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Social dimensions of forestry road management : a study of Wawa district residents

Mihell, Kimberley Ann

The Social Dimensions of Forestry Road Management: A Study of Wawa District Residents

By

Kim Mihell

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Abstract

This study explores the social dimension of forestry road access management in the Ontario Ministry of Natural Resource's Wawa District (northern Ontario). Road access restrictions in the District are often implemented for the protection of remote tourism values, and many recreationists have expressed strong opposition to these restrictions. This study examines the issue from two perspectives. First, it determines residents' satisfaction levels with current forestry road management, and explores how satisfaction varies with user characteristics. Second, it determines residents' evaluations of the desirability of specific road access tools and controls, such as signs, gates, and physical impediments, and explores how these evaluations vary. The user characteristics considered include age, community of residence, use frequency, familiarity, environmental beliefs, and recreational activities pursued. The results provided varying degrees of evidence for the relationships between the user characteristics and satisfaction and management tool evaluations. However, although all user characteristics considered were shown to have some predictive ability, there was low support for all models and much variation was left unexplained for both satisfaction and management tool evaluations, suggesting that there remain other unidentified factors influencing these social dimensions of forestry road management.

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Chapter 1: Introduction

1.1 Forest Industry in Ontario

Ontario's forest industry has played an important role in the provincial economy as early as 1827, when logging companies first began paying fees to the Crown to harvest Crown lands (Runesson, 2002). By 2002, forestry and wood products had grown to become Ontario's third largest industry and its second greatest net export, with one quarter of Canada's total forest-based shipments produced by Ontario. Reliance on the forest industry has traditionally been particularly strong in northern Ontario. In 2002, forestry was eight times more economically significant to northern Ontario than to Ontario as a whole, 60 per cent of northerners lived in forest-dependent communities, and the northern forest industry accounted for 96 per cent of all logging jobs in Ontario (Runesson). Although the forest industry is currently suffering (Ontario Forestry Coalition, 2008), northern Ontario's past reliance on the forest industry, the large forested land base, emerging forest industries such as biofuel and co-generation plants, government stimulation programs, and related industries that are dependent on forest policies such as carbon trading, suggest that forest industries will continue to play an important role in northern Ontario (Willick, 2009). As well, despite the downturn in traditional industries, new industries are emerging. For example, the provincial government's new Feed-in-Tariff has stimulated renewable energy developments (Ontario Power Authority, 2009). Although such developments do not rely directly on the forest resource, they often occur in the forested landscape and therefore, share many similarities with dedicated forest industries, such as infrastructure (e.g., access roads) and potential impacts to environmental values (Ontario Ministry of the Environment, 2010). Thus, while the industry will likely look different than in the past (Willick, 2009), it is anticipated that forest industries and their related infrastructure will continue to have an impact on northern communities, landscapes, and lifestyles.

Assuming that forest industries will continue to play an important role in northern Ontario, the question becomes how best to manage forest resources industries and their related infrastructure. As the industry changes, Ontario will face a host of challenges unique to the new ventures. Nonetheless, a core group of issues and management principles will remain relevant. For example, ensuring the sustainability of the resource is a shared issue common across all industries. This is reflected in the provincial Crown Forest Sustainability Act, which aims "to provide for the sustainability of Crown forests and, in accordance with that objective, to manage

Crown forests to meet social, economic and environmental needs of present and future generations" (Ontario Ministry of Natural Resources [OMNR], 2010a). Accordingly, the Ontario Ministry of Natural Resources (OMNR) has produced guidance documents providing direction for the operational, environmental, and social aspects of forest management applicable across a range of forest industries. These guides include silvicultural guides, a tourism guide, a cultural heritage values guide, a stand/site guide, and landscape guides (OMNR, 2009). They provide direction on a broad range of topics such as pest management, operations in riparian areas, habitat protection, silvicultural techniques, and the protection of resource-based tourism values (OMNR).

While all of the different management dimensions are interrelated and ultimately cannot be treated in isolation when developing forest management plans, each has its own unique challenges and issues that must be addressed. One approach for complex management situations is to focus on each dimension individually and, as knowledge is gained, integrate it into the larger context. Following this strategy, this study focuses on one aspect of forest management – the management of forestry roads. As described in the following section, this is a particularly contentious forest management issue in Wawa District. This study focuses on the social dimensions of forestry road management, looking specifically at local residents' use of forestry roads, their satisfaction with current management, and their evaluations of management tools.

1.2 Forestry Roads

Forest operations constantly change the locations and extent of road and trail access to many publicly-owned lands and waters in Ontario. Changes such as new access, and upgrading or maintaining existing access, bring with them both positive and negative effects for economic, social, and ecological interests. For example, while roads can positively or negatively affect recreation opportunities, they can also affect the physical and chemical environments, alter animal behaviours, increase introductions of exotics, and reduce game and fish populations (Forman et al., 2003; Trombulak & Frisell, 2000).

Forestry roads are used for both industrial and nonindustrial uses. Industrial interests use roads to access developments and harvest sites, and transport resources and materials. Nonindustrial interests use roads for economic activities (e.g., trapping, prospecting, tourism), recreation, and resource gathering (e.g., firewood, berries, mushrooms). Regarding tourism, road-based activities such as all terrain vehicle (ATV) use are increasing (Outback ATV Club,

2007), and northern Ontario communities are actively trying to capitalize on this trend by expanding their road-based tourism industries. Roads are also used by First Nations for purposes such as traditional harvests (e.g., wild rice) (Hunt, Lemelin, & Saunders, 2009).

Access management policies and plans need to address all of these economic, social and ecological interests. From a social perspective, roads are used by a variety of people for recreational, social, and cultural purposes. Managers are tasked with balancing the preferences of these users with those of economic interests, while still adequately protecting the environmental and cultural values in the area. In fact, the OMNR's Statement of Environmental Values underscores the importance of including all interested groups and individuals in resource management planning processes (Environmental Registry, 2010).

In Ontario, forestry roads are planned through strategies that provide details for creation, maintenance, access tools and controls, and future use or decommissioning (OMNR, 2010a). Access tools and controls are typically used to restrict motorized vehicle access when forestry operations occur, or occurred, in areas of concern, such as near tourism establishments. Access tools and controls include physical tools and techniques (i.e., natural abandonment, water crossing removals, physical removal of the roadbed, road impediments, and winter access for forest operations) and regulatory tools and techniques (i.e., signs restricting use, road use permits, and gates) (OMNR, 2001). Access plans must address how roads will be managed during and after their use by the forest industry. Similarly, as mentioned, there are a variety of emerging industries on the northern Ontario landscape. Although none of these industries have required road development anywhere near to the extent of forestry thus far, they will likely require significant road networks in the future. Although some coordination of road use between industries is likely, it is probably that most developments will require some new roads to serve their specific purposes. For example, wind farms typically demand a substantial road network, as direct access to each turbine is needed, along with access to additional infrastructure such as electrical wires. Thus, as the northern Ontario economy changes, there may be a greater proportion of roads attributed to other industries. However, the core issues and conflicts about roads and access management will remain similar regardless of the reason for road construction.

Despite the long history of access control use in Ontario, there is little information available about how residents use forestry roads for recreation, or how they evaluate the acceptability of either broad access strategies or specific access tools and controls. Similarly, although limited studies have been conducted (e.g., Hunt & Hosegood, 2008), there is little

empirical evidence about the effectiveness of tools and controls to limit or to restrict road access.

Wawa District represents a particularly interesting case because of a long history of issues around forestry roads and road access. As in many areas of Ontario, conflict exists between road-based recreationists and resource-based tourist outfitters (Hunt et al., 2009). Some residents have expressed opposition to forestry road restrictions, arguing that the public has the right to travel unimpeded on all roads on Crown land on the rationales that Crown land is public land and should be equally accessible to all, and that public subsidies are provided for forestry roads and therefore, public use should not be restricted, as demonstrated through media articles and letter writing campaigns, public demonstrations, vandalism of access tools and controls, and noncompliance with restrictions (e.g., Ontario Federation of Anglers and Hunters [OFAH], 2007; Poliquin, 2007). Some tourist outfitters counter that these restrictions are necessary to maintain the remote aspect of their business that attracts clients (e.g., Bazeley, Morandin, & MacIsaac, 2006; McKenzie Forest Products Inc., 2006). However, the approaches for managing road access vary across the province. The Wawa District Land Use Guidelines developed in the 1980s included a prescriptive strategy for resource-based tourism, but similar approaches have not been adopted across the province. Inconsistencies also exist within Wawa District. Notably, the District's Land Use Guidelines do not apply equally across the District as a result of changes to District boundaries since the guidelines were adopted. Newly added regions are not subject to the same prescriptions as the original area (CLUAH, 2006). Given the inconsistencies between and within OMNR Districts, Hunt et al. (2009) suggested that some individuals may view the prescriptions in Wawa District as unjust.

Resource-based conflicts are not unusual. For example, researchers have identified conflicts between recreationists such as skiers and snowboarders (e.g., Vaske, Dyar, & Timmons, 2004) and hikers and mountain bikers (e.g., Carothers, Vaske, & Donnelly, 2001). However, resource-based disagreements are not limited to recreationists specifically. Rather, individuals can disagree on the acceptability of certain activities occurring, in general or in specific areas, and conflicts can arise from simply knowing that such activities are happening. For example, individuals might disagree on the acceptability of motorized vehicle use in provincial parks, regardless of whether they recreate in these areas (Vaske, Donnelly, Wittman, & Laidlaw, 1995). Such conflicts are common and are well documented in the academic literature. However, disagreements concerning the acceptability of road access restrictions and the related access tools and controls, particularly those implemented for the benefit of economic interests, are less well

known or documented.

No formal studies have looked at individuals' perspectives on different access tools and controls in an economic, or specifically tourism, context. Rather, the studies that have been conducted generally considered access preferences within a wildlife conservation context (e.g., McFarlane, Craig, Stumpf-Allen, & Watson, 2007). Hunt et al. (2009) explored the factors influencing road access conflicts in Wawa District, but did not explore opinions on the acceptability of different access tools and controls.

These information gaps impede managers' abilities to develop effective forestry road management plans that balance social, ecological, and economic values. Although overall management goals are often quite specific, managers have the flexibility to choose amongst a variety of tools and controls to meet the defined goals, thus allowing them to consider the plan's acceptability to residents and other interested or affected parties (Hunt & Morgan, 2005). However, without knowing how individuals evaluate tools and controls, managers are unable to tailor the plans to their audience. As well, when lacking knowledge on the effectiveness of different access tools and controls, managers must err on the side of caution when selecting the tools to use.

This study was developed to address one of these knowledge gaps: individuals' perceptions of the desirability of the various access management tools and controls. Specifically, it explores residents' evaluations of different road access tools and controls in a remote tourism context and how these evaluations are related to user characteristics and recreational pursuits. It also evaluates residents' satisfaction levels with current forestry road management, and how satisfaction varies with resident characteristics. The study considers both active and retired forestry roads (i.e., no longer used for forestry operations), without distinguishing between the two. Knowing how residents' characteristics and recreational pursuits influence their satisfaction and management evaluations can assist managers in choosing options that might be more acceptable to residents, hopefully reducing road access conflicts, increasing satisfaction and support for access management strategies and plans, and increasing compliance with any regulatory access restrictions.

1.3 Study Objectives and Research Goals

This research has two main objectives and two more specific research goals. A number of hypotheses were tested to meet these objectives. This section outlines the broad objectives and the research goals. The specific hypotheses are presented in Chapter 2.

1.3.1 Study Objectives

Objective 1: Provide resource managers with practical knowledge that can be applied in the development of access management plans.

Foremost in this study is the recognized need of public resource managers in Wawa District for information that they can use to develop more socially acceptable access plans, in an effort to increase satisfaction, reduce conflicts, and increase acceptance and compliance with access management plans. Therefore, this study is focused on obtaining practical results that could be applied by field staff in the OMNR. The goal of providing managers with a better understanding of how different groups will respond to access restrictions will be achieved by examining the associations between individuals' characteristics and their access tool evaluations and overall satisfaction.

Objective 2: Contribute to research in the areas of recreation satisfaction and forestry road management.

Currently, there is a great deal of satisfaction research, and a lesser amount of forestry road management research. Of the forestry road management research, very few studies occur in contexts similar to this one, where access restrictions are implemented to protect economic interests (i.e., the remote nature of tourism establishments). Instead, most studies have focused on areas where restrictions are implemented for ecological reasons (e.g., McFarlane et al., 2007). Although Hunt et al. (2009) examined conflict in Wawa District's economic-protection context, neither they nor any other studies have looked explicitly at evaluations of tools and controls in such a setting.

In sum, this study is intended to contribute to the satisfaction research by exploring how Wawa District residents' satisfaction with forestry road management varies with individual characteristics. It will contribute to the forestry road management research by examining how individuals evaluate restrictive tools and controls implemented in an economic-protection context, and exploring how these evaluations are associated with individuals' characteristics.

1.3.2 Research Goals

The above objectives can be rephrased more succinctly as the following two research goals:

- Report and explain variations in Wawa District residents' satisfaction levels with current forestry road management
- Report and explain variations in Wawa District residents' evaluations of tools and controls to manage road access

1.4 Thesis Organization

This thesis is divided into seven chapters. This chapter has introduced the issues, and outlined the broad objectives and research goals. Chapter 2 includes a review of the relevant literature, and concludes with a discussion of the specific hypotheses and the associated explanatory variables. Chapters 3 and 4 present the methods: Chapter 3 outlines the broad statistical paradigm under which this research was conducted, while Chapter 4 details the specific analytical techniques employed. In Chapter 5, I present the results of the study, followed by a discussion of the findings in Chapter 6. In Chapter 7, the concluding chapter, I briefly summarize the work conducted and the findings, and outline some suggestions for future studies that would enhance, or complement, this research.

Chapter 2: Literature Review and Hypotheses

2.1 Introduction to Road-Based Issues and Research

Interest in forestry roads and related issues is becoming more prominent as reflected by the increasing amount of road-related research. This research has focused on many road-related issues, including the recreational use of roads (e.g., Clark, Koch, Hogansm Christensen, & Hendee, 1984; Coghlan & Sowa, 1998; Cordell, Teasley, Super, Bergstrom, & McDonald, 1997; Lime, 1971), ecological impacts of roads (e.g., Forman et al., 2003; Gunn & Sein, 2000; Trombulak & Frissell, 2000), conflicts amongst road and forest users (e.g., Hunt et al., 2009; Mann & Absher, 2008), values, attitudes, and beliefs toward roads (e.g., Avison Management Ltd., 2005; Bengston & Fan, 1999; Clark et al., 1984), and the acceptability (e.g., Avison Management Ltd., 2005; McFarlane et al., 2007) and effectiveness of different road access management tools and controls (Hunt & Hosegood, 2008).

This research shows that beliefs and attitudes about roads vary dramatically amongst recreationists. Many individuals consider roads to be an integral part of the recreational experience, even citing the act of driving on forestry roads as a favoured recreational activity (Clark et al., 1984; Coghlan & Sowa, 1998; Cordell et al., 1997). Some forest recreationists prefer recreational sites on or near roads, while others rate these same areas as the least desirable sites (Clark et al., 1984; Cordell et al., 1997; Lime, 1971).

Although this study focuses on the social dimensions of forestry road management, important ecological road impacts have been identified that should not be overshadowed by vocal human interests in access management plans. Trombulak and Frissell (2000) outlined a broad array of potential impacts on both terrestrial and aquatic ecosystems, including wildlife mortality during construction and from collisions with vehicles, modified animal behaviours, increased spread of invasive species, and altered physical and chemical environments. Perhaps most relevant to this study are the impacts of enhanced human access: increased hunting and fishing pressure, passive wildlife harassment by recreationists, and land use changes such as resource extraction operations associated with forestry road developments (Trombulak & Frissell, 2000). For example, Gunn and Sein (2000) concluded that increased angling facilitated by forestry roads is the greatest road-related pressure facing lake trout (*Salvelinus namaycush*), more than direct environmental impacts such as spawning habitat loss. Similarly, Kaufman, Snucins, Gunn and Selinger (2009) found that there were significant differences in angling

intensity during the open-water season in accordance with access type. Lakes accessible via primary and secondary roads faced more angling pressure than remote lakes, and were more likely to be fished beyond the estimated sustainable levels. Hunt and Lester (2009) supported these conclusions with the finding that forestry roads influence the development of access points (i.e., trail or road access to lakes) on Boreal Shield lakes. They found that access points were positively correlated with the proximity of the nearest road to a lake and the density of the roads within 1 km of the lake.

Rempel, Elkie, Rodgers, and Gluck (1997) demonstrated that human pressures are not limited to fisheries. They found that moose (*Alces alces*) density suffered with the combined effects of landscape disturbance (i.e., logging or burns) and hunter access (i.e., road developments), although not with either one alone. For example, moose populations did well in modified clearcut areas without increased road access, but suffered in similar areas with high road density, due to the increased hunter access.

Besides ecological impacts, social impacts, notably conflicts among different road user groups, often arise over road construction and management of access. Bengston and Fan (1999) suggested that, given the increasing use of forestry roads for purposes apart from the original intent, and the conflicting beliefs and attitudes about roads, recreationists are highly divided on appropriate road management, and conflict between recreation groups would likely become an important source of social conflict in forest management. Mann and Absher's (2008) work supported this hypothesis, and demonstrated that road issues are not geographically limited to North America. They concluded that, although Germany's multiple use forestry roads may reduce ecological impacts by concentrating use, they also lead to increased conflicts between user groups forced to share the same infrastructure. Hunt et al. (2009) have explored the specific case of road access conflicts in northern Ontario. They concluded that varying attitudes and beliefs about roads can lead to conflicts amongst users and stakeholders. In this case, conflict between tourism operators and road-based recreationists arose from, among other things, differing values about remoteness and public land access and the acceptability of road access restrictions.

Other researchers have studied topics that, while not specifically focused on roads, provide insight into potential reasons underlying differing levels of satisfaction and management preferences. Many researchers have explored recreationists' satisfaction levels and the personal and situational factors affecting satisfaction. They have argued that understanding factors

influencing satisfaction ratings is necessary to provide the most beneficial opportunities for recreationists and to gain loyal visitors (e.g., Tian-Cole, Crompton, & Willson, 2002). Researchers have identified many influential factors relevant across a broad scope of activities (e.g., Foster & Jackson, 1979), and some factors specific to particular activities, such as water levels and whitewater paddling (e.g., Whisman & Hollenhorst, 1998). Understanding the situational and personal factors influencing satisfaction is important in the context of this study. I anticipate that if residents are satisfied with forestry road management they will be more apt to support OMNR initiatives and comply with road access restrictions, which in turn will reduce conflicts. Understanding previously identified situational and personal characteristics that influence satisfaction levels can assist in identifying potential influential factors in this context. I also expect that satisfaction will be influenced partly by residents' evaluations of access management plans. Hence, it is useful to consider factors that have been found to influence individuals' management preferences.

