shands, W. 1992. Leadership in a community of interests. Paper presented at the Second Canada/U.S. Workshop on Visitor Management in Parks, Forests, and Protected Areas. University of Wisconsin, Madison.

Shannon, M. 1987. Forest planning: learning with people. In: M.L. Miller, R.P. Gale and P.J. Brown (eds.) Social Science in Natural Resource Management Systems. Boulder, CO: Westview Press.

Smith, R.L. 1992. Elements of Ecology (3rd Edition). New York: HarperCollins Publishers.

Stankey, G.H., D.N. Cole, R.C. Lucas, M.E. Petersen and S.S. Frissell. 1985. The limits of acceptable change (LAC) system for wilderness planning. Gen. Tech. Rep. INT-176. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Stankey, G.H., S.F. McCool and G.L. Stokes. 1990. Managing for appropriate wilderness conditions: the carrying capacity issue. In J.C. Hendee, G.H. Stankey and R.C. Lucas (eds.) Wilderness Management (2nd edition). Golden, CO: Fulcrum Press.

Tarleton, P., J. Snell and D. Frandsen. 1995. Human use monitoring in national parks. In S. McCanny and D. Henry (eds.) Ecological Monitoring: a Handbook for Prairie and Northern National Parks. Winnipeg, MB: Department of Canadian Heritage, Professional and Technical Service Centre.

Tayler, G.E. 1990. The visitor management process. In: R. Graham and R. Lawrence (eds.) Towards Serving Visitors and Managing Our Resources: Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas. Waterloo, ON: University of Waterloo, Tourism Research and Education Centre and Environment Canada, Canadian Parks Service.

Thorud, D.B. and S.S. Frissell. 1976. Time Changes in Soil Density Following Compaction Under an Oak Forest. Minnesota Forest Research Note 257.

Tivy, J. 1972. The Concept and Determination of Carrying Capacity Of Recreational Land in the USA : a Review Of Relevant Literature. Perth: Countryside Commission.

Tucker, W.R. 1998. Defining, Monitoring and Managing Valued Ecosystem Components of Experiences in the Kingsmere Wilderness Area. Unpublished report. Parks Canada, Prince Albert National Park.

U.S. Department of the Interior (DOI). 1997. VERP: The Visitor Experience and Resource Protection (VERP) Framework, a Handbook for Planners and Managers. U.S. Department of the Interior, National Park Service.

Wagar, J.A. 1968. The place of carrying capacity in the management of recreation lands. Rocky Mt. - High Plains Parks and Recreational Journal 3(1):37-45.

Wall, G. (ed.). 1989. Outdoor Recreation in Canada. Toronto: John Wiley & Sons.

Wall, G. and Wright, C. 1977. The Environmental Impact of Outdoor Recreation. Publications Series No. 11. Waterloo, ON: University of Waterloo, Department of Geography.

Internet Websites

Abbott, H. 1997. Yoho National Park Lake O'Hara Trail Monitoring Plan. Parks Canada, Yoho National Park. http://www.worldweb.com/ParksCanada-Yoho/TrailMonitor/English/index.htm

Giongo, F. and J. Bosco-Nizeye. 1998. A Study of Visitor Management in the World's National Parks and Protected Areas. Colorado State University, Department of Recreation Resources. http://www.ecotourism.org/textiles/wallace.txt

Kelso Conservation Area. 1998. Kelso Conservation Area Master Plan. Halton Region Conservation Authority Administration. http://www.hrca.on.ca/mastplan.htm

Parks Canada. 1999. Gwaii Haanas National Park Draft Backcountry Management Plan. Parks Canada, Gwaii Haanas National Park Reserve. http://www.harbour.com/parkscan/gwaii

Parks Canada. 1998c. Riding Mountain National Park - Natural Heritage. Parks Canada, Riding Mountain National Park. http://parkscanada.pch.gc.ca/parks/manitoba/riding_mountain/English/naturale.htm