Some researchers have explored the relationships between individuals' environmental value orientations and their management preferences (e.g., Bengston, Fan, & Celarier, 1999; Bright, Manfredo, & Fulton, 2000; Jurowski, Uysal, Williams, & Nog, 1995; Manning, Valliere, & Minteer, 1999; Vaske, Donnelly, Williams, & Jonker, 2001; Webb, Bengston, & Fan, 2008; Winter, 2005; Xu & Bengston, 1997), while others have tried to identify sources of regulatory and setting preference heterogeneity within groups of outdoor recreationists, such as anglers (e.g., Arlinghaus & Mehner, 2004a; Arlinghaus & Mehner, 2004b) and hunters (e.g., Hunt, Haider, & Bottan, 2005). Researchers have also explored the links between site familiarity (e.g., Hammitt, Backlund, & Bixler, 2006; McFarlane & Boxall, 1996; Wynveen, Kyle, Hammitt, & Absher, 2007) and past use and use frequency (e.g., Hammitt & McDonald, 1983; Schreyer, Lime, & Williams, 1984) and management preferences. These research themes are further discussed in the coming sections.

The following sections outline past findings about public preferences and the acceptability and the effectiveness of road management strategies and tools (Section 2.2). This is followed by a general discussion of recreation satisfaction research (Section 2.3). Next, a discussion of research themes and recreation characteristics that have shed light on management and setting preferences is provided including: sociodemographics (Section 2.4.1), recreational activities (Section 2.4.2), environmental beliefs (Section 2.4.3), familiarity (Section 2.4.4), and past use and use frequency (Section 2.4.5). Lastly, the specific hypotheses and the associated variables considered in this study are outlined in Section 2.5.

2.2 Road Management Strategies and Tools

2.2.1 Acceptability of Management Strategies and Tools

Several researchers have explored the opinions of recreationists, publics, and stakeholders on the acceptability of both broad management strategies such as road closures to protect ecological values (Clark et al., 1984; Hunt et al., 2009; McFarlane et al., 2007), and localized tools such as gates and signs (e.g., Avison Management Ltd., 2005).

Given that recreationists are attracted to recreate on non-protected public lands because of a lack of regimentation, the ability to conduct many activities prohibited elsewhere, and the opportunity to explore little-used roads (Clark et al., 1984), it might be expected that recreationists would resist any restrictions imposed on their recreational activities. However, researchers have found mixed results, with perspectives on access management varying with geography and context (e.g., Bengston & Fan, 1999; Clark et al., 1984; Hunt et al., 2009; McFarlane et al., 2007). Some counterintuitive beliefs about road management have emerged as well.

An overarching belief that public recreationists have the right to access and use all public lands has emerged from past studies and is thought to underlie much of the opposition to road access restrictions. This belief has been identified in Ontario (Hunt, et al., 2009) and British Columbia (Avison Management Ltd., 2005). In Wawa District, Hunt et al. concluded that individuals hold different views about the right to use publicly owned lands, and while some individuals acknowledged that access restrictions were acceptable management measures, others were adamant that "...if it's public land and it's in Ontario, all Ontarians should have the right to use it" (Hunt et al., 2009, p.11). This perception also emerged in northern British Columbia's Vanderhoof Forest District where some respondents believed that any restrictions are unacceptable:

> "Citizens should not be denied access to roads they have paid for. There should be no access restrictions and no road closures at all. Opening access spreads out resource use rather than concentrating it in defined areas" (Avison Management Ltd., 2005, p.9).

Equally prominent in both areas was the opinion that road access restrictions should not favour one social value over another. Wawa District residents who made this point were

referring directly to remote tourism operations (i.e., train or float plane accessible). These residents felt that tourism operators had too much power in road management decision-making, and received disproportionate benefits from the restrictions implemented (Hunt et al., 2009). Respondents in the Vanderhoof Forest District expressed this concern in reference to a broad array of interests. Many respondents felt strongly that access management should not enable 'elitist' use of any part of the land base, but rather should provide equal opportunities for fish, wildlife, recreation, range, and wilderness experiences. Some respondents noted that restrictions should only be implemented for legitimate reasons, and should apply equally to everyone. Although not explicitly noted, this suggests that respondents might favour physical decommissioning over regulatory tools, as decommissioning provides the same treatment to all users (Avison Management Ltd., 2005). This perspective has also been voiced by the Ontario Outdoors Recreational Alliance (OntORA), a volunteer organization dedicated to equal access to Crown land in Ontario. They have stated that OntORA supports access restrictions "where it can be proven scientifically that human presence has a significant and permanent detrimental effect on the environment," but does not support restrictions implemented to protect economic interests such as remote tourism values (OntORA, 2008). If there is a choice between different viable management options along with road closures, such as public education, coordinated operational plans, stakeholder agreements, access control points, or Wildlife Act Closures, then designated road closures were considered less desirable than all options apart from public education in the Vanderhoof Forest (Avison Management Ltd., 2005). Trent (1995) also found that recreationists favour a multiple-benefits management approach emphasizing a long-term balance between human and ecological concerns.

No existing study has found unanimous opposition to any road access restriction. In fact, research has generally shown that public opinion on the acceptability of road access closures varies given the context for the closures (Clark et al., 1984; Hunt et al., 2009; McFarlane et al., 2007; Trent, 1995). In a survey of road-based recreationists of the national forests of the Pacific Northwest, Clark et al. found that closures for the purposes of road maintenance or repair, wildlife protection, and/or fire hazard reduction were generally deemed acceptable, while closures implemented to improve hunting quality or to conserve limited maintenance money were generally considered less acceptable. In their study of road conflicts in Wawa District, Hunt et al. found indirect support for this hypothesis. While they did not explicitly compare acceptability ratings in different contexts, they did conclude that the conflicts between

recreationists and tourism operators stem partly from aspects directly related to these two parties. They found that conflicts stem largely from perceptions of inequity (e.g., unfair advantages/disadvantages accorded to each group), goal interference conflicts (e.g., direct conflicts between recreationists pursuing different activities), social values conflicts (e.g., differing valuations of remoteness and public land access), and the overall context and history of road management in different areas. Although some of these factors might still apply in, for example, an ecological protection context (e.g., valuation of public land access, history of road management), many are specific to the conflict at hand (e.g., perceptions of inequity, goal interference between road-based recreationists and remote tourists). This suggests that Wawa District residents might find closures more (or less) acceptable if implemented under different circumstances.

Comparing these results to those of McFarlane et al. (2007) suggests that this might indeed be the case. Although McFarlane et al. also did not explicitly compare opinions in different contexts, they looked at public perspectives in a different context than did Hunt et al. (2009). Where Hunt et al. considered perspectives toward road access closures implemented to protect remote tourism values, McFarlane et al. focused on closures implemented to protect ecological values, specifically grizzly bear (*Ursus arctos horribilis*) conservation. McFarlane et al. found substantially more support for road access restrictions than did Hunt et al. Although opinions varied between communities, they found general agreement among all respondents that some degree of access restrictions on recreational use of public land for the purpose of grizzly bear conservation was acceptable. Similar results emerged from the survey in the Vanderhoof Forest District, where many respondents were adamant that restrictions should not be implemented to create unequal opportunities for human use, but were more accepting of the notion that access restrictions be used to help protect natural heritage values. It was explicitly noted that access restrictions to serve guide-outfitters were unacceptable (Avison Management Ltd., 2005).

Trent (1995) concluded that many recreationists in the Pacific Northwest also supported increased regulations for the protection of fish and wildlife on public lands, and management approaches that balance human and ecological values. She found that support for road closures in ecologically sensitive areas where recreation occurred ranged from 52 per cent to 63 per cent. The least support was associated with respondents who are mostly likely to use the area in question for recreation.

Interestingly, even with the popularity of road-based recreation and demonstrated opposition to road closures in many circumstances, road-based recreationists do not always support new forestry road developments, nor do they always support road upgrades. In particular, many Pacific Northwest recreationists were opposed to new road development in currently roaded areas, expressing concern that additional roads would attract new users, which was seen as undesirable. However, the majority of these respondents expressed support for new roads in currently inaccessible areas, thus, opening new areas for road-based recreation (Clark et al., 1984).

Regarding road upgrades, managers sometimes assume that, because paved roads are easier to travel on, they would be welcomed by recreationists. However, research has shown that this is not necessarily the case (Clark et al., 1984; Lucas, 1964). Lucas came to this conclusion initially, in a study of recreationists in the Boundary Waters Canoe Area, and it was supported by Clark et al. in the Pacific Northwest. Clark et al. proposed that users in these areas are seeking specific road-based recreational experiences, and paved roads may not be necessary for, and may actually detract from, these experiences.

Studies of forestry road management have also considered the acceptability of logging to recreationists in these areas, questioning whether people would get more from these experiences if roads were built and managed specifically for recreation, without visible evidence of logging (e.g., Clark et al., 1984; Hendee, Stankey, & Lucas,1978; Hunt, Twynam, Haider, & Robinson, 2000). The few findings thus far have indicated varying opinions between different recreational groups. Hendee et al. were some of the first to consider this question. Given their focus on wilderness area users, it was perhaps predictable that their results would demonstrate an incompatibility between recreation and logging. In contrast, Clark et al.'s study of road-based recreationists concluded that for most of that group, logging was acceptable.

Hunt et al. (2000) also examined the desirability of logged settings to recreationists. Their results were consistent with those of Clark et al. (1984) and Hendee et al. (1978) in that they found that desirability ratings varied between different groups of recreationists. Most notably, they concluded that consumptive recreationists (i.e., hunting, fishing, ice-fishing) and motorized recreationists were more open to recreating in logged areas than were non-consumptive recreationists. Furthermore, they expanded on the previous research by identifying other factors associated with perceived acceptability of logged settings for recreation. They found that individuals interested in pursuing multi-day recreation trips found logged settings less desirable

than those pursuing single-day ventures. They also considered sociodemographics, and their findings revealed that married, older, retired or blue collared employed, and rural individuals with lower levels of formal education, had greater desirability for recreating in logged settings than others. Trent (1995) concluded that recreationists that used forest areas most often were the most likely to report interference from logging, but it was still considered a problem by only one-fifth of the respondents.

Few studies have looked at the acceptability of specific access management tools, such as gates or signs. However, there is some information available about these perceptions. One survey that did assess these views was the Vanderhoof Access Management Study (Avison Management Ltd., 2005). Respondents rated the desirability of a variety of road access controls including gates, berms/blocks, excavations, signs, bridge removal, spreading slash, and rehabilitation. Although the use of signs was considered slightly more desirable than other controls, no one control was favoured heavily over the others. The largest number of respondents finding any tool desirable was 15 per cent. Mixed views were expressed concerning specific tools, illustrating the broad array of public opinions. For example, while some respondents supported the use of gates, others argued that "Gates make kingdoms for those that have keys" (Avison Management Ltd., p.8).

McFarlane et al. (2007) also explored opinions towards different restrictions. However, rather than looking at the acceptability of specific tools such as gates, they looked at temporary versus permanent restrictions implemented for wildlife conservation. Interestingly, permanent closures were not always viewed the most negatively, For example, participation in hunting had a significantly negative effect on support for temporary access restrictions, but the relationship was not significant for permanent closures.

2.2.2 Effectiveness of Management Strategies and Tools

When deciding which tools and controls to use when implementing access restrictions, managers must base their decisions not only on stakeholder preferences, but also on the effectiveness of the tool for obtaining the desired outcome. The most popular tool will not be the best choice if it is ineffective. However, only a few studies have examined the effectiveness of different road access controls. Some researchers measured the effectiveness of signs (e.g., Henschel, 2003; Hunt & Hosegood, 2008), while the Vanderhoof Forest Access Management Study asked respondents about their perceptions of the effectiveness of the current road access

management (Avison Management Ltd., 2005).

Although the Vanderhoof study considered the effectiveness question, it did not measure the effectiveness of specific controls. Rather, it asked respondents whether they felt that current access road management in the Vanderhoof Forest was effective. Nonetheless, the comments that were provided shed some light on public and stakeholder perceptions of effectiveness. Many respondents felt that gates, in combination with signs, and even berms or blocks, are the most effective means of restricting access, while others suggested that gates are ineffective because people who want to will work to get around them, and others suggested that signs are not effective in isolation. This assumption has been echoed by other groups and individuals who believe that because signs do not physically impede travel on roads, they are ineffective at restricting access (e.g., Henschel, 2003). A number of Vanderhoof respondents also emphasized the need for access restrictions to be legislated and enforceable if they are to be effective.

Hunt and Hosegood (2008) also discussed the advantages of a combination gate-signage approach. They explained that, unless a gate is accompanied by a sign, bypassers cannot be charged with an infraction. Signs provide the additional benefit of allowing managers to designate restrictions for specific areas, activities, or timeframes, potentially making them more acceptable to the public. McFarlane et al. (2007) also found that the public had stronger support for flexible and seasonal access restrictions than they did for permanent ones.

Signage can be divided into two general approaches: fear-based messages that threaten sanctions (e.g., Sorice, Flamm, & McDonald, 2007) and educational messages based on moral appeal (e.g., Marion & Reid, 2007). However, the efficacy of each approach has varied. Marion and Reid supported the use of educational methods, arguing that fear-based messages are antagonistic and rely heavily on enforcement to be effective. However, others have countered that this approach is best suited for ecological contexts, as opposed to social contexts where individuals may be knowingly pursuing noncompliant behaviours (Hendricks, Ramthum, & Chavez, 2001). This is consistent with the findings outlined above regarding greater acceptance of access restrictions implemented for ecological rather than for social or economic reasons (e.g., remote tourism values) (Avison Management Ltd., 2005; Hunt et al., 2009; McFarlane et al., 2007). Thus, given that northern Ontario road access restrictions are generally implemented for social reasons (i.e., protection of remote tourism values), and that noncompliance likely arises from willful behaviours, Hunt and Hosegood (2008) suggested that educational, moral-based signage would likely be ineffective.

Although managers have often been reluctant to rely on signage given its assumed ineffectiveness, past research shows that fear-based or regulatory signage can reduce noncompliance. For example, Hunt and Hosegood (2008) concluded that signs implemented to restrict motorized vehicle traffic during the first two weeks of the regular moose (*Alces alces*) hunting season, when access is restricted to the clients of tourism operators and other hunters travelling by foot, led to a compliance rate of nearly 90 per cent.

2.3 Satisfaction: The Concept, Its Measurement, and Influencing Factors

2.3.1 Introduction

Satisfaction emerged as an important theme in recreation studies in the 1960s, with the acknowledgement that a primary goal of outdoor recreation management is to provide opportunities from which users may derive satisfaction. It was assumed, and has since been confirmed, that satisfaction levels will influence post-experience behaviours of recreationists, with high satisfaction likely leading to repeat visitors, to support for the agency, and to positive word-of-mouth messages (e.g., Tian-Cole et al., 2002). If managers can identify the components of recreation experiences that affect satisfaction levels, they might be able to increase positive components and decrease negative components, thus enhancing user benefits and maximizing satisfaction (Whisman & Hollenhorst, 1998). Thus, this field of study has worked to develop accurate measures and conceptualizations of the satisfaction construct, and to identify situational and personal factors influencing satisfaction levels.

2.3.2 Conceptualization and Measurement

Broadly speaking, satisfaction refers to individuals' perceptions of their experiences. If individuals enjoyed an experience, they will generally report high satisfaction levels. Conversely, low-quality experiences will lead to reports of low satisfaction. However, although researchers have been studying satisfaction for roughly 50 years, the concept remains a challenging one to conceptualize and measure. As such, researchers have developed a variety of models and methodologies for conceptualizing and measuring recreationists' satisfaction levels.

Conceptually, leisure research has approached satisfaction from two primary perspectives: needs/benefits satisfaction and appraisal satisfaction (Mannell, 1999). The needs/benefits approach theorizes that satisfaction levels depend on how adequately an individual's participation meets their leisure needs or motives. In the appraisal satisfaction

approach, satisfaction is considered a "form of cognitive appraisal or evaluation of the extent to which an individual's leisure style or some aspect of it meets with current expectations" (Manning, 1999, p. 238).

In terms of measuring satisfaction, faced with the extensive variability among visitor expectations, and the difficulty of measuring and monitoring those expectations, managers initially developed a surrogate measure of experience quality: managerial standards. These standards were developed for all aspects of recreation experiences, and included items such as "Restrooms will be checked and cleaned hourly." The underlying assumption was that quality input would result in quality output (i.e., quality experiences and satisfied visitors, LaPage, 1983). As recreation satisfaction research progressed, researchers began measuring visitor satisfaction more directly using a variety of more comprehensive measures including global evaluation (e.g., Foster & Jackson, 1979), multiple dimensions (e.g., Beard & Ragheb, 1980), and composite measures (e.g., Dorfman, 1979; Peterson, 1974).

Although no one standard conceptualization and measurement approach has been defined, overall satisfaction is now commonly conceptualized and measured as a function of multiple satisfactions derived from a variety of distinct elements of an experience, each of which can influence satisfaction positively or negatively (e.g., Graefe & Fedler, 1986; Peterson, 1974; Tian-Cole et al., 2002). This approach ties into the needs/benefits conceptualization discussed above, in that satisfaction depends on how well multiple factors of an experience meet a participant's expectations, or needs. The influential factors can include both situational and subjective factors. Situational factors objectively describe specific attributes of a recreation setting, such as the presence of litter or the number of other people, and can have positive or negative effects on satisfaction (e.g., Dorfman, 1979; Graefe & Fedler; Herrick & McDonald, 1992; Peterson). Subjective factors refer to individuals' subjective evaluations of objective site attributes. For example, the number of people at a site is an objective situational factor, while individuals' perceptions of crowding at the site are subjective evaluations of the number of people. Researchers have also concluded that the subjective perceptions of distinct attributes of an experience are compensatory, in that positive aspects (e.g., social interactions) can offset negative ones (e.g., dirty campsite) and lead to high overall satisfaction, or vice versa (Lue, Crompton, & Stewart, 1996; Tian-Cole et al., 2002). Thus, recreationists can have high levels of overall satisfaction, even if they are dissatisfied with particular aspects of the experience. Conversely, they can have low levels of overall satisfaction even if they are satisfied with some

aspects.

Researchers have emphasized the important influence of subjective evaluations on satisfaction, often arguing that visitors' subjective evaluations may be better predictors of overall satisfaction than objective situational variables. Dorfman (1979) explained that campers (and other groups of recreationists) are not a homogeneous group in terms of their individual preferences, expectations, needs, attitudes, or personality attributes. Where some might prefer developed facilities and conveniences in campsites, for others this would detract from the experience. Hypothetically, satisfaction is maximized when aspiration equals perception (Dorfman).

Researchers have built on this work and have begun including both objective situational variables and subjective ones as independent variables in satisfaction research. This approach has proved effective for both consumptive (e.g., Graefe & Fedler, 1986) and non-consumptive activities (e.g., Whisman & Hollenhorst, 1998), successfully explaining over 50 per cent of the variation in satisfaction in both cases.

In summary, although there are common elements between conceptualizations and measures of recreation satisfaction, there is no single standardized measure that can be applied across all studies. Dorfman (1979) concluded that recreational satisfaction can be conceptualized and measured in many different ways, and argued that there is no single best way to measure satisfaction; each measure may be used for different purposes. He noted that satisfaction measures can be obtained from single item measures or from multiple item scales, but cautioned that the two measures are only moderately related. Furthermore, the use of concepts such as preferences versus expectations will significantly change the resulting measures. Given the variety of conceptualizations and measures, it should not be assumed that any two measures are equivalent or are even highly correlated. Thus, while recreationist satisfaction is a useful construct, it is important to bear in mind that studies employing various measures of satisfaction as dependent variables may obtain different results due to the particular measure used, and, with that in mind, comparisons between studies should be made cautiously (Dorfman).

2.3.3 Factors Influencing Satisfaction

Researchers have identified many situational and personal factors that influence recreationists' satisfaction levels for activities such as camping (e.g., Dorfman, 1979), wilderness canoeing (Peterson, 1974), hunting (e.g., Vaske, Fedler, & Graefe, 1986), and white water

paddling (Herrick & McDonald, 1992; Whisman & Hollenhorst, 1998). Recreationists have been asked to express their attitudes towards thousands of aspects of recreational experiences (events, conditions, attributes). However, Dorfman argued that existing research demonstrated that only a few factors account for most of the variability in satisfaction levels, and that there is general agreement on several underlying key components.

First, specific environmental conditions have been shown to influence satisfaction levels of campers (e.g, Dorfman, 1979), wilderness canoeists (e.g., Peterson, 1974), and white water paddlers (e.g., Herrick & McDonald, 1992; Whisman & Hollenhorst, 1998). The specific environmental conditions identified included scenic beauty, good weather, wildlife, wilderness, clear lakes and streams, mature virgin forests, and pristine environmental conditions.

Second, an absence of negative conditions also emerged as an important influence on satisfaction levels. Conditions reducing satisfaction included poor weather (Dorfman, 1979), crowding (Dorfman; Herrick & McDonald, 1992; Whisman & Hollenhorst, 1998), annoying or inconsiderate neighbouring campers (Dorfman), litter or pollution (Dorfman ; Peterson, 1974), and biting insects (Peterson).

Third, meeting personal recreational goals and objectives positively influences satisfaction. Previously identified goals include enjoying oneself in the outdoors, relaxation, and tranquility (e.g., Dorfman, 1979) along with mental rest and escape (Dorfman; Whisman & Hollenhorst, 1998), challenge (Whisman & Hollenhorst; Vaske et al., 1986), and skill testing (Vaske et al.).

Finally, researchers have identified a positive correlation between use patterns and satisfaction (Dorfman, 1979; Whisman & Hollenhorst, 1998). They have concluded that experience-use history (i.e., the amount of past experience with a site) can influence satisfaction (Herrick & McDonald, 1992). Use patterns can be measured in terms of total visits, total years of use, or the frequency of visitation. Similarly, it can be measured for specific activities based on the frequency of participation in an activity (Hammitt, Bixler, & Backlund, 2004).

An important consideration when evaluating recreationists' satisfaction is the finding that satisfaction can be influenced by factors beyond the boundaries of the experience or the site itself. For example, a visitor may have had a negative experience while traveling to the site, such as receiving a speeding ticket. In this case, he/she is not in a receptive mood to enjoy the experience and dissatisfaction emerges. Thus, there are likely to be occasions when an agency's

performance in delivering a service has little to do with a visitor's overall satisfaction (Tian-Cole et al., 2002).

2.4 Explanatory Variables: User Characteristics Influencing Satisfaction and Management Tool Preferences

Past research has identified an array of factors and user characteristics that can influence management preferences and beliefs and overall recreation satisfaction. This section presents variables previously identified as potentially important, including sociodemographics, recreational pursuits, environmental beliefs, familiarity, and use history and frequency. It concludes with a discussion of the hypotheses tested in this study and the associated explanatory variables.

2.4.1 Sociodemographics

2.4.1.1 Individual Characteristics – Age, Sex, Education, and Knowledge

Past research has considered the relationships between age, sex, education, and knowledge with individuals' management preferences. Studies have found mixed results concerning the association between these variables and management preferences.

In the contexts of wildlife conservation and environmental protection, women have been found to demonstrate more positive attitudes towards wildlife and more support for protection-oriented management strategies than men (e.g., McFarlane et al., 2007). Vaske et al. (2001) found that women tended to be more biocentric-oriented than men, and would thus be more likely to support protectionist-management approaches in United States National Forests.

Young people have displayed similarly positive attitudes and acceptance of protection-oriented management (McFarlane et al., 2007), and have demonstrated more pro environmental orientations than older individuals (e.g., Jurowski et al., 1995). Age has also been associated with setting preferences. Hunt et al. (2005) found that younger moose hunters preferred sites with few human encounters, and placed more importance on the number of moose sightings than did other hunters.

Individuals with higher formal education have demonstrated similar trends. This group tends to have positive attitudes toward wildlife and support for protectionist management (e.g., McFarlane et al., 2007; Williams, Ericsson, & Heberlein, 2002). Vaske et al. (2001) found that this group was also generally more biocentric-oriented than those with less formal education, and therefore, would likely have more support for protectionist-management approaches in United States National Forests.

Findings on the influence of knowledge of wildlife on protection-oriented management support have been mixed. Ericsson and Heberlein (2003) have found no relationship in one sample and a negative relationship in another, while McFarlane et al. (2007) identified a positive relationship between knowledge and support for protection.

2.4.1.2 Community of Residence

Many researchers have found that individuals' management and setting preferences are correlated with their home communities. This has been considered by comparing urban populations versus rural populations (e.g., Arlinghaus & Mehner, 2004a; Boxall & MacNabb, 2000; Hunt et al., 2005; Manfredo & Zinn, 1996; McFarlane et al., 2007), and by comparing rural populations to one another (e.g., Ericsson & Heberlein, 2003; Hunt et al. 2009; Kellert, Black, Rush, & Bath, 1996; McFarlane et al.). Manfredo and Zinn's results supported an urban-rural divide, finding that urban populations tend to be more supportive of protectionist management strategies. Boxall and MacNab found that urban and rural moose hunters differed in their preferences for moose hunting setting characteristics, and Hunt et al. (2005) found that the number of moose sightings was more important to rural hunters when selecting a site. Arlinghaus and Mehner found that urban and rural anglers differed in their support for many management approaches, such as reducing regulations, constraining commercial fisheries, reducing boat traffic, and improving physical access to water bodies.

However, studies have also found that important divides can occur between rural communities, rather than simply an urban-rural divide (e.g., Ericsson & Heberlein, 2003; Kellert et al., 1996; McFarlane et al., 2007). These studies have identified large opinion discrepancies between residents of rural communities dependent on extractive industries and residents of rural communities dependent on tourism. Residents of communities dependent on extractive industries expressed more negative attitudes towards large carnivores, were less willing to modify their behaviour for their conservation, and were especially resistant to access restrictions on public land. On the other hand, residents of communities dependent on nature-based tourism demonstrated more positive attitudes toward large carnivores and were more supportive of actions undertaken for their protection (Ericsson & Heberlein; Kellert et al.; McFarlane et al.). McFarlane et al. found that the preferences of the urban population and the tourism-dependent rural population were closely aligned, but other studies have found conflicting results (e.g., Manfredo & Zinn, 1996).

Hunt et al. (2009) also examined perspectives from two rural communities on access restrictions, but from different angles than in the previous studies. First, the context for the access restrictions was the protection of remote tourism values, not wildlife conservation. Second, rather than comparing a resource-dependent versus a tourism-dependent community, this study compared two resource-dependent rural communities (Dubreuilville and Ignace) that have displayed differing levels of conflict around access road management. They concluded that the differences in conflict between the two communities were largely influenced by differences in the physical, managerial, and social contexts of each area. Physically, resource scarcity is more evident in Dubreuilville than in Ignace. The Ignace area has a much greater endowment of surface water (74,661 ha) than does Dubreuilville (7,628 ha), and a greater proportion of surface water was publicly accessible by road or trail in Ignace (33.1%) than in Dubreuilville (18.8%). Conversely, Dubreuilville had a greater percentage of surface water with remote tourism (27.3%) than did Ignace (18.5%) (Hunt et al, 2009).

The managerial contexts also differed between the two areas. The District Land Use Guidelines developed in the 1980s provided land use policy for broadly designated land use zones. The guidelines for the Dubreuilville area included a resource-based tourism strategy. This strategy provided standards to control road use within three kilometres of waters with remote tourism establishments, and discouraged all terrain vehicle trails around waters with remote tourism establishments. The guidelines for the Ignace area, however, did not incorporate any specific tourism-related access considerations. Consequently, road access restrictions and controls are now considered on an individualized, case-by-case basis. Many Dubreuilville residents opposed the prescriptive management approach, while the site specific management approach used in Ignace did not face the same resistance (Hunt et al., 2009).

2.4.2 Recreational Activities

A number of researchers have found that the recreational activities that individuals pursued influenced their management and setting preferences. Differences have been identified between consumptive recreationists and others, motorized recreationists and others, and non-consumptive recreationists and others (e.g., Hunt et al., 2005; Hunt et al., 2009; Langeneau, O'Quin, & Duvendeck, 1980; McFarlane et al., 2007; Paquet & Belanger, 1997).

Some studies have identified preference differences between motorized/consumptive and non-consumptive recreationists. McFarlane et al. (2007) concluded that off-road vehicle users

were significantly more opposed to both temporary and permanent road closures than were other recreationists, including other motorized and consumptive recreationists. Regarding setting preferences, studies showed that consumptive/motorized and non-consumptive recreationists had different tolerance levels for logged settings. This has been demonstrated with hunters (Langeneau et al., 1980), anglers and snowmobilers (Paquet & Belanger, 1997). Hunt et al. (2005) noted that setting preferences could also vary within an activity depending on the mode of travel used to pursue the activity. Specifically, they found that hunters who used trucks preferred more easily accessible areas than those who used ATVs or walked.

Although Hunt et al. (2009) did not specifically examine the influence of activities on preferences, their finding that goal interference conflicts were prominent between road-based recreationists and remote tourism operators suggested that groups pursuing different recreational activities had different opinions about acceptable access management and restrictions. Goal-interference conflicts arise when the behaviours of some individuals or groups interfere with the outcomes that other individuals or groups are seeking (Jacob & Schreyer 1980). In this case, remote tourism operators were concerned that motorized recreationists using forestry roads near remote tourism operations might impact the goals of their tourists, and thus, they supported access restrictions. These goals include non-consumptive (e.g, relaxation, escape) and consumptive (e.g., fishing, hunting) outcomes sought from tourism experiences. Motorized recreationists, on the other hand, typically opposed these access restrictions. Generally, remote tourism operators were willing to accept the presence of recreationists provided these individuals had accessed the area using traditional means (e.g., canoe), supporting the conclusion that it is the particular activity or the mode of access that is considered a problem, not the presence of recreationists.

2.4.3 Environmental Beliefs

2.4.3.1 The Emergence of Environmental Beliefs

As early as 40 years ago, it was proposed that ecological problems were largely a result of society's prevailing values, attitudes, and beliefs, characterized by beliefs in abundance and technology, devotion to growth and prosperity, faith in science and technology, and commitment to a laissez-faire economy, limited governmental planning, and private property rights (e.g., Whisenhunt, 1974). Pirages and Ehrlich (1974, p. 43-44) termed these collective values,

attitudes, and beliefs society's "Dominant Social Paradigm" (DSP), and explained that a social paradigm is a lens "through which individuals or, collectively, a society interpret the meaning of the external world...[and]...a mental image of social reality that guides expectations in a society."

The 'environment,' and global environmental problems, began emerging as important public policy issues around 1970, representing a growing awareness of the disconnect between modern societies and the physical environments on which they depend (Van Liere, 1981). Responding to this changing awareness, researchers began suggesting that a more ecologically sound world view was emerging, one that was less focused on the pursuit of high levels of economic growth and more concerned with the preservation of environmental quality (e.g., Dunlap & Van Liere, 1978). In contrast to the DSP, Dunlap and Van Liere termed this new world view the "New Environmental Paradigm" (NEP).

As this field of research has developed, social and behavioural scientists have studied the links between environmental beliefs and aspects such as sociodemographics, recreational pursuits, conservation behaviours, and management preferences (Van Liere, 1981). This section briefly describes how environmental beliefs have been measured, and then discusses the relationships between environmental beliefs and management preferences.

2.4.3.2 Measurement of Environmental Beliefs

Broadly, environmental beliefs refer to people's attitudes and beliefs towards the environment and their perceptions of the role of humans in relation to the environment. The broad concept of environmental beliefs has been captured by researchers in a variety of ways, including studying people's attitudes towards specific environmental issues (Dunlap, Van Liere, Mertig, & Jones, 2000), or considering more general attitudes towards the broader environment as a whole (Dunlap & Van Liere, 1978).

Incorporating the concept of environmental beliefs requires that they be measured in some way. This has been done through the concept of environmental concern, which has been characterized in a variety of ways. The early studies in the 1970s and early 1980s focused on respondents' concern for specific environmental issues, such as acid rain or pollution (Dunlap et al., 2000). These measures varied considerably, incorporating different environmental issues and different expressions of concern (e.g., support for environmental protection regulations versus engagement in conservation behaviours) (Van Liere, 1981). Researchers commonly combined

items dealing with different environmental issues into a single environmental concern measure (Weigel & Weigel, 1978), but it was unclear if attitudes towards these different issues equally reflected the broader concept of concern with environmental quality (Van Liere). In an effort to improve these initial measures of "environmental concern," researchers have moved towards multiple-item indicators to improve reliability, and standardized measures to facilitate comparisons among studies and the formation of broader generalizations about environmental concern (Van Liere). Alongside the equivalency problem of traditional measures was a growing belief amongst some researchers that concerns with individual environmental issues were becoming increasingly integrated into a broader world view: the New Environmental Paradigm (Dunlap & Van Liere, 1978). This development pushed some researchers' focus towards instruments seeking to measure a broader environmental attitude.

Dunlap and Van Liere (1978) have developed the most commonly used standardized measure for a broad environmental world view. They developed a set of 12 Likert items measuring the NEP, and testing indicated that the items could be legitimately treated as an NEP scale (Dunlap & Van Liere, 1978, 1984). The NEP Scale quickly became the most widely used measure of an environmental, or ecological, world view, with endorsement of the NEP treated as reflecting a pro environmental orientation (Dunlap et al., 2000). It has provided researchers with the means to measure the public's fundamental value and belief systems towards the environment, as opposed to the more superficial measures of earlier research (Jackson, 1986).

The NEP and DSP world views can be conceptualized as representing opposite ends of a spectrum of environmental attitudes and values (Jackson, 1986). High scores on the NEP Scale indicate stronger pro environmental attitudes; they indicate that the respondent endorses a world view in which humans are an integral part of the ecosystem and adapt to the changing limits dictated by the environment (Vining & Ebreo, 1992). Lower scores are more consistent with acceptance of the traditional DSP (Jackson).

Originally conceived as a unidimensional measure of an NEP world view, some researchers have suggested that the NEP is inherently multidimensional. In particular, three US studies (Albrecht et al., 1982; Geller & Lasley, 1985; Noe & Snow, 1990) suggested that the NEP is composed of three distinct dimensions - Balance of Nature, Limits to Growth, and Humanity over Nature. However, factor analyses of NEP results have been inconsistent, leading Dunlap et al. (2000) to conclude that it may be premature to assume that the 12 NEP items measure three distinct dimensions. Irrespective of its being used as a single scale or as a

multidimensional measure, the NEP can still be usefully employed to measure ecological world views. The decision to break the items into two or more dimensions ought to be made on a case-by-case basis (Dunlap et al.).

Building on the original NEP Scale, Dunlap et al. (2000) developed a revised NEP Scale designed to improve upon the original one in three ways: (1) A broadened content to tap into the additional facets of "human exemptionalism," or the idea that humans are exempt from the constraints of nature, and the likelihood of potentially catastrophic environmental changes; (2) revised wording of the items to offer a better balance of pro and anti-NEP statements; and (3) updated language to eliminate outmoded sexist terminology. In keeping with the growing recognition of broad "ecological" (as opposed to narrower, more specific, and less systemic "environmental") problems facing the modern world, this revised 15 item instrument was labelled the "New *Ecological* Paradigm Scale" (Dunlap et al.).

Dunlap et al.'s (2000) revised NEP Scale study of Washington State residents indicated a high degree of internal consistency among the fifteen items, suggesting that it is appropriate to treat the new set of fifteen items as constituting a single "New Ecological Paradigm Scale." This revised scale appears to be an improved measuring instrument compared to the original scale, as it: (1) provides more comprehensive coverage of key facets of an ecological worldview; (2) addresses the directionality imbalance in the original scale; and (3) updates the outmoded, sexist terminology in some of the original scale's items (Dunlap et al.).

Other researchers have developed far more comprehensive conceptualizations of the NEP and DSP, encompassing a wide range of beliefs and values. However, these elaborate instruments have largely proven unwieldy, and the original and revised NEP Scales have remained the most commonly used measures of environmental beliefs (Dunlap et al., 2000).

2.4.3.3 NEP Weaknesses and Limitations

Although the NEP scales (both the original and revised versions) have become commonly used measures of environmental beliefs, some concerns have been noted that should be identified. These include concerns about an inability to adequately capture respondents' understanding of environmental issues (Lalonde & Jackson, 2002), respondents' tendency to favour biocentric responses (Vining & Ebreo, 1992), a lack of certainty about the dimensionality of the scales (Kaltenborn, Bjerke, & Strumse, 1998), and the dichotomous nature of this approach.