Parks Canada. 1997c. Grasslands National Park, Camping. Parks Canada. http://parkscanada.pch.gc.ca/parks/saskatchewan/grasslands/English/campinge.htm

Payne, R.J., A. Carr and E. Cline. 1997. Applying the Recreation Opportunity Spectrum (ROS) for Visitor Opportunity Assessment in Two Canadian National Parks: A Demonstration Project. Parks Canada, Natural Resources Branch. http://parkscanada.pch.gc.ca/library/Ros/english/maine.htm

U.S. Department of the Interior (DOI). 1999. Desired Future Conditions. Gulkana River Studies Newsletter 2(1). U.S. Department of the Interior, Bureau of Land Management, Glennallen Field Office. http://www.gulkanariver.com/p2-1.html

U.S. National Park Service (NPS). 1999. Grand Canyon National Park Draft Wilderness Management Plan. U.S. Department of the Interior, National Park Service. http://www.nps.gov/grca/wilderness/draftwmp.htm

U.S. National Park Service (NPS). 1998. Shenandoah National Park Backcountry/Wilderness Management Planning Framework. U.S. Department of the Interior, National Park Service. http://www.nps.gov/shen/ps/nr/bwmp/ch4.htm

U.S. National Park Service (NPS). 1997a Fact Sheet: Carrying Capacity in Delaware Water Gap National Recreation Area. U.S. Department of the Interior, National Park Service. http://www.libertynet.org/~drkn/factsheets/Carrying_Capacity.html

U.S. National Park Service (NPS). 1997b. Zion General Management Plan Newsletter #4. U.S. Department of the Interior, National Park Service. http://www.nps.gov/planning/Zion/vmrp/

U.S. National Park Service (NPS). 1995. Visitor Experience and Resource Protection Implementation Plan: Arches National Park - Utah. U.S. Department of the Interior, National Park Service, Denver Service Center. http://www.nps.gov/planning/arch/verpintr.html

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Appendix A: Backcountry Visitor Impact Management Strategy for RMNP

Objectives

The objective of this backcountry visitor impact management strategy is to maintain ecological integrity in Riding Mountain National Park's (RMNP) backcountry while allowing for appropriate visitor activities and experiences.

Purpose

The strategy's purpose is to provide RMNP staff and management with a framework for preventing, monitoring, measuring and mitigating impacts on backcountry resources and visitor experiences caused by visitor and/or park maintenance activities.

Implementation

To meet the strategy's objective, RMNP staff and management must implement the initial steps of the strategy and must be committed to following through with the remaining steps that involve ongoing monitoring and management actions. Steps 1-3 have already occurred in the park but may require some revision. These steps, along with steps 4-7, are the first stages of the strategy and must be implemented as soon as possible. The remaining steps, 8-11, are the ongoing component of the strategy and management must ensure that these steps follow a predetermined time line for implementation.

Once the initial steps have been implemented and continual monitoring is underway, there will likely be revisions to various components of the strategy. For example, it may be determined that the public involvement strategy is not extensive enough, the indicators and standards do not adequately reflect desired conditions and limits of acceptable change or that the monitoring plan is difficult to operationalize. This strategy is flexible enough to allow for these and other changes without compromising its ultimate objective. It is not so rigid that any difficulties in its implementation should be considered insurmountable.

At any time throughout the process of implementing the strategy, changes that are made must be documented and the strategy revised accordingly. These changes must also be adequately communicated to park staff and relevant stakeholders.

Steps in the Strategy

While the details of each step are provided in Chapter 5, the following section discusses who should be involved in implementing each step. For example, the park's Backcountry Working Group (BWG) will likely have a large role to play in decision making. Further public involvement may also be necessary in certain steps. The scientific expertise of park management and staff is required in several of the steps. As well, staff and management must ensure that the strategy remains consistent with Parks Canada policy and RMNP management plans. Finally, it is important to note that developing indicators, standards and a monitoring plan can be highly technical tasks, requiring knowledge about sampling design and data analysis. If the planning team does not have this expertise, the team may need to consult with experts to ensure that these components of the strategy are valid, reliable and useful.