First, Lalonde and Jackson (2002) argued that the original NEP scale is limited in its inability to capture people's increasingly thorough understanding of the nature, severity, and scope of environmental problems over the past twenty to thirty years. They further suggested that this issue may be enhanced if study participants are well educated and informed by more recent and sophisticated ecological and scientific knowledge than the original NEP scale was designed to capture. They cautioned that social scientists must choose carefully between a standardized scale, such as the NEP, that facilitates temporal and geographic comparability and replication, versus more specific, contemporary scales providing greater accuracy and relevancy. Although the revised NEP scale addressed some content issues, the concerns are relevant to it nonetheless, as contexts and knowledge evolve on an ongoing basis.

The second point is not necessarily a weakness, but more a caution to consider when interpreting NEP results. Researchers should bear in mind that respondents tend to select the more biocentric results, and therefore, responses often range from somewhat biocentric to very biocentric, rather than from anthropocentric to biocentric. For example, Vining and Ebreo (1992) found that recyclers' attitudes were most favourable towards the environment, but nonrecyclers' attitudes were favourable as well, to a lesser degree. Therefore, while arguably the NEP scale may not fully capture individuals' environmental beliefs given the tendency to select biocentric responses, differences can still be identified between differing levels of biocentrism.

A third concern regarding both NEP scales is the uncertainty as to whether the scales are uni-dimensional or multi-dimensional. As described above, factor analyses have been inconsistent. Consequently, some researchers have argued that the dimensionality needs to be more carefully studied and confirmed (Kaltenborn, Bjerke, & Strumse, 1998).

Lastly, some researchers have expressed concern about the dichotomous perspective of the NEP scales, which treat biocentrism and anthropocentrism as incompatible belief systems (e.g., Corral-Verdugo, Carrus, Bonnes, Moser, & Sinha, 2008). However, some studies have concluded that there may be a possibility of an integration between anthropocentric and biocentric views that cannot be captured by the NEP measures (e.g., Bechtel, Corral-Verdugo, Asai, & Gonzalez, 2006; Bechtel, Corral-Verdugo, & Pinheiro, 1999). For example, the findings of Bechtel and colleagues (1999, 2006) suggested that in some cultures the biocentric worldview could be compatible with anthropocentric beliefs. Similarly, Corral-Verdugo et al. found that an integrative, nondichotomic paradigm was a slightly better predictor of water conservation behaviours than the more common dichotomous measures. Such results support the notion of a

worldview in which some anthropocentrism becomes compatible with some biocentric perspectives. Such worldviews cannot be captured by the NEP scales.

2.4.3.4 Environmental Beliefs and Management Preferences

Researchers who have examined the relationships between both broad environmental beliefs (e.g., NEP) and attitudes towards specific environmental issues (e.g., pollution) and management preferences have consistently found a link between the two, and argued that clarifying values can assist in identifying socially appropriate policy alternatives and management options (e.g., Webb et al., 2008). This link has been identified in regards to forests (e.g., Vaske et al., 2001; Winter, 2005; Webb et al.; Xu & Bengston, 1997), wetlands (e.g, Winter), and parks (Jurowski et al., 1995).

From a broad management perspective, research has demonstrated that conflicting values towards forests underlie, and can help explain the intensity of, conflicts over forest management in Australia (Webb et al., 2008) and North America (Xu & Bengston, 1997). Based on content analyses of Australian and North American new items, these studies concluded that values are slowly shifting from an anthropocentric orientation to a more biocentric orientation. Xu and Bengston suggested that, contrary to the United State's current emphasis on economic efficiency within forest management, this shift in values may demand a reduced role for economics in forest management, with greater emphasis placed on the health and integrity of forest ecosystems.

Environmental beliefs also help predict the general management approaches that individuals will support for natural resources on public lands. Research has concluded that biocentric-oriented individuals were more supportive of protective management approaches, while anthropocentric-oriented individuals are more likely to oppose protection and support management approaches that facilitate direct human use. This has been demonstrated for both wetland (Winter, 2005) and forest management (e.g., Vaske et al., 2001).

Similar results have been found for national parks. In a study of visitors to Florida's Biscayne Bay National Park, Jurowski et al. (1995) identified two distinct groups: Group I reflected strong biocentric value orientations, while Group II members displayed stronger anthropocentric value orientations. Along with differing value orientations, the two groups demonstrated distinct management preferences. The main distinguishing factor was that the more biocentric-oriented group supported protection and regulation, while the more anthropocentric-

oriented group preferred management actions that altered the environment to facilitate human use, such as the development of more visitor centres and more hiking trails.

Arlinghaus and Mehner (2004b) concluded that anglers' support for habitat management versus fish stocking as a management tool was related to their environmental beliefs, with biocentric-oriented anglers showing greater support for habitat management.

2.4.4 Familiarity

2.4.4.1 Introduction

Recreationists' familiarity with a site is another variable that has been included in recreation studies. It refers to personal knowledge of a site due to on-site experience and remembrance and is a sense of familiarity (Nasar, 2000). Recreationists' familiarity has been shown to be related to length of stay (Gokolavi, Bahar, & Kozak, 2007), perceived value of experiences (Ha & Jang, 2010), perceptions of stressful social and environmental conditions (Lazarus & Folkman, 1984; Peden & Schuster, 2008), satisfaction (Soderlund, 2002), behavioural intentions (Ha & Jang), perceptions of scenery and activity choice (Oku & Fukamachi, 2006), willingness to substitute sites (Wynveen et al., 2007), perceptions of managerial problems (Peden & Schuster), support for management and development (McFarlane & Boxall, 1996), and site selection (McFarlane & Boxall).

Familiarity has been conceptualized in three main ways. First, it has been considered as a stand-alone concept (e.g., Gokolavi et al., 2007; Ha & Jang, 2009; Oku & Fukamachi, 2006). Second, it has been conceptualized as one dimension of place attachment, or place bonding (e.g., Hammitt et al., 2006; Hammitt, Kyle, & Oh, 2009; Wynveen et al., 2007). Third, it has been applied as a behavioural indicator of recreation specialization (e.g., McFarlane, 2004; McFarlane & Boxall, 1996).

The measurement of familiarity has also varied between studies. Two main methods have been used. First, it has been measured by having respondents rate their agreement with statements assessing their familiarity with a site (e.g., "I have visited the site many times and am quite familiar with it") (e.g., Hammitt et al., 2006; Peden & Schuster, 2008; Wynveen et al., 2007;). Second, others have inferred familiarity based on the number of past visits to a site, or the number of years since the first visit to the site (e.g., Gokovali et al., 2007; McFarlane, 2004; McFarlane & Boxall, 1996).

This section outlines key findings in terms of the three main conceptualizations of

familiarity. The associations with management preferences and site selection are discussed in each section.

2.4.4.2 Familiarity as a Standalone Concept

Some studies have explored familiarity with a site as a stand-alone concept, rather than embedding it within a larger theoretical framework. This approach has been applied to satisfaction research (Ha & Jang, 2010; Soderlund, 2002), tourism studies (Gokolavi et al., 2007), outdoor recreation studies (Oku & Fukamachi, 2006), and restaurant studies (Ha & Jang).

From a satisfaction perspective, research suggests that different levels of familiarity provide customers, or visitors, with different frameworks of reference for evaluations of a site, product, or experience, and these differing familiarity levels result in different interpretations and assessments of the same site or experience (Ha & Jang, 2010). These evaluations, and hence familiarity, are likely related to customer satisfaction and behavioural intentions (Soderlund, 2002).

Gokolavi et al. (2007) considered the relationship between familiarity with a tourism destination and the length of stay at the site. They concluded that familiarity is an important influence on the length of stay, with higher familiarity associated with longer stays. Ha and Jang (2010) considered the importance of familiarity in a different context: ethnic restaurants. They concluded that different aspects of Korean restaurants appealed to American customers, in accordance with their familiarity levels.

More directly related to this study are those researchers who have applied the familiarity concept in an outdoor recreation context. Oku and Fukamachi (2006) conducted one such study, assessing the relationships between visitors' characteristics and their choice of activities and perceptions of scenery, in one of Japan's suburban recreational forests. By giving visitors cameras and then analyzing the pictures taken, they found that scenic perceptions and the types of activities engaged in varied with familiarity levels. Specifically, less familiar visitors tended to take more "event" type pictures (i.e., pictures of people and the activities they were engaged in), while more familiar visitors took more "place" pictures (i.e., pictures of a specific area, such as a trail or scenic spot).

Some researchers have also suggested that familiarity with wilderness environments has the potential to influence perceptions of stress in a variety of ways (Peden & Schuster, 2008). If some recreationists perceive clearly defined areas for their preferred recreational activities, this

could lead to inter-group conflicts and disputes over access to outdoor recreation resources should others pursue, or wish to pursue, incompatible recreational activities in that area (Jacob & Schreyer, 1980). Lazarus and Folkman (1984) discussed how site familiarity can reduce stress by facilitating the avoidance of undesirable experiences. They argued that more familiar individuals are better able to anticipate stressful situations, and are thus, more likely to proactively avoid them. They noted, however, that more familiar users are more likely to experience stress when they do encounter undesirable conditions.

2.4.4.3 As a Dimension of Place Attachment

Some researchers have examined the importance of familiarity as one dimension of place attachment, or place bonding. This section provides a brief overview of the place attachment literature, and then provides a more detailed discussion of the role of familiarity within this concept and key findings.

Place Attachment Overview

Researchers in many disciplines have explored the relationships that people have with place. There are a variety of related concepts pertaining to human-site interactions discussed in the literature, including place attachment (Moore & Graefe, 1994), place bonding (Hammitt et al., 2004), and sense of place (Jorgensen & Stedman, 2001), reflecting the complex multidimensionality of the construct.

Williams and Roggenbuck (1989) developed the first model of recreation resource place attachment. This was termed place attachment, and consisted of two dimensions: place dependence and place identity. Place dependency develops when an individual considers a site important because of its functional value (Stokols & Shumaker, 1981), while place identity occurs when individuals consider a setting to be special for emotional or symbolic reasons (Moore & Graefe, 1994). This conceptualization has become the conventional and most prominently used model to explain human-place relationships in the recreation resource field (e.g., Bricker & Kerstetter, 2000; Moore & Graefe).

However, some researchers have deviated from Williams and Roggenbuck's two-dimensional model, proposing that the complex nature of the place concept would be better suited to more dimensions. Thus, researchers have added dimensions such as place or affective attachment (e.g., Kyle, Graefe, Manning, & Bacon, 2004), social bonding (Kyle, Graefe, &

Manning, 2005), and familiarity, belongingness, and rootedness (Hammitt et al., 2004; Hammitt et al., 2006) to the original two dimensions. Most relevant to this study is the work of Hammitt and colleagues, who built on the two-dimensional model by naming the overall concept 'place bonding' and adding three additional dimensions: place familiarity, belongingness, and rootedness.

Past findings have supported the inclusion of familiarity, and the other dimensions, in the place bonding model. Hammitt et al. (2006) found that all five dimensions were significant predictors of overall place bonding, and familiarity was the most reliable measure. Hammitt et al. (2009) tested the ability of the two-dimensional and the five-dimensional model in predicting a dependent variable, experience use history, and found that the five-dimensional model had slightly higher predictive ability than the former. Peden and Schuster's (2008) results also supported the inclusion of familiarity in the place bonding model.

Given the support for including familiarity in the place bonding construct, it is important to understand the role it plays in this area. It is believed that gaining familiarity is the initial stage of the place bonding process. As they gain familiarity, individuals often see these places differently, feel differently about them, develop a sense of belonging, and often wish to increase their bond with the location (Roberts, 1996). Hammitt et al. (2004) emphasized the role of memories in the development of place familiarity. They suggested that memories enable individuals to develop affective bonds with places.

Familiarity and Management Preferences

A number of studies have looked at the relationship between the familiarity dimension of place bonding and willingness to substitute sites, management preferences, and evaluations of environmental and social conditions. Wynveen et al. (2007) examined the links between campers' place bonding and willingness to substitute their camping location for another local campground, using the five-dimensional place bonding model. They assessed these relationships at a developed campground, a semi-remote campground, and a wilderness setting. They concluded that the familiarity dimension of place bonding was the only dimension significantly related to willingness to substitute in the overall model, at the developed campground, and at the semi-remote campground. For the wilderness setting both the familiarity and the rootedness dimensions were significant. In all cases, familiarity was negatively related to substitution. These findings suggest that, as visitors develop a cognitive bond with a site (i.e., increased familiarity),

they are less likely to substitute an alternate campground (Wynveen et al.)

Peden and Schuster (2008) examined the relationships between the familiarity dimension of place bonding and individuals' evaluations of stressful social conditions and managerial problems. They found that familiarity was positively associated with both. As familiarity increased, so too did perceptions of stressful social conditions and perceptions of managerial problems.

2.4.4.4 As a Dimension of Recreation Specialization

McFarlane and colleagues (McFarlane, 2004; McFarlane & Boxall, 1996) have considered familiarity from a recreation specialization perspective. Recreation specialization stratifies groups based on their experience and skills with an activity. For example, Scott and Shafer (2001) classified recreationists as novice, established, or specialized. Specialization is commonly conceptualized as consisting of three dimensions: a behavioural dimension, a cognitive dimension (skill and knowledge), and an affective dimension (commitment) (McIntyre & Pigram, 1992).

McFarlane and Boxall (1996) examined campers' campground management preferences in Alberta Forest Recreation Areas (FRA) based on recreation specialization levels. They used familiarity with the sites to represent the behavioural dimension of specialization, and concluded that campers with the highest familiarity with an area had less support for traditional timber management and campground development than less familiar individuals. They also found that more familiar campers were less tolerant of facility developments, particularly those seen as extraneous to the camping experience, such as fast food outlets, lodges, or hotels.

McFarlane (2004) also examined the association between the behavioural, affective, and cognitive dimensions of specialization and site choice among vehicle based campers in Alberta. Again, familiarity was used to represent the behavioural dimension. She concluded that familiarity is associated with site selection. Campers at unmanaged sites had greater familiarity with the chosen site than did campers at managed campgrounds. The greatest familiarity was found among those campers choosing 'random' sites (i.e., Crown land sites unassociated with any official campgrounds).

2.4.5 Past Experience and Use Frequency

2.4.5.1 Introduction

The amount and/or frequency of past experience in a particular recreation activity or at a particular recreation site provides another method for segmenting recreationists and explaining

differing views on natural resource management. Past experience has been considered as one dimension of the broader concept of specialization (Kuentzel & Heberlein, 1992; McFarlane, 2004; McFarlane, Boxall, & Watson, 1998), and as a stand-alone construct (Hammitt, Knauf, & Noe, 1989; Hammitt & McDonald, 1983; Schreyer et al., 1984; Williams, Schreyer, & Knopf, 1990).

The importance of past experience and use frequency is founded on the premise that experienced users have a greater knowledge base concerning particular activities or places, are more place familiar, and therefore, have a richer basis for evaluating resource settings and use (Schreyer et al., 1984). Schreyer et al. explained that an individual's behaviour results from his or her interpretation of an event. Interpretation implies the evaluation of information. Previous participation can influence the type and amount of information individuals have at their disposal (Schreyer et al.), and the resulting frame of reference may influence future use patterns and evaluations of recreational experiences (Hammitt & McDonald, 1983). Its potential influence on user perceptions, behaviours, and expectations has stimulated research exploring these relationships (Hammitt & McDonald).

The following section reviews the measurement tools that have been used to assess experience and use. This is followed by a discussion of the relationships between use and place attachment and site substitution (Hammitt et al., 2004; Moore & Graefe, 1994; White, Virden, & van Riper, 2008; Williams, Patterson, Roggenbuck, & Watson, 1992; Wynveen et al., 2007), evaluations of social and environmental conditions (Budruk, Stanis, Schneider, & Heisey, 2008; Hammitt & McDonald, 1983; Ibitayo & Virden, 1996; Peden & Schuster, 2008; Schreyer et al., 1984; White et al., 2008), evaluation of management (Hammitt & McDonald, 1983; McFarlane & Boxall, 1996; Peden & Schuster; Schreyer et al. 1984), site selection (Kuentzel & Heberlein, 1992; McFarlane, 2004; McFarlane et al., 1998), use patterns (Schreyer et al.), motivations (Choi, Loomis, & Ditton, 1994; Ditton, Loomis, & Choi, 1992; Schreyer et al.; Williams et al., 1990), perceptions of conflict (Ramthun, 1995; Schreyer et al.; Vaske et al., 1995), and satisfaction (Schreyer et al.).

2.4.5.2 Measurement

Past experience has been measured in a variety of ways. Generally, it is measured using indicators such as years of experience in an activity or at a site, frequency of participation or visitation, and number of sites visited. The work of Hammitt et al. (1989) supported the use of

such numerical indicators. They compared the relationship between horseback riders' management preferences and two measures of past experience: 1) an index value composed of four measures of frequency and years of participation, and 2) a user-declared classification of four experience skill levels (beginner to expert). They found that the subjective, user-declared classifications were not as significantly related to preferences as the numerical measure, and concluded that numerical, index measures are the more valid indicators of participatory influence on recreation preferences. However, other studies have concluded the opposite (e.g., Ewert, 1986), and thus, the preferred method remains in question.

Hammitt and McDonald (1983) took a similar approach. They referred to the concept as "past on-site experience," and assessed it using four items that measured total years of experience, and frequency of participation per year, on the specific rivers being studied and on all rivers in general. Ibitayo and Virden (1996) took a simpler approach, using the number of past visits to a park over the previous year.

Schreyer et al. (1984) were the first to use the term 'Experience Use History' (EUH) to describe the concept of past experience, which has now been adopted by many researchers (e.g., Hammitt et al., 2004; Hammitt et al., 2006; Hammitt et al., 2009; Peden & Schuster, 2008). EUH is a measure of past experience, and has typically been operationalized in terms of total number of visits, total years of participation or use, and frequency of participation or visitation per year. Most research has reported two main dimensions of EUH: previous experience in a given setting and previous experience in similar settings (Watson & Niccolucci, 1992). A multi-variable construct reflecting previous experience in a given setting and in similar settings, EUH is typically treated as a unidimensional concept, with past participation variables combined to form one index value (Hammitt et al., 2009). The measure typically includes items regarding use of the study site specifically (e.g., the Agawa River) and similar sites in general (e.g., all whitewater rivers) (Hammitt et al., 2004; Schreyer et al., 1984). Although most research has reported the above two dimensions of EUH (site specific experience and overall experience) (Watson & Niccolucci, 1992), there have been some variations. For example, Peden and Schuster (2008) identified three distinct dimensions of EUH: years of hiking experience, the number of days spent hiking yearly, and the number of days spent hiking in the respective study area per year.

As an example of the implementation of the EUH concept, Schreyer et al. (1984) created an EUH index measure for river recreationists based on three variables: 1) number of times floating the study river, 2) number of rivers floated, and 3) total number of river trips. Using this information, they grouped respondents into six groups. Novices were on their first ever river trip,

and beginners had a low amount of experience on a few rivers. Locals had high experience on the study river but little experience elsewhere. Collectors had floated a large number of rivers but did not have high experience on any one river, while visitors had a large amount of total river running experience but little experience on the study river. Lastly, veterans had a large amount of experience on both the study river and other rivers.

2.4.5.3 Place Attachment and Willingness to Substitute

Some researchers have investigated the links between past use or EUH, place bonding (further discussed in section 2.4.4.3), and willingness to substitute sites (Hammitt et al., 2004; Moore & Graefe, 1994; White et al., 2008; Williams et al., 1992; Wynveen et al., 2007).

Wynveen et al. (2007) and Hammitt et al. (2004) both examined the relationships between EUH, place bonding, and willingness to substitute. Wynveen et al. concluded that EUH was positively related to campers' place bonding, and negatively related to campers' willingness to substitute. Hammitt et al. had similar results in that EUH was directly predictive of trout anglers' place bonding. However, while the relationship between EUH and site substitution was in the same direction, this direct link was not statistically significant.

In a study of rail trail users, Moore and Graefe (1994) concluded that the best predictor of place identity was years of use, and frequency of use was a significant predictor of place dependence. Similarly, Williams et al. 1992 found that past experience was correlated with both place identity and place dependence. These findings were supported by White et al. (2008) as well. However, none of these studies have identified the causal order of these two constructs. On one hand, past experience could lead to more attachment with a place. On the other hand, place attachment may lead to increased visitation (Hammitt et al., 2004).

2.4.5.4 Evaluations of Conditions

Some studies have explored the influence of past experience, or EUH, on recreationists' evaluations of social or environmental conditions (Budruk et al., 2008; Hammitt & McDonald, 1983; Ibitayo & Virden, 1996; Peden & Schuster, 2008; Schreyer et al., 1984; White et al., 2008). Most research has supported a link between EUH and evaluations, but there have been some inconsistencies (e.g., Budruk et al., 2008; Peden & Schuster).

Hammitt and McDonald (1983) were among the first to consider this relationship. They concluded that more experienced river floaters were sensitive to, and perceptive of, environmental disturbances. Schreyer et al. (1984) also found that EUH was positively associated with perceptions of environmental damage. White et al. (2008) expanded on these

findings by examining the relationship between past experience and both environmental and social recreation impacts. They concluded that the longer visitors had been coming to a site, the more problematic they perceived impacts to be. This was true for both environmental and social impacts, but the relationship was particularly pronounced for the social dimensions (i.e., depreciative behaviour and recreation conflict). These results are consistent with those of Ibitayo and Virden (1996), who concluded that park visitors' level of past experience was related to the perception of depreciative behaviours such as littering, water pollution, noise, alcohol consumption, and vandalism.

It has been suggested that differences exist because longer-term visitors are comparing current conditions to past conditions, and are more aware of the social and environmental shift that has occurred than less experienced users. In this sense, longer term visitors' evaluations may be more accurate than those of less frequent visitors (White et al., 2008).

Conversely, Peden and Schuster (2008) found that neither the amount of time spent hiking in an area nor the number of years one has hiked there influences perceptions of social problems. Budruk et al. (2008) looked specifically at the relationships between EUH, place attachment, and perceptions of crowding, and concluded that crowding evaluations remained constant over differing EUH levels.

In situations where differences exist, it has been suggested that more experienced individuals are better able to anticipate and avoid undesirable situations by moderating their site choice and time of visitation, similarly to the more familiar individuals discussed in section 2.4.4.2. For example, a paddler may recognize that his or her favourite river has undesirable use levels on holiday weekends, and thus, avoid the river at those times (Hammitt et al., 2004; Peden & Schuster, 2008).

2.4.5.5 Evaluations of, and Support for, Management

Researchers have also examined the links between past use and evaluations of, and support for, management actions (Hammitt & McDonald, 1983; McFarlane & Boxall, 1996; Peden & Schuster, 2008; Schreyer et al. 1984). With few exceptions, studies have supported this relationship.

Hammitt and McDonald (1983) investigated whether past experience was related to the perceived need for management controls and the degree of support for various potential management practices. They found that more experienced users indicated a greater need for

management controls to control environmental impacts. These users supported initiating management controls immediately to prevent current damage, while less experienced users favoured controls implemented to prevent future impacts. This is consistent with their finding that more experienced users were more perceptive of current impacts.

Hammitt and McDonald (1983) also found that level of experience was related to degree of support for specific management practices. Experienced users were more supportive of actions such as providing more garbage containers and making users responsible for carrying out their own litter, but less supportive of regulatory control of their behaviour and facility development.

Schreyer et al. (1984) concluded that current management was evaluated least favourably by those with the most on-site experience (i.e., locals and veterans). Interestingly, this group was also most in favour of managerial control in general. Schreyer at al. suggested that these users may feel that the current managerial objectives were not in their best interest. They hypothesized that these frequent users may have a sense of possessiveness about the resource, and may view management actions as responding more to the needs of "outsiders." Thus, they may evaluate current management negatively, but desire stricter control aimed at protecting their interests. Conversely, less experienced users may not support intensive management if they are not as aware of current and potential problems, and thus, may be concerned that further managerial action will hinder their experiences.

McFarlane and Boxall's (1996) results supported these earlier studies. They found that past experience, measured with number of years camping and number of camping trips per year, influenced support for both traditional timber management in the area and recreational development. Greater camping experience was associated with less support for traditional timber management, and less support for high levels of development, similarly to the preferences of campers with greater familiarity (section 2.4.4.4).

Peden and Schuster's (2008) results again differed from previous work. They found that past experience was unrelated to perceptions of managerial problems.

2.4.5.6 Behaviour and Site Selection

Some studies have examined links between past experience and recreation behaviours. The behaviours studied have included site selection (Kuentzel & Heberlein, 1992; McFarlane,

2004; McFarlane et al., 1998), trip length, mode of travel, and group type (Schreyer et al., 1984).

McFarlane et al. (1998) considered past experience with the study site and similar sites as one dimension of recreation specialization. They concluded that more experienced canoeists chose more remote, difficult routes with little management intervention, while less experienced users opted for easier, more accessible, and more developed routes. McFarlane (2004) had similar results. She also operationalized past experience as one behavioural dimension of specialization, and concluded that it was associated with vehicle-based campers' site selection. As frequency of camping on random, unmanaged Crown land locations increased, so too did the probability of selecting such a site. Similarly, greater camping frequency at provincial parks was associated with a greater likelihood of selecting a developed site. General camping experience and years of association with the site were not related to site choice. Conversely, Kuentzel and Heberlein (1992) concluded that the past experience dimension of recreation specialization was not associated with choice of hunting location.

Schreyer et al. (1984) identified links between EUH and other behavioural dimensions, including trip length, mode of travel, and group type. They concluded, surprisingly, that the most experienced users were the most likely to take one-day trips. Although this is counter-intuitive to the belief that trip length will increase with experience, Schreyer et al. suggested that frequent users (i.e., veterans and locals) and those with easy access to a particular site (i.e., locals), are likely to make trips whenever the opportunity arises, leading to many shorter, convenient trips. Regarding mode of river travel, rafts were the predominant vessel but veterans and visitors were most likely to use kayaks, and collectors were most likely to use canoes. In terms of group type, most novices took commercial trips, beginners were divided between commercial and non-commercial, and the others were predominantly on non-commercial trips.

2.4.5.7 Motivations, Conflict, and Satisfaction

Finally, researchers have studied the links between past experience and frequency of use and recreationists' motivations, perceptions of conflict, and overall satisfaction levels. First, researchers have explored how motivations differ across use levels for river floaters and paddlers (Schreyer et al., 1984; Williams et al., 1990) and for anglers (Cho et al., 1994; Ditton et al., 1992). Schreyer et al. and Williams et al. both looked at floaters and paddlers, and both applied the six EUH categories developed by Schreyer et al. Schreyer et al. found that less experienced users were most motivated by reasons such as "to experience new and different things," and "to

do something with the family," while more experienced users were more motivated by a sense of achievement, sense of self-worth, or the attainment of personal meaning. Williams et al. found that the magnitude of differences in motivations was related to the differences in EUH levels, supporting a relationship between EUH and motivations.

Ditton et al. (1992) and Choi et al. (1994) both found evidence for differing angler motivations in accordance with the number of days fishing in the previous year. They concluded that greater participation frequency was associated with more interest in catching trophy fish.

Second, a small number of studies have looked at the links between use levels and perceptions of conflict, but the results have been inconsistent. Schreyer et al. (1984) concluded that perceptions of conflict increased with greater EUH. Conversely, Ramthun (1995) found that sensitivity to conflict decreased as experience increased, and Vaske et al. (1995) reported no significant relationships.

Lastly, Schreyer et al. (1984) examined the relationship between EUH and an overall measure of trip satisfaction. However, this was the only variable tested that did not have a significant relationship with EUH.

2.5 Hypotheses

A number of hypotheses were developed to meet the research goals defined in Chapter 1. In brief, this research strives to report and explain variations in Wawa District residents' satisfaction levels and their evaluations of road access tools and controls. Based on the literature reviewed and knowledge of the study area, I identified several variables that could influence local residents' satisfaction levels and management tool evaluations. They are age, frequency of use of forestry roads, familiarity with one's surrounding area, recreational activities pursued, environmental beliefs, and community of residence. The resulting hypotheses are detailed below, with brief justifications and information on the variables used to measure the constructs. Measurement details are provided in Chapter 4.

Hypothesis 1: Increasing age is negatively associated with satisfaction and with desirability ratings for management tools and controls.

As discussed in Section 2.4.1, age has been identified as a potentially important factor influencing satisfaction and management preferences. Besides the evidence discussed in that

section, the expansion of the resource-based tourism industry in Wawa District in recent years, the development of a District Tourism Strategy (OMNR, 1992), and the subsequent implementation of access road restrictions to protect tourism values all suggest that more elderly respondents would likely have recreated on Crown land before the introduction of these restrictions, and thus may evaluate restrictive tools and controls more negatively, and be less satisfied with overall management, than younger individuals.

Hypothesis 2: Frequency of use of forestry roads is negatively associated with satisfaction and with desirability ratings for management tools and controls.

As outlined in Section 2.4.5, research has identified links between past experience and use frequency and management and setting preferences. Given past findings that increasing use and experience is associated with less willingness to substitute sites, negative evaluations of social and environmental conditions, and negative evaluations of management, I hypothesize that increasing frequency of use will be associated with lower satisfaction and evaluations of management tools and controls.

Hypothesis 3: The pursuit of consumptive recreation is negatively associated with satisfaction and with desirability ratings for management tools and controls.

As outlined in Section 2.4.2, recreational activities pursued have been identified as potentially important influences on satisfaction and management preferences. Building on past research, this study considers three categories of recreational pursuits (Hypotheses 3, 4, and 5). This hypothesis considers the relationship between the pursuit of consumptive recreation and residents' satisfaction and management tool preferences. Based on the past studies discussed in Section 2.4.2, I hypothesize that consumptive recreationists will have lower satisfaction and management tool evaluations than residents who do not pursue these activities.

Hypothesis 4: The pursuit of motorized land-based recreation is negatively associated with satisfaction and with desirability ratings for management tools and controls.

The second category of recreational activities considered is motorized land-based recreation. As per the studies discussed in Section 2.4.2, I hypothesize that participation in these activities will be negatively correlated with satisfaction and management tool evaluations.

Hypothesis 5: The pursuit of non-consumptive recreation is positively associated with satisfaction and with desirability ratings for management tools and controls.

The final category of recreational activities considered is non-consumptive recreation. As distinct from the previous two categories, based on past research I hypothesize that participation in non-consumptive recreational pursuits will be positively correlated with satisfaction and management tool evaluations.

Hypothesis 6: Place familiarity is negatively associated with satisfaction and with desirability ratings for management tools and controls.

As discussed in Section 2.4.4, past research has identified relationships between familiarity and management and setting preferences. Given previous research associating familiarity with less willingness to substitute sites, negative evaluations of social and environmental conditions, and negative evaluations of management, I hypothesize that familiarity will be negatively correlated with satisfaction and management tool evaluations.

Hypothesis 7: Biocentric belief orientations are positively associated with satisfaction and with desirability ratings for management tools and controls.

As discussed in Section 2.4.3, environmental beliefs have been identified as an important predictive factor for management and setting preferences. As per previous research, I hypothesize that biocentric-oriented individuals will be more satisfied and evaluate management tools and controls as more desirable than their more anthropocentric-oriented counterparts.

Hypothesis 8: Satisfaction with management and perceptions of desirability of tools and controls varies with community of residence.

Community of residence has also been identified as potentially important, as discussed in Section 2.4.1. In the current work, three aspects of community are considered:

i. *Community size (i.e., population) will be positively associated with satisfaction and with desirability ratings for management tools and controls.*

   Although all communities in this study are rural communities that are primarily dependent on resource extractive activities, larger communities tend to have more

diversified economies, including sectors not wholly reliant on resource extraction. As well, it is possible that, as populations increase, residents will see more evidence of the positive aspects of government programs in their communities (e.g., recreational facilities, social programs). Thus, I hypothesize that residents' satisfaction and management tool evaluations will be higher as population increases.

ii. *An OMNR presence in a community will be positively associated with satisfaction and with desirability ratings for management tools and controls.*

Only two of the communities in Wawa District have an OMNR office (Wawa and Manitouwadge). I hypothesize that a visible agency presence will enhance community relations and agency trust, and therefore, residents of communities with an OMNR office will have higher satisfaction and management tool evaluations than residents of communities without an OMNR office.

iii. *The degree of access restrictions in the vicinity of a community will be negatively associated with satisfaction and with desirability ratings for management tools and controls.*

Hunt et al. (2009) found that the degree of road access conflicts in a community was influenced by the abundance of nearby water bodies, and the proportion of those water bodies affected by access restrictions. Therefore, I hypothesize that the degree of access restrictions around a community will be negatively correlated with satisfaction levels and management tool evaluations.

Chapter 3: Theoretical Foundation, Research Approach, and Statistical Paradigm

This chapter describes the foundation for this study. After describing the theoretical foundation, I discuss the general research approach, and the statistical paradigm under which the analyses were conducted. Specific methodological details are provided in Chapter 4.

3.1 Theoretical Foundation and Research Approach

3.1.1 Overview

This section discusses the foundational theories used to guide and inform this research, and discusses the appropriateness of a quantitative approach. First, it presents the theoretical concepts used to inform this study, and explains why a number of theoretical concepts were used as opposed to framing it wholly within one theoretical paradigm. Second, it provides the rationale for using a quantitative research approach. It outlines the pros and cons of qualitative and quantitative approaches, and discusses why the scope and research goals of this study make it well suited to a quantitative approach.

3.1.2 Study Breadth

The scope of this study is broad in terms of both geographic area and the population studied. From a geographic perspective, rather than pin-pointing one distinct area or feature, such as a park, river, or trail, this study considers the OMNR Wawa District as a whole (~ 46 982 km^2, CLUAH, 2006) (Appendix A). Similarly, the population studied incorporates all residents of Wawa District: those who do and do not recreate on Crown land. Of those who do recreate, all types of recreationists were included in the study; I did not focus on one specific group of recreationists (e.g., anglers) within the District.

Potentially important influential variables were identified through the literature review and used to develop the hypotheses. The broad scope of this research combined with a strong theoretical justification for the selected variables will enable this study to produce a clear picture of the current situation in Wawa District: an understanding of residents' satisfaction levels and their perceived desirability of different road access management tools, and how both of these are associated with user characteristics.

3.1.3 Quantitative Approach

This study is best suited for a quantitative approach. While qualitative research collects rich, in-depth information on a few cases (Centers for Disease Control [CDC], 2010), the data collected is contextual and, therefore, less able to be generalized (Neill, 2007). This study benefited from quantitative research's ability to collect a wide breadth of information across a large number of cases (CDC), and to produce results that are generalizable to the larger Wawa District population (Weinreich, 2006). As well, the precise measures of relationships between variables and the statistical models created under a quantitative approach become practical tools that managers can use to assist them in understanding the current situation and predicting how the population will respond to proposed changes.

While this approach will lose the richer, contextual data provided through qualitative research, one must determine the appropriate trade-off between the benefits of quantitative versus qualitative approaches. For this study I considered a broad scope, and generalizable results that are easily applied in resource management to be top priorities, making a quantitative approach the most appropriate option. An additional benefit of a quantitative approach is managers' familiarity and comfort with such methods. In general, many managers who have not been heavily involved in research have a higher comfort level with quantitative rather than qualitative studies.

Specifically, this study is a descriptive, or observational, quantitative study. In such studies conditions are measured as they are; no attempt is made to modify baseline conditions or behaviours (Hopkins, 2000).

Quantitative research must strike a balance between precision and applicability. Researchers highly concerned with precision will often reduce, as best they can, all variation in subject characteristics and behaviours. While this approach yields more precise effect estimates (i.e., the average amount the dependent variable increases when the independent variable increases one standard variation and the other independent variables are held constant) , it reduces the generalizability of the results. Researchers more concerned with the applicability of the study may choose to broaden the sample and forfeit some level of precision to gain greater applicability (Hopkins, 2000).

In summary, I conducted this research using a descriptive, quantitative approach. Although precision remains an important consideration, this was balanced with the need to

ensure adequate applicability of the results. A social survey approach was taken, using a mail-out questionnaire to address the research questions.

3.2 Statistical Paradigm

3.2.1 Overview

This section describes the statistical paradigm under which the research was conducted: an information theoretic framework. It provides some context for this approach including a discussion of how and why it was developed and what advantages it offers. The specific analytical techniques employed under the information theoretic umbrella are described in Chapter 4.

3.2.2 Statistical Paradigm - Information Theoretic

An information theoretic paradigm (Anderson, Burnham, & Thompson, 2000), involves a relatively new statistical approach that is increasingly replacing traditional statistical testing methods. In brief, the principle of parsimony provides a philosophical basis for model selection, and Kullback-Leibler information provides an objective target based on deep, fundamental theory. The information theoretic paradigm, combined with likelihood-based inference, provides a practical, general methodology for data analysis. Specifically, this approach uses Akaike's Information Criterion to provide a strength of evidence measure for each model included in the analysis (Anderson et al.).

This section discusses the advantages of an information theoretic approach, expands on the above mentioned concepts, and describes how the results of such an approach are interpreted. The details of how the approach is implemented are in Chapter 4, with the results in Chapter 5.

3.2.2.1 Traditional Methods (Null Hypothesis Testing)

Traditionally, researchers have assumed that, within a set of candidate models, there exists a single correct (or even true) or, at least, a best model, and that it is sufficient to make inferences from the data using only this model. Although both the identity and the parameter values of this best model are unknown, it is assumed that these can be well estimated. Building on these assumptions, traditional (i.e., classical) inference often involves a search for that single correct model, with parameters and statistical inference estimated from this one model. Model

selection uncertainty is not considered because it is assumed that the single best model has been identified (Burnham & Anderson, 2004).

The dominant classical approach has been Null Hypothesis Testing (NHT). This approach is also referred to as significance testing and null hypothesis significance testing, and is a hybridization of Fisher's (1928) significance testing and Neyman and Pearson's (1933) hypothesis testing (Royall, 1997). An NHT approach involves framing the research question in terms of two contrasting hypotheses: the null hypothesis representing no difference between population parameters of interest, and an alternative hypothesis representing either a unidirectional or bidirectional alternative. The two hypotheses essentially correspond to two different models (Anderson et al., 2000).

Once a researcher defines the two hypotheses, a test statistic is calculated from the sample data. This statistic is compared to its hypothesized null distribution, allowing the researcher to assess the consistency of the data with the null hypothesis. Extreme values of the test statistic suggest that the sample data are inconsistent with the null hypothesis. An arbitrary significance level is typically predefined to serve as a cut-off that distinguishes between statistically significant and statistically nonsignificant results (Anderson et al., 2000).

However, researchers and statisticians have been increasingly challenging this approach (e.g., Johnson, 1999). Although doubts about the usefulness of NHT are not new (e.g., Berkson, 1938), criticisms in the scientific literature have been more frequent in recent years. Many statisticians question the practical utility of hypotheses testing, stressing instead the value of estimation of effect size and associated precision (e.g., Goodman & Royall, 1988). Anderson et al. (2000) suggested that NHT is uninformative when the findings do not provide any estimates of means or effect sizes and their precision and signs, and argued that tests of statistical null hypotheses have relatively little utility and are not a fundamental component of the scientific method.

The social sciences have demonstrated particularly strong concern with the NHT approach. Anderson et al. (2000) have identified at least three special journal features and two edited books that have been published questioning the utility of NHT in the social sciences. A number of problems with the application of the NHT approach have been identified, some of which are presented here.

One of the problems identified with NHT is that nearly all null hypotheses are false on *a priori* grounds (Johnson, 1999; Anderson at al., 2000). The rejection of such a hypothesis does

little to advance scientific knowledge and provides few meaningful insights for planning, management, or further research (Anderson et al.).

Another issue with NHT, which is well known but frequently ignored, is that the selection of a particular significance level is without theoretical basis, and is, therefore, somewhat arbitrary (Anderson et al., 2000). Berkson (1938) was one of the first statisticians to object to this practice. Coming from a biological sciences perspective, Anderson et al. suggest that the use of a fixed significance level arbitrarily classifies findings into biologically meaningless categories, significant and nonsignificant, resulting in relatively uninformative conclusions.

Researchers have also expressed concern with the cornerstone of NHT, the P-value (i.e., the probability of obtaining a test statistic at least as extreme as the observed one). They have suggested that problems of using the P-value as an inferential tool stem from its very definition, its application in observational studies, and its interpretation (e.g., Johnson, 1999).
A number of issues with P-values have been identified.

1. P-values tend to over-estimate the evidence against the null hypothesis (Anderson et al., 2000).

2. P-values are explicitly dependent on the null hypothesis (Anderson et al., 2000).

3. P-values depend on sample size (Berkson, 1938).

4. There is a strong publication bias towards only publishing significant P-values (Hedges & Olkin, 1985), but P-values rely on an arbitrary choice to distinguish between significant and insignificant.

5. Although not inherently a defect of P-values, researchers often misinterpret them as evidence for either the null or the alternative hypothesis.

6. P-values do not provide information on effect sizes and their precision. This also limits the effectiveness of future meta-analyses (Anderson et al., 2000).

3.2.2.2 Moving Beyond the Traditional Methods

Given the recognized issues and challenges with traditional methods, and the recent major advances in the theory and application of data analysis, it should not be surprising that

NHT's utility is being challenged (Anderson & Burnham, 2002). Researchers increasingly agree that significance testing is a poor approach to model selection and variable selection in regression analysis, discriminant function analysis, and similar procedures (Akaike, 1973). The simplest alternative is to continue using classical frequentist methods (e.g., analysis of variance of covariance, regression), while switching the focus to effect sizes and their precision, rather than statistical tests, P-values, and problematic statements about statistically significant vs. nonsignificant (Anderson, Burnham, & White, 2001). Simply changing this focus would provide results that would be more useful in future meta-analyses (Hedges & Olkin, 1985). For this particular study, this will facilitate broader analyses and comparison between and amongst studies as more road access research is conducted, allowing a better understanding of broadly applicable versus site specific findings.

Chamberlin (1965) proposed the concept of multiple working hypotheses rather than simply a statistical null vs. an alternative. While this seems like a superior method, it presents challenges if researchers attempt to apply it to a traditional paradigm. This combination leads to the multiple testing problem in statistical hypothesis testing, and arbitrariness in the selections of a significance level and of a null hypothesis (Anderson et al., 2000).

Scientists are moving beyond the classical methods, changing their views of inference, and adopting different methods, such as information theoretic and Bayesian approaches, to pursue Chamberlin's multiple-hypothesis concept (Lukacs et al., 2007) and to facilitate strong inference (Platt, 1964). Information theoretic approaches are based on criteria that estimate Kullback-Leibler information loss, and favour models that minimize this loss (discussed further below) (Kullback & Leibler, 1951). Information theoretic approaches allow researchers to rank multiple hypotheses (represented by models) according to the calculated strength of evidence for each (Anderson et al., 2001). Perhaps of particular interest to social scientists is the applicability of information theoretic methods to conflicts arising in the management of natural resources, in which case the different hypotheses represent the varying stakeholder positions (Anderson et al.). As well, these approaches are useful for resource managers as they are consistent with modern approaches to decision making in face of the competing ecological models found in adaptive resource management, in which all stakeholder positions are considered and accorded some level of value (e.g., Walters, 1986).

3.2.2.3 Information Theoretic Approach – Advantages

The information theoretic approach was selected for this thesis for a few reasons. First, as

Burnham and Anderson (2004) explained, no models exist that exactly represent full truth, and researchers should not expect such a model to be in the set of candidate models. While this is true in general, it is especially important in the context of this study, where I am examining human perspectives and beliefs, which should be expected to vary between individuals, and all perspectives should be accorded some consideration in resource management decisions. Thus, information theorists' belief that one true model does not exist (Burnham & Anderson) is well suited to this study.

Second, the information theoretic approach is relatively simple to apply, is applicable across a wide range of empirical situations and scientific disciplines, and the methods are computable by hand, if necessary. As well, the results are relatively straightforward for both the researcher and the audience to understand, (Anderson et al., 2000, 2001; Burnham & Anderson, 2004). Information theoretic methods allow researchers to calculate the evidence for or against hypotheses, and to consider multiple hypotheses simultaneously (Lukacs et al., 2007). Under this paradigm, researchers make inferences from models and parameters conditioned on data, not on probability statements about the data conditional on a null model (Lukacs et al.). It provides evidence for multiple hypotheses and allows researchers to make inferences from either a single (best) model or from many models (Anderson et al., 2000).

Lastly, researchers should be cautious not to mix information theoretic and NHT approaches. There are a variety of problems associated with mixing the evidentiary results from an information theoretic approach with null hypothesis tests and their associated P-values. For example, once models have been ranked through an information theoretic analysis, no current theory exists suggesting that a test statistic associated with a test between any two models has some known distribution (i.e., for t or z or χ^2) as a basis for computing P-values. Thus, researchers emphasize the importance of using one approach consistently for a study (Anderson & Burnham, 2002; Anderson et al., 2001).

3.2.2.4 Kullback-Leibler Information

Kullback-Leibler information is the foundation of the information theoretic approach used in this thesis. The Kullback-Leibler information paradigm is an extension of likelihood theory, and is now a dominant paradigm in information and coding theory (Anderson et al., 2000).

In the Kullback-Leibler information paradigm, f represents full reality, or truth. Kullback-

Leibler information, *I (f,g)* is defined as a measure of the information lost when a model, *g,* is used to approximate truth, *f.* Under the Kullback-Leibler information paradigm, models are evaluated according to the information lost. The model losing the least information relative to the others in the set is considered the best, and the remaining models can be ranked according to the information lost (Burnham & Anderson, 2004).

Kullback-Leibler information, *I(f,g)*, can be expressed as a statistical expectation of the natural logarithm of the ratio of full reality to the approximating model. Given that full reality is unknown, but is fixed across all models, it can be treated as a constant (Anderson et al., 2000).

However, *I(f,g)* cannot be used directly in model approximation because it requires knowledge of full truth, and of the parameters, θ, in the approximating models (Burnham & Anderson, 2004). This information cannot be precisely known, as full truth is unknown, and model parameters are estimated in data analysis. Models based on estimated parameters are distinct from those based on known parameters, and necessitate a change in the model selection criterion. Rather than model selection based on minimizing known Kullback-Leibler information, the model selection criterion must instead rely on minimizing the expected estimated Kullback-Leibler information (Burnham & Anderson, 2004). This study uses Akaike's Information Criterion (Akaike, 1973), which is discussed further in Chapter 4.

3.2.2.5 Information Theoretic Paradigm

As with the Kullback-Leibler information paradigm, information theorists do not believe in the notion of one true model. This paradigm is based on the belief that no model exists that exactly represents full truth, and researchers should not be seeking to find one (Anderson & Burnham, 2002). Information theorists stand behind George Box's famous statement "All models are wrong but some are useful" (Burnham & Anderson, 2004). Furthermore, this approach recognizes that the 'best model' depends on sample size. The amount of information in large data sets (e.g., n=3500) is much greater than that in small data sets (e.g., n=22). Thus, smaller effects are often only revealed as sample size grows (Burnham & Anderson).

Understanding these limitations, information theoretic approaches strive to estimate the relative closeness of each fitted model to conceptual truth, or full reality. The goal is to assess how well fitted each model in the candidate set compares with reality, which is quite different than trying to find the one true model (Anderson & Burnham, 2002).

An information theoretic paradigm demands that model selection be based on a well-

justified criterion of what constitutes the 'best' model, or the 'strongest' models. There are three main requirements for this criterion. First, it should be founded on an accepted philosophy about models and model-based statistical inference, including the consideration that data are finite and 'noisy.' Second, the criterion must be estimable from the data for each fitted model, and must fit into a general statistical inference framework. Third, the criterion must reduce to a number for each fitted model, given the data, and must allow the researcher to quantify the uncertainty that each model is the strongest model through computation of model weights. A criterion that meets these requirements allows us to move beyond inference based on only the selected best model, and conduct inference based on the full set of candidate models (Burnham & Anderson, 2004).

Notions of significance and P-values are not part of the information theoretic paradigm (Anderson & Burnham, 2002). Instead, these analyses focus on a small set of plausible hypotheses (Johnson, 1999; Anderson et al., 2000). Quantitative evidence is provided for each hypothesis, enabling a thoughtful interpretation of the findings (Anderson & Burnham). Interpretation of the results lets the researcher rank the models from best to worst, and can be scaled to allow an understanding of which hypotheses might be close, and which are separated widely, in terms of empirical evidence. Model selection uncertainty is not ignored, but is incorporated into estimates of precision. Finally, researchers can base the formal statistical inference on all the models in the set rather than on merely the model estimated to be the best (Anderson & Burnham).

Proper application of the information theoretic paradigms requires the availability of good, relevant data that have been collected in an appropriate manner. Additionally, three general principles guide scientific model-based inference (Burnham & Anderson, 2004):

- Simplicity and parsimony: Information theorists strive to follow Occam's razor (Wudka, 1998), which suggests that researchers "Shave away all but what is necessary." They recognize that model selection ultimately comes down to a bias versus variance trade-off – the statistical principle of parsimony. When models have too few parameters inferences can be biased, but when they have too many precision may suffer or spurious effects may be identified (Burnham & Anderson, 2004). This is known as the model selection balance – the need to find the appropriate balance between under- and overfitted models (Forster, 2000).

- Multiple working hypotheses: Chamberlin ([1890] 1965) was among the first to advocate using several well-supported hypotheses (i.e., models) without including a null hypothesis – the concept of "multiple working hypotheses." It is generally accepted that analyses will tend to support one or more hypotheses, while providing less support for others. Science and knowledge are advanced through repetition of this approach. Hypotheses with little empirical support are removed from consideration, while new or more elaborate ones are added. It is important to note that even as the model set evolves it should always stay relatively small, restricted to a small set of well-supported hypotheses (Burnham & Anderson, 2004). The development of these hypotheses is discussed further below.

- Strength of evidence: Information theorists believe that providing quantitative evidence to judge the strength of evidence, instead of providing arbitrary significant vs. nonsignificant dichotomies, is central to science (Burnham & Anderson, 2004).

3.2.2.6 Multimodel Inference

One strength of the information theoretic approach is the option to base inferences on the entire set of models (multi-model inference, MMI), rather than on a single selected best model (e.g., Anderson et al., 2000; Anderson et al., 2001). This approach avoids the implication that variables not included in the estimated best model are unimportant (Anderson et al., 2001). If an objective is to assess the relative importance of variables, inference can be made based on the sum of the Akaike weights for each variable, across models that include that variable (Burnham & Anderson, 2004).

3.2.2.7 Hypothesis/Model Development

The quality of information theoretic findings ultimately rests on the quality of the *a priori* set of candidate models (hypotheses) (Anderson & Burnham, 2002), thus encouraging greater *a priori* thinking than NHT, which focuses on the testing of a null hypothesis against an alternative (Lukacs et al., 2007). This paradigm assumes that a set of plausible *a priori* candidate models, well supported by the underlying science, have been defined and are represented by carefully chosen statistical models (Anderson et al., 2001; Anderson & Burnham; Burnham & Anderson, 2004). Consideration of the *a priori* "science" of the issue is critical at this important stage

(Burnham & Anderson, 2004). Failure to develop several plausible science hypotheses and models to represent them leads to the problem that no model is useful.

Researchers must also be cautious not to include too many models in the candidate set. As above, this problem occurs when too little forethought goes into developing an *a priori* candidate models. In these cases, studies will use a statistical software package to analyze hundreds, or even thousands of models (Anderson & Burnham, 2002). The analysis of such a large number of models is not justifiable, except when prediction is the only objective or in the most exploratory phases of an investigation (Burnham & Anderson, 2004). Cases in which the number of models exceeds the sample size are certainly problematic (Anderson & Burnham).

Chapter 4: Data Collection, Treatment, and Analysis

4.1 Data Collection

4.1.1 Target Population

As discussed in Chapter 1, this study targeted the entire resident population of Wawa District of the OMNR. Targeting the entire population and then exploring associations between individuals' preferences and their characteristics will enable resource managers to understand the preferences of all residents instead of a few select segments (e.g., motorized recreationists) when making resource management decisions.

The six main communities in Wawa District are White River, Wawa, Dubreuilville, Manitouwadge, and Hornepayne. As mentioned, Marathon, located just west of the District, is include in this study as well.

White River is located midway between Sault Ste. Marie and Thunder Bay. It was initially settled as a railway town along the Canadian Pacific Railroad, but forestry became more important when Abititi Price established a lumber mill in the 1970s. However, the current owners, Domtar Forest Products, indefinitely shut the operations down in 2007 (Township of White River, 2010).

Wawa is located 225 kilometres north of Sault Ste. Marie along the Trans Canada Highway. Historically, Wawa's primary industries have been mining and forestry, but the economy has been slowly diversifying. For example, the service sector has been growing steadily (Wawa Economic Development Corporation, 2009).

Dubreuilville was founded in 1961, and is located at the end of highway 519 east of the Trans Canada Highway. It was established as a logging community, and forestry remains the most important sector (Dubreuilville Township, 2009).

Manitouwadge is located north of Lake Superior and the Trans Canada Highway. It was founded by three prospectors as a mining community, and developed both mining and forestry as the primary economic activities (Township of Manitouwadge, 2009).

Hornepayne is located on highway 631 400 kilometres northwest of Sault Ste. Marie. It was established as a small railway town in 1915, but the forest industry became the major employer (Township of Hornepayne, 2009).

Marathon is located just west of Wawa District adjacent to Lake Superior. Marathon's economic base consists primarily of gold mining and a local pulp mill (Marathon, 2009).

Statistics Canada (2006) provides some information on the Wawa District communities. It maintains data on the White River Township, the Michipicoten Township (Wawa), the Dubreuilville Township, the Manitouwadge Township, the Hornepayne Township, and the community of Marathon. Table 1 summarizes this information, showing the 2001 and 2006 population totals, the population decrease between 2001 and 2006, the total number of private dwellings, the population density, and the land area. These statistics emphasize the rural nature of the study area, and suggest a consistent population decrease across the entire area.

Table 4.1

Wawa District Community Profiles (Statistics Canada, 2006)

	White River	Michipicoten	Dubreuilville	Manitouwadge	Marathon	Hornepayne
2006 Population	841	3204	773	2300	3,863	1209
2001 Population	993	3668	967	2949	4,416	1362
Population Change (%)	-15.3	-12.6	-20.1	-22.0	-12.5	-11.2
Private Dwellings (2006)	443	1453	314	1212	1,678	480
Population Density per km^2 (2006)	8.7	7.7	8.6	6.5	22.7	5.9

4.1.2 Questionnaire Development

The questionnaire was developed from a review of previous studies and consultation with academic researchers and OMNR staff. Many groups and individuals reviewed the questionnaire, including academics, students, residents, and government employees. These reviews included both informal individual consultations and a formal focus group. The questionnaire was also presented to the Crown Land Use Atlas Harmonization (CLUAH) working group[1]. The comments provided by all reviewers helped to shape the drafts and final version of the questionnaire.

[1] The CLUAH group helped to work on a land use planning amendment policy instrument/project for unregulated Crown lands and waters in OMNR Wawa District from 2006-2009.

The initial draft was given to the academic supervisors and committee members for feedback, and revisions were made accordingly. Once this review was complete, the questionnaire was taken to the Wawa District OMNR, where OMNR staff involved with the CLUAH project had the opportunity to comment. Once their input was incorporated into the questionnaire, it was presented at a CLUAH working group meeting. A brief presentation outlining the project goals and the research methods was given, and all participants were provided with a copy of the questionnaire. There was time to provide comments at the meeting, and contact information was provided that allowed individuals to provide additional feedback.

Once the feedback from the OMNR staff and the CLUAH group members had been considered and incorporated into the questionnaire, feedback was sought from individuals who were less directly involved in forestry road management. This step was critical to ensure that the questionnaire was appropriate for all District residents and not just those individuals who were highly knowledgeable and involved in forestry road management. This was accomplished in several ways.

First, a formal focus group was held in Manitouwadge. Focus groups are a form of qualitative research in which a small number of people discuss a specified topic, such as a product, service, concept, advertisement, idea, or packaging. (American Statistical Association, 1997). Focus groups can be conducted in a variety of ways depending on the research goals, including two-way focus groups, mini focus groups, teleconference focus groups, and online focus groups (Marshall & Rossmann, 1999). Most relevant to this study are focus groups used to pre-test ideas and inform the choice of words or phrases in a questionnaire, ensuring that the intended meanings are conveyed and that the survey is appropriately tailored to the target audience (Dillman, 2000; American Statistical Association, 1997). Six individuals attended the session in Manitouwadge. While participation was open, all who attended were OMNR employees, and thus, were still representative of that particular agency. However, none were directly involved with forestry road management, and thus represented a broader spectrum of perspectives than solely individuals with direct experience managing roads. The session began with brief introductions, and then the participants independently filled out the survey. Once complete, I went through the survey with the group and they provided feedback on each question.

Second, the questionnaire was sent for review to one individual in Manitouwadge who was interested but unable to attend the focus group. Third, other Lakehead graduate students, acquaintances in Wawa, and Wawa District OMNR employees not directly involved with

forestry road issues also reviewed the questionnaire. The questionnaire was revised accordingly and sent to the academic supervisors and committee for final comments.

Lastly, as a significant Francophone population exists in Wawa District, a certified OMNR translator translated the questionnaire into French. Three native French speakers reviewed the original questionnaire and the translation to ensure accuracy. However, only two respondents requested a French questionnaire.

4.1.3 Final Questionnaire Design

The questionnaire was designed to collect the data necessary to test the hypotheses regarding residents' satisfaction with current access road management and residents' preferences for road access management tools and controls. This design required questions that assessed the dependent and candidate explanatory variables.

Some additional information was also collected. For example, although 'age' and 'community of residence' were the only demographic variables included in the hypotheses, the questionnaire collected a variety of demographic variables to allow the construction of a more complete demographic profile of respondents. It also gathered perspectives on different issues related to road access, tourism, recreation, and management by having respondents indicate their agreement (or disagreement) with a variety of statements. These statements were developed from previous research (Hunt et al., 2009) that identified potential causes of conflicts over road access around Wawa. Although this information was not used directly in the management tool or satisfaction analyses, it was collected to provide a more complete picture of residents' perspectives and beliefs.

The collected information included (see Appendix A for the full survey):

a. Demographic information (i.e., gender, age, hometown, education);
b. Recreational vehicles owned (e.g., canoe, ATV) and membership in environmental or outdoor organizations
c. Forestry road use (i.e., the importance of Crown Lands for recreation, familiarity with areas within Wawa District, frequency of forestry road use, activities pursued on or from forestry roads);

d. Perceptions of the current situation (i.e, satisfaction with current forestry road management, opinions about forestry road management, perceptions on the root causes of forestry road management conflicts (as identified by Hunt et al., 2009));
e. Environmental value orientations (i.e., placing respondents along a continuum ranging from anthropocentric to biocentric according to the *New Ecological Paradigm* scale (Dunlap et al., 2000)); and
f. Respondents' preferences for different forestry road management tools (i.e., natural abandonment, water crossing removal, road impediments, winter roads, signs, road use permits, and gates).

The questions evaluating respondents' views (i.e., perceived desirability of management tools, satisfaction, perceptions of the current situation, value orientations) utilized five-level Likert items, with the middle option being 'neutral' and a 'no opinion' option available as well. Dawes (2008) concluded that data from five, seven, and ten levels produce very similar descriptive statistics (e.g., mean, variance, skewness, and kurtosis), reducing the necessity to have more than five levels.

4.1.4 Survey Process

The first step in the survey process was to obtain a sample of respondents from the population of residents. Using a purchased list, local residents were randomly selected for the sample from a population of residential addresses in Wawa District. Survey implementation followed the Tailored Design Method (Dillman, 2000) that involved multiple contacts with every potential respondent. The questionnaire was presented in a booklet format.

Once the sample was finalized, a package was mailed to all selected individuals. Each envelope contained two cover letters (i.e., an English cover letter and a French cover letter) (Appendix B), an informed consent card (Appendix C), a business-reply return envelope, and a questionnaire (Appendix D). The French letter explained that participants could send the survey back with FRANÇAIS written on the cover and they would be sent a French questionnaire. Following Dillman's (2000) Tailored Design Method (TDM), a postcard reminder was sent to all participants one week after the first mail-out (Appendix E), and a second questionnaire was sent to those who had not yet responded two weeks after the postcard mail-out with a final letter (Appendix F). Each questionnaire was assigned a unique identifying number, to ensure that once

a response was received no more reminders were sent to that individual. The final response rate was 36 per cent. This is a fairly low response rate, as there is evidence that response rates for studies using the TDM typically reach 50 to 70 per cent for the general public (Dillman, 1978, 1983). However, it is still slightly above the 30 per cent threshold identified by Fowler (1984), below which samples are not generally representative of the sampled population.

4.2 Variables Measurement and Data Coding

This section begins with a general description of the coding methods used. Detailed coding explanations are next given for the dependent and explanatory variables used in the satisfaction and management tool desirability analyses. A table summarizing the variables is provided at the end of the section.

4.2.1 Data Entry and Coding Considerations

4.2.1.1 Categorical Data

Categorical data are separable into categories that are mutually exclusive, such as gender. These data are typically measured on a nominal scale, using labels such as 'male' and 'female' instead of measurements (Powers & Xie, 1999). An example of a categorical variable in this study is 'participation in motorized land-based recreation,' where the options are 'yes' and 'no.'

The categorical variables in this study were effects coded. This coding is slightly different from traditional dummy coding. In both coding schemes, k-1 variables are created where k is the number of categories. Consider the case with three categories blue, red, and green. For dummy coding, two variables (say blue and green) are created and coded as one when the colour matches the variable name and zero otherwise. Therefore, all statistical comparisons using this coding are comparing the effect of blue and green versus the reference of yellow (the base). For effects coding, when yellow is present, it is coded as -1 for both the blue and green variables. Therefore, the reference is the average rather than a specific colour. Effects coding does not affect the relative strength of effects for colour. The effects codes create "cleaner" estimates for intercepts and interaction effects (UCLAa, n.d.).

4.2.1.2 Likert Data

Some questions were scored using Likert scales, on which an individual rates his/her agreement with a statement on a response scale (Trochim, 2006). For example, this study asked respondents to rate their satisfaction with current access road management on a Likert scale

ranging from strongly disagree (-2) to strongly agree (2). Similarly, respondents ranked the desirability of different access management tools on a Likert scale ranging from very undesirable (-2) to very desirable (2).

It is important to distinguish between a *Likert Scale* and a *Likert Item*. A Likert item is simply a statement which a respondent is asked to evaluate on any kind of subjective or objective criteria (e.g., level of agreement or disagreement). A Likert (or summative) scale, however, is the sum of responses on several Likert items. During analysis, each item may be analyzed separately, or in some cases responses may be summed to create a score for a group of items (Trochim, 2006).

Likert data in this study were treated as interval-level data. Although some debate exists about whether this data is best treated as ordinal or interval (e.g., Jamieson, 2004), this approach is consistent with past research (e.g., Lubke & Muthen, 2004).

4.2.2 Data Treatment – Dependent Variables

4.2.2.1 Satisfaction

Satisfaction was the dependent variable in the first analysis. Respondents were asked to rate their satisfaction with current forestry road management on the following five-level Likert item:

> How satisfied or dissatisfied are you with the current ways that the OMNR manages logging roads in Wawa District? ***(please circle the number that best describes your view)***

Very Dissatisfied		Neutral		Very Satisfied	No Opinion
1	2	3	4	5	☐

The data was coded from -2 to 2, with -2 representing the lowest satisfaction, 2 representing the highest satisfaction, and 0 representing a neutral opinion. 'No opinion' was coded as 6, and missing responses were coded as 99. The no opinion and missing responses were not used in the analysis of the data.

4.2.2.2 Management Tool Preferences

The management tool preferences were the dependent variables in the second analysis. This question had respondents rate the desirability of eleven different road access management tools. This list included physical decommissioning tools, regulatory tools, and passive management tools (see Appendix A). Physical decommissioning tools are used to physically

modify a road to make it physically impassable. These tools included water crossing removals (bridges and culverts), roadbed removal, and road impediments. Regulatory tools are used to restrict access through regulations. Because the road is not made physically impassable, these approaches can be used to allow for the use of roads by some groups or individuals while restricting other's use. These tools included signage, road use permits, and gates. Lastly, passive management approaches included natural abandonment and winter roads. Natural abandonment refers to letting a road naturally return to a more natural, less useable state, without taking additional physical decommissioning steps to make it impassable. Winter roads are roads that travel over water bodies, and are thus only useable in the winter months when the water bodies are frozen. Given that they are not usable during the spring, summer, and fall months, regulatory or physical decommissioning access controls are not necessary on these roads.

Respondents rated each tool on a five-level Likert item, ranging from very undesirable (-2), to neutral (0), to very desirable (2). Missing responses were coded as 99 and were not included in the analysis.

4.2.3 Data Treatment – Explanatory Variables

4.2.3.1 Environmental Beliefs

Environmental beliefs orientation was an explanatory variable used for both analyses. It was measured using the *New Ecological Paradigm* scale, a set of 15 five-level Likert-items. This was a true Likert scale; the responses for the 15 statements could be combined and analyzed as one summative or average scale for each respondent. Respondents had the option of selecting a 'no opinion' option, coded as '6,' and missing responses were coded as '99.' Again, individuals who selected any no opinion or missing responses were excluded from analyses.

One environmental belief orientation score was estimated for each individual, representing their overall environmental belief orientation. The statements alternated (i.e., a '2' for one question indicated a biocentric perspective, while a '2' for the next question indicated an anthropocentric perspective). Thus, before combining the responses, the codes for each statement were altered such that an answer of '2' always represented a biocentric perspective. I then calculated the mean of the 15 responses for each respondent. The resulting value represents a respondent's location along a continuum ranging from most anthropocentric (-2) to most biocentric (2). This is consistent with Dunlap et al.'s (2000) conclusion that the NEP can be usefully employed as either a single scale or as a multidimensional measure.

4.2.3.2 Familiarity

Familiarity was an explanatory variable in both analyses. Respondents rated their familiarity with each of the six forest management units in Wawa District (Algoma, Nagagami, Magpie, White River, Black River, and Big Pic forests). The responses were coded as -1= unfamiliar, 0= somewhat familiar, and 1=very familiar. Individuals who selected no opinion or missing responses were excluded from analyses. Familiarity measures have varied between studies, but this approach was consistent with past research that has used self-declared levels of familiarity (e.g., Hammitt et al., 2006; Peden & Shuster, 2008; Wynveen et al., 2007).

To simplify this variable, I opted to consider an individual's familiarity with the area surrounding their home community. This was based on the assumption, consistent with past research, that recreationists prefer to travel shorter distances (e.g., Hunt et al., 2005). Therefore, when coding the data, I selected the 'familiarity' rating for the area in which the individual lived, which was based on his/her postal code. For example, for individuals who lived in the community of Wawa (and Hawk Junction), I used their 'familiarity' score for the Algoma Forest and discarded their familiarity scores for the other areas. Similarly, for Dubreuilville residents, I used their familiarity rating for the Magpie Forest; for White River residents, I used their familiarity rating for the White River Forest; for Hornepayne residents, I used their familiarity rating for the Nagagami Forest; for Manitouwadge, I used their familiarity rating for the Black River Forest; and for Marathon residents, I used their familiarity rating for the Big Pic Forest.

4.2.3.3 Frequency of Use

Frequency of use was an explanatory variable in both analyses. Respondents estimated their average number of weekly trips on forestry roads for each season. These four responses were amalgamated into one 'frequency' value for each individual. First, the frequency of use codes were converted to an estimate of the actual number of trips taken by the individual (i.e., none = 0; less than one = 0.5; one to two = 1.5; three to five = 4; more than five = 6.5). The four values were averaged, and this value was used as the frequency of use variable. If an individual did not indicate his/her involvement in all four seasons this score could not be calculated and a missing value code of '99' was entered. Individuals who selected no opinion or missing responses were excluded from analyses.

4.2.3.4 Age

Age was an explanatory variable in both analyses. Respondents selected the five-year age group to which they belonged, ranging from 24 or younger to 70 or older. To create categories containing sufficient sample sizes for meaningful analysis, the responses were grouped into three different age categories. The categories were developed based on the goal of creating groups with similar numbers of samples. The three final groups were 39 years or less, 40-54 years, and 55 years or older. People in the 40-54 years age groups provided the greatest number of responses; hence, this group is the smallest in terms of the age span. The groups were coded as -1=39 years or less, 0=40-54 years, and 1=55 years or older (i.e., ordered categorical data). Missing responses were coded as '99.' Individuals who selected no opinion or missing responses were excluded from analyses.

4.2.3.5 Participation in Recreational Activities

Respondents' participation in a variety of recreational activities was an explanatory variable in both analyses. This question listed a number of recreational activities and asked residents to answer 'yes' if they participated in the activity, or 'no' if they did not. The activities listed were as follows: hunting/trapping, fishing/ice fishing, motorized land-based recreation (e.g., snowmobile, ATV), motorized water-based recreation (e.g., jet ski), non-motorized land-based recreation (e.g., skiing hiking), non-motorized water-based recreation (e.g., canoeing), gathering (e.g., berrypicking, firewood), or work. Using effects coding, for each activity a 'yes' response was coded as '1' and a 'no' response was coded as '-1.' Individuals who selected no opinion or missing responses were excluded from analyses.

I combined responses to create more general groupings of participation in 'consumptive,' 'non-consumptive,' and motorized land-based recreation. For the 'consumptive recreation' group, I combined hunting/trapping and fishing/ice fishing in one group. If a respondent participated in any of these activities they were coded as 'yes' (1) for participation in consumptive recreation. If a respondent did not participate in any of these activities, they were coded as 'no' (-1).

Similarly, for the non-consumptive recreation group, I combined non-motorized land-based recreation and non-motorized water-based recreation in one group. If a respondent participated in either they were coded as 'yes,' (1) and if they participated in neither they were coded as 'no,' (-1). Missing responses were coded as '99.' The third grouping consisted of motorized land-based recreationists.

Some respondents participated in multiple categories of recreation and were coded as 'yes' for each one. As the analysis was not comparing, for example, consumptive versus non-consumptive recreationists, but rather was comparing individuals who pursue consumptive recreation versus those that do not, it was not necessary to eliminate those who participated in two or more categories.

4.2.3.6 Community of Residence

Respondents' home community was an explanatory variable in both analyses. As per the hypotheses, it was coded in three different ways.

First, it was coded according to size. The communities were split into three different groups: small (White River, Hornepayne, Dubreuilville), medium (Manitouwadge), and large (Wawa, Marathon). These divisions were based on Statistics Canada data. In the most recent census, Wawa and Marathon had populations above 3000, Manitouwadge had a population between 2000 and 3000, and White River, Dubreuilville, and Hornepayne had populations below 1500. Two variables were created to represent community size. Given this different approach to this variable, dummy based coding was used to create the following two variables:

1. Large communities: Marathon and Wawa were grouped together and coded as '1.' All other communities were grouped together and coded as '0'.
2. Medium communities: Manitouwadge was coded as '1.' All other communities were grouped together and coded as '0'.

Second, the data were coded according to the degree of access restrictions near the community. From estimates provided by staff from the Wawa District, OMNR, Dubreuilville and Hornepayne have the greatest amount of restrictions near their areas. Thus, I divided the communities into two groups: Dubreuilville and Hornepayne, coded as '1,' and the remaining communities coded as '-1.'

Third, the data were coded based on whether or not there was an OMNR office in the community. The communities were separated into two groups. The first group contained communities with an OMNR presence (Wawa, Manitouwadge) and was coded as '1.' The second group contained communities without an OMNR presence (Dubreuilville, Hornepayne, Marathon, and White River) and was coded as '-1.' In all cases, missing responses were coded as

'99.' and individuals who selected no opinion or missing responses were excluded from analyses.

4.2.3.7 Variables Summary

Table 4.2 summarizes the information presented in sections 4.2.2.1 through 4.2.3.6, and identifies a shortened label for each variable.

4.3 Specific Analytical Techniques

The analytical techniques employed were chosen based on two criteria. First, the selected methods had to be appropriate under an information theoretic approach. Second, each method had to be appropriate for the dependent variable in question (i.e., satisfaction and management tool preferences). This led to different analytical techniques being employed for the two analyses.

This section begins with a description of the technique shared between the two analyses: Akaike's Information Criterion, which provides a practical way of applying the information theoretic concepts. It proceeds to describe the different methods applied for each analysis: principal component analysis and ordinary least squares regression for the management tool preferences analysis, and Tobit model analysis for the satisfaction analysis. The section builds on the earlier information theoretic discussion, describing how those conceptual ideas can be practically applied in model evaluation.

4.3.1 Akaike's Information Criterion

4.3.1.1 Model Selection Criteria

Akaike's Information Criterion (AIC) is a frequently used model selection criterion in information theoretic approaches. Akaike (1973) found a formal relationship between Kullback-Leibler information and maximum likelihood, both dominant paradigms in their fields (information and coding theory, and statistics) (Anderson et al., 2000). He identified a simple relationship between *I(f,g),* the information lost over model g, and the log-likelihood function (Anderson et al., 2001). This relationship allows an estimator of the expected, relative Kullback-Leibler information to be derived based on the maximized log-likelihood function, making it possible to combine estimation and model selection under a single theoretical framework. This

Table 4.2
Dependent and Explanatory Variables: Descriptions and Coding.

Variable	Label	Description	Coding
Satisfaction	Satis	Respondents rated their satisfaction with current forestry road management on a 5-level Likert item ranging from 'very dissatisfied' to 'very satisfied'	Very dissatisfied = -2 Dissatisfied = -1 Neutral = 0 Satisfied = 1 Very satisfied = 2
Management tool desirability	Physical decommissioning = Phys_dec Bridge removal = Brid_rem Culvert removal = Culv_rem Seasonal signage = Signs_seas Area Signs = Signs_area Seasonal and area signs = Signs_all Road use permits = Use_permits Gates = Gates Winter roads = Win_roads Natural abandonment = Nat_aban	Respondents rated the desirability of 11 management tools on a 5-level Likert item ranging from 'very undesirable' to 'very desirable.'	Very undesirable = -2 Undesirable = -1 Neutral = 0 Desirable = 1 Very desirable = 2
Age	Age	Respondents were divided into three groups: 39 years or less, 40-54 years, and 55 or older	39 years or less = -1 40-54 years = 0 55 years or older = 1
Community of residence – size	Comm_size	Communities were divided into large (Wawa, Marathon), medium (Manitouwadge), and small (Dubreuilville, Hornepayne, White River) based on Statistics Canada data.	*Large communities:* Marathon, Wawa = 1 All others = 0 *Medium communities:* Manitouwadge = 1 All others = 0

Table 4.2 cont'd

Variable	Label	Description	Coding
Community of residence – nearby access restrictions	Comm_rest	Communities were divided according to the degree of access restrictions near the community.	Dubreuilville, Hornepayne = 1 All others = -1
Community of residence – OMNR presence	Comm_OMNR	Communities were divided based on whether or not there was an OMNR office in the community.	OMNR office present = 1 OMNR office not present = -1
Familiarity	Famil	Respondents rated their familiarity with each region of Wawa District on a 3-level scale ranging from 'unfamiliar' to 'very familiar.' The familiarity score for each individual was for the area in which he/she lived.	Unfamiliar = -1 Somewhat familiar = 0 Very familiar = 1
Frequency of use	Freq_use	Respondents estimated their average number of weekly trips in each season. The four values were averaged, and this value was used as the frequency of use variable.	None = 0 Less than one = 0.5 One to two = 1.5 Three to five = 4 More than five = 6.5
Environmental beliefs	Env_beliefs	Environmental beliefs were calculated using the 15 item *New Ecological Paradigm Scale*. Each Likert item ranged from "strongly disagree' to 'strongly agree.' Responses were summed and averaged to obtain a respondent's score.	Strongly disagree = -2 Disagree = -1 Neutral = 0 Agree = 1 Strongly agree = 2 No opinion = 6
Recreational activities pursued	Consumptive recreaction = Cons_rec Non-consumptive recreation = Noncon_rec Motorized land-based recreation = Mot_rec	Respondents indicated whether they participated in a number of recreational activities. The variables extracted from these responses were consumptive recreation, non-consumptive recreation, and motorized land-based recreation	Pursue consumptive recreation: Yes = 1, No = -1 Pursue non-consumptive recreation: Yes = 1, No = -1 Pursue motorized land-based recreation: Yes = 1, No = -1

* 'No opinion' was coded as '6,' and missing responses were coded as '99' in all cases.

led to his AIC estimator (Anderson et al., 2000, 2001). When the number of parameters is large relative to the sample size, a modified criterion (AICc) can be used (Anderson et al., 2000). In this study, the sample size is sufficiently large to use standard AIC values.

For model i, AIC is given by

$$AIC_i = -2 \log_e (l(\theta_{max} | \text{data})) + 2K$$

where $\log_e (l(\theta_{max} | \text{data}))$ is the value of the log-likelihood (i.e., the natural logarithm of the likelihood of the data set) maximized relative to the set of parameters, θ, in model i, given the data, and K is the number of parameters in the model (Anderson et al., 2000, 2001).

Assuming that a set of well-supported *a priori* candidate models (hypotheses) has been defined (discussed further below), AIC is calculated for each of the models in the set (Anderson et al., 2000; Anderson et al., 2001). The model with the lowest AIC value is considered the best model for the data (Anderson et al., 2000). The AIC approach is one of a best inference, given the data and the set of candidate models, and further developments provide a strength of evidence for each model (Anderson et al., 2000).

4.3.1.2 Analysis

ΔAIC Values

AIC values are not interpretable in their initial form as they contain arbitrary constants and are affected by sample size. To best interpret the data, researchers rescale the AIC for each model to (Anderson et al., 2000, 2001; Burnham and Anderson, 2004):

$$\Delta_i = AIC_i - \min(AIC)$$

where min(AIC) represents the smallest of the AIC values calculated for the candidate models. Once the AIC values have been rescaled, the strongest model in the candidate set will have $\Delta_i=0$, and the remaining models will have positive Δ_i values. The arbitrary constant is eliminated from these transformed values. Δ_i is defined as the information loss experienced if using fitted model g rather than the strongest model in the set, g_{min}, for inference. Rescaling the initial AIC values allows meaningful interpretation without the issues of unknown scaling constants and sample size arising (Burnham & Anderson, 2004).

The Δ_i are simple to interpret and allow a quick strength of evidence comparison and ranking of models. As Δ_i increases, so too does the information lost, and the less plausible is the

fitted model as being the best approximating model in the set (Anderson et al., 2000, 2001; Burnham & Anderson, 2004). Some simple guidelines have been developed to help assess the relative merits of the models considered: Models having $\Delta_i \leq 2$ have substantial support (evidence), models with $4 \leq \Delta_i \leq 7$ have considerably less support, and models having $\Delta_i > 10$ have essentially no support. Although such differences may seem minimal when the AIC values themselves are large, the Δ_i values are free of large scaling constants, and are therefore, the appropriate values from which to interpret strength of evidence (Anderson et al., 2001; Burnham & Anderson).

Likelihood of a Model given the Data

The quantification of information loss, Δ_i, allows the computation of the likelihood of model g_i given the data (Lukacs et al., 2007)

$$L(\theta \mid data, g_i) = \exp(-\Delta_i / 2), \quad i = 1, \ldots, R$$

where R is the number of models in the candidate set. This expression is a likelihood function over the model set in the sense that $L(\theta|data,g_i)$ is the likelihood over the parameter space (for model g_i) of the parameter θ, given the data (x) and the model (g_i) (Anderson et al., 2000; Burnham & Anderson, 2004). These values are useful in relative comparison of the hypotheses (Anderson et al., 2001).

Once model likelihoods have been defined, researchers can use an *evidence ratio* to compare the relative likelihood of two models, *i* and *j* (Burnham & Anderson, 2004; Lukacs et al., 2007). This is expressed as $L(g_i|data)/L(g_j|data)$. This ratio depends only on the two models being considered; the remaining models in the candidate set do not affect this calculation. If the evidence ratio is large, we can assume the model g_j is a poor model compared to model g_i, based on the data (Burnham & Anderson, 2004).

In this context, likelihood has a technical, quantifiable meaning, and should not be confused with probability. For example, if person A holds three lottery tickets and person B holds one, person A is three times more *likely* to win than person B. Thus, we can quantify the likelihood without knowing the absolute probability of either person winning, for which we would need to know the total number of tickets (Burnham & Anderson, 2000).

Akaike Weights, w_i

It is helpful to normalize the model likelihoods such that they sum to one and to treat them as probabilities (Anderson et al., 2000; Burnham & Anderson, 2004; Lukacs et al., 2007):

$$w_i = \frac{\exp(-\Delta_i / 2)}{\sum_{r=1}^{R} \exp(-\Delta_i / 2)}$$

The model probabilities, w_i, also called the "Akaike weights," are informative as the "weight of evidence" in favour of model *i* as being the actual Kullback-Leibler best model in the candidate set, given the data (Anderson et al., 2001; Anderson et al., 2000; Burnham & Anderson, 2004). Unlike a P-value, which is the probability of the data given the null hypothesis, Akaike weights are the probability of model *i* given the data (Lukacs et al., 2007). The ratios w_i / w_j are equal to the original likelihood ratios, and therefore, they are invariant to the model set, but the w_i values depend on the entire candidate model set because they sum to one. The w_i can be interpreted as the probability that a model is, in fact, the best model for the data (Anderson et al., 2000; Burnham & Anderson).

4.3.2 Principal Component Analysis

Principal component analysis was used to transform the management tool evaluations, Likert data into a smaller number of new, more meaningful variables. These variables were used as the dependent variables in subsequent analyses.

Principal component analysis (PCA) is a variable reduction procedure (SAS Institute, 2010) with the goals of discovering or reducing the dimensionality of a dataset, and identifying new meaningful underlying variables that will account for most of the variance in the observed variables (Cattell, 1966; Kaiser, 1991). It is appropriate when data has been obtained on a number of variables that may be correlated with one another (i.e., there may be some redundancy in the variables) (SAS Institute).

The first component extracted accounts for a maximal amount of total variance in the observed variables, meaning that it will be correlated with at least some of the observed variables, and may be correlated with many variables. When a variable (such as a questionnaire item) is given a great deal of weight in constructing a principal component, that variable is said

to *load* heavily on that component. (SAS Institute, 2010). The second component accounts for a maximal amount of variance in the data set that was not accounted for by the first component, and is uncorrelated with the first. The remaining components extracted follow the same pattern. Each accounts for the maximal amount of variance in the data that was not accounted for by the preceding components, and is linearly unrelated with all of the preceding components. Technically, the number of components extracted is equal to the number of variables being analyzed. However, given that the variance accounted for decreases with every component, typically, only the first few components extracted account for meaningful amounts of variance, and only these are retained, interpreted, and used in subsequent analyses (SAS Institute, 2010). Eigenvalues greater than one (Kaiser, 1991) and scree plots (Cattell, 1966) were used to determine an appropriate number of components. It is usual to rotate the components to increase their tendency to load with different variables (Kaiser, 1991). Therefore, I conducted a Varimax rotation after selecting the number of components. Labels for the components reflected the variables loading on each component. For example, all of the physical decommissioning tools loaded heavily on one component, with no other items, and thus, that component was labelled "physical decommissioning." Finally, scores were estimated by the regression method for each rotated component and saved for use as dependent variables in subsequent analyses.

4.3.3 Regression Analysis

Regression analysis was used in the management tool preference analysis following the PCA, with the components emerging from the PCA serving as the explanatory variables in the regression analysis. Regression analysis is appropriate in this situation given two properties of the new variables: their interval-level scaling and their unlimited scale (ranging from + to – infinity).

Linear regression involves estimating the linear relationships between a set of independent variables (**X**) and a dependent variable of interest (Y). Simple linear regression predicts the value of a dependent variable based on one independent variable, while multiple linear regression uses two or more independent variables to predict the value of a dependent variable. This study uses ordinary least squares (OLS) regression, which is the most common type of linear regression. OLS regression calculates the values of the constant, c ("intercept"), and the regression coefficients, b ("slope"), that minimize the sum of the squared residual values for a set of observations (Garson, 2009).

Parameters are estimated for each of the independent variables that relate the dependent and independent variables (e.g., elevation in m and average temperature in C). The size of each parameter estimate provides a measure of effect. It represents the amount the dependent variable changes when the corresponding independent variable changes by one unit. The sign of the parameter estimate indicates the direction of the effect. For example, a negative estimate would indicate that temperature decreases with increasing elevation (Garson, 2009).

Researchers are often interested in comparing the relative sizes of the parameter coefficients. However, this direct comparison of coefficients is generally not possible, as they are often measured on different scales. In such cases, we cannot compare the size of the various coefficients, and thus, cannot identify which independent variable has the greatest effect (Saint-Germain, 1998).

The fit of the model is communicated through an R^2. This R^2 can be interpreted as the amount of variation in the dependent variable explained by the independent variables. For example, an R^2 value of 0.60 indicates that the independent variables explain 60 per cent of the variation in a dependent variable. Thus, higher values are taken to indicate better models. An adjusted R^2 penalizes the R^2 calculation when more independent variables are used. However, R^2 values should not be used as the main criterion for assessing whether a fit is reasonable. While a high R^2 indicates that a regression line came very close to observations, it does not indicate whether the fit is "good" in other ways. For example, the parameter coefficients may be illogical even if an R^2 value is high (Garson, 2009).

The results also present the log likelihood function, used in the information theoretic approach and discussed in section 4.3.1. In linear regression, parameters are estimated by maximizing the log likelihood function (i.e., choosing the parameter value that makes the data actually observed as likely as possible) (Rodriguez, 2009).

Multicollinearity is a problem that occurs when two or more of the independent variables are highly correlated to one another (i.e., they basically measure the same phenomenon). In such cases, models containing both variables will run into problems, because either variable would be nearly as effective on its own. If multicollinearity is discovered, the researcher may drop one of the two variables that are highly correlated, or simply leave both variables in the equation and note that multicollinearity is present (Saint-Germain, 1998).

4.3.4 Tobit Model Analysis

A Tobit model analysis approach was used for the satisfaction analysis. Tobit models are econometric models suited to studies where the dependent variable is only partially observed. This approach allows researchers to censor a dependent variable accordingly (Smith & Brame, 2003). In a censored model, some sample values are reported at a limit value instead of at actual values. For example, if a minimum value of 10 is set and all values below 10 are reported at the limit value of 10, the model is censored. Tobit models can set upper limits, lower limits, or both upper and lower limits (Amemiya, 1985).

As in linear regression, Tobit models can be estimated with maximum likelihood estimation. The Tobit estimator provides consistent estimates of parameters governing the distribution of a censored dependent variable (Smith & Brame, 2003). Again, each parameter estimate represents the amount the dependent variable changes when the corresponding independent variable changes by one unit, and the sign of the parameter estimate indicates the direction of the effect.

No simple approach to model fit is available for Tobit analyses. Instead, researchers report summary statistics that are not interpretable as per cent of variation explained. One such statistic is McFadden's rho-squared statistic, a transformation of the log-likelihood statistic intended to mimic the R^2 metric of linear regression. The adjusted McFadden's rho-squared statistic penalizes a model for including too many predictors (UCLAb, n.d.). McFadden's rho-squared values tend to be lower than their OLS equivalents, and rho-squared values between 0.20 and 0.40 should be considered very satisfactory (Hensher & Johnson, 1981).

4.4 Analysis Procedure

4.4.1 Overview

This section outlines the steps conducted in the data analyses; specifically how and where the analytical techniques described in section 4.3 were applied in this study. It first describes the processes used to develop the hypotheses and the models tested in this study. From there, the analyses divides into two streams: the satisfaction analysis and the management tool evaluations analysis. Although there were some differences in how these analyses were conducted, they are described together with any deviations noted.

Several computer software programs were employed for the data entry and coding, and the analysis. These included SPSS, LimDep, and Microsoft Excel.

4.4.2 Hypotheses Development

A set of *a priori* hypotheses was developed before beginning the analysis, which comprised a set of explanatory variables that could potentially influence individuals' management preferences, road access preferences, and/or satisfaction with an experience, or recreation conflict. These variables are based on the analysis of the literature described in Chapter 2. In brief, the variables selected were age, community of residence (based on size, nearby restrictions, and OMNR presence), frequency of use of forestry roads for recreation, familiarity with one's surrounding area, environmental beliefs, and participation in consumptive recreation, non-consumptive recreation, and motorized land-based recreation.

4.4.3 Model Development

Once the hypotheses were developed, a set of candidate models was created using the explanatory variables defined in the hypotheses. An initial set of candidate models was developed by identifying all possible combinations of the explanatory variables, resulting in a potential of 512 models. Hence, the model development process focused on reducing the number of models to a manageable number, in a logical fashion that did not eliminate any potentially strong models. This involved a number of steps.

The first step was deciding how to approach the 'community' variable. Because this variable was coded in three different ways, to include it in the initial model set increased the number of potential models by a factor of four (i.e., models g, $g + c1$, $g + c2$, $g + c3$). Thus, it was decided to first create a set of candidate models with the community variable removed. This reduced the initial set of candidate models to 128.

The second step involved reducing the set of 128 models to avoid models with potentially high multicollinearity. It was reasonable to expect that some variables were highly correlated. For example, the 'consumptive recreation' variable and the 'motorized recreation' variable were likely correlated, given their similar focus, and the fact that 'motorized recreation' was one of the variables used to develop the 'consumptive recreation' variable.

Based on this expectation, the correlation coefficients between all the explanatory variables were calculated (Table 4.3), and any models containing a pair (or pairs) of highly

correlated variables were eliminated (significant at alpha = 0.01). This minimized the potential for multicollinearity problems in the subsequent analysis, and reduced the candidate model set to 20 models.

Table 4.3

Pearson Correlation Coefficients between Explanatory Variables.

		Cons_rec	Noncon_rec	Mot_rec	Env_beliefs	Age	Freq_use
Noncon_rec	Pearson Cor.	0.151*	1				
Mot_rec	Pearson Cor.	0.417**	0.141*	1			
Env_beliefs	Pearson Cor.	-0.124*	0.048	-0.121	1		
Age	Pearson Cor.	-0.251**	-0.242**	-0.260**	0.077	1	
Freq_use	Pearson Cor.	0.276**	0.144*	0.351**	-0.186**	-0.184**	1
Famil	Pearson Cor.	0.291**	0.066	0.247**	-0.166**	-0.096	0.305**

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Given that including the community variable would increase the candidate model set from 20 to 80, this community variable was introduced at a later step in the analysis process. While this is further explained in section 4.4.4, in brief, I identified the strongest models without the community variable in the first steps of the analysis, and then calculated only these models with the community variable included. This allowed for assessing only the stronger models with the community variable included, rather than adding the community variable into models containing weak combinations of the other explanatory variables.

In summary, the models were created by selecting well-supported variables through a comprehensive literature review, identifying all possible combinations of these variables (minus the community variable), and then reducing the chance of multicollinearity by eliminating any models containing pairs of highly correlated variables. Finally, the community variable, in its three different forms, was added into the strongest models.

4.4.4 Satisfaction and Management Tool Analyses

Once the candidate model set was created, I split the analyses into two parts. Part I examined residents' satisfaction with current forestry road management, and Part II analyzed respondents' desirability ratings for eleven different road access management tools. Using the models defined in the candidate set, the analyses examined whether age, frequency of use of forestry roads for recreation, familiarity with one's own area, participation in consumptive recreation, participation in non-consumptive recreation, participation in motorized land-based recreation, environmental beliefs, or community of residence influenced an individual's satisfaction or management tool desirability ratings. Strength of evidence statistics were provided for each model, allowing a determination of which variables, independently or in combination, were the most strongly related to satisfaction levels and desirability ratings.

Before the following steps were undertaken, the management tool data were reduced using a Principal