Step 1 *Assemble an interdisciplinary project team.*
The BWG; consisting of park wardens, managers and representatives of external stakeholder groups, meets the criteria of an interdisciplinary project team. The BWG provides recommendations and input into backcountry operational issues and will be instrumental in implementing the backcountry visitor impact management strategy.

Step 2 *Develop a public involvement strategy.*
The BWG's first step should be to determine its role in implementing the strategy and to what extent further public involvement (e.g. surveys, public meetings) will be required.

Step 3 *Develop statements of purpose, significance and primary interpretive themes for the backcountry; identify backcountry planning objectives, issues and concerns.*
RMNP's backcountry managers and staff and the BWG should ensure that the vision statement for the park's backcountry appropriately addresses the backcountry's purpose, significance and primary interpretive themes. Planning objectives, issues and concerns must then be addressed.

Step 4 *Inventory current resource and social conditions at each site or a chosen sample of sites.*
There should be at least one person in the first season of implementation dedicated to conducting site inventories.

This analysis should be documented, usually through a combination of maps, matrixes, photographs and text. This is a crucial first step in operationalizing the strategy since

the conditions will then be compared to chosen standards for each condition in later steps. However, RMNP's backcountry managers and the BWG may wish to conduct step 5, identifying indicators, prior to inventorying the sites. This will depend on whether there is enough time to select indicators prior to conducting the inventory in the first field season.

Step 5 *Identify key indicators of resource and social conditions for the backcountry.*

The selection of indicators is an important step that should involve public input, either through collaboration with the BWG or with more extensive public involvement. However, RMNP management should consult the scientific literature and/or previous research done on the park's resources prior to involving the BWG or other public forum. This gives a starting point from which to begin the process of selecting indicators.

Step 6 *Develop standards for key impact indicators which define the limits of acceptable change.*

The method used to select indicators (e.g. public consultation) should be repeated in the process of selecting standards. Backcountry users will likely have much to contribute regarding their desire for acceptable backcountry conditions and their input should be paramount in selecting standards. As well, management must ensure that standards reflect the mandate to protect ecological integrity.

Step 7 *Develop a monitoring plan.*

Once site inventories have been conducted and indicators and standards have been selected, a monitoring plan must be developed. The BWG must decide to what extent it will be involved in developing this plan and whether further public involvement is required. However, the monitoring plan is likely to involve technical details that must be decided upon by staff or management with the necessary expertise.

Step 8 *Monitor resource and social indicators to compare standards and existing conditions.*

RMNP has many options regarding who will conduct the monitoring:

- existing staff;
- summer students;
- overseas students;
- ecotourism outfitters;
- research vacations;
- backcountry users; and

- other stakeholders.

Step 9 *Identify probable causes of impacts.*
While this task will likely be conducted by RMNP staff or management who have the statistical data regarding visitor use patterns, it would also be beneficial to involve backcountry users who may help explain the causes of the impacts. Informal discussions with users in the field or visitor surveys would likely prove beneficial in conducting this task.

Step 10 *Identify strategies for management action.*
Since the actions identified during this step will affect both resources and visitor experience, both management and users must be involved in determining the appropriate strategies. Both the BWG and a larger sample of users should be involved. A survey of users to gauge their attitudes towards various management strategies would help guide management in selecting appropriate actions.

Step 11 *Implement the chosen strategies.*
Management actions that involve physical changes such as adding or removing facilities, site hardening and trail maintenance should be conducted by appropriate park staff. However, users may be encouraged to volunteer to take part in some of these activities.

Management strategies that involve restrictions to visitor use such as site closures or use limits must be adequately communicated to users and potential users. Methods of communication may include public meetings, informal discussions with users or publications. To minimize potential conflict resulting from changes to backcountry management, users must be involved in as many stages of the entire backcountry visitor impact management strategy as possible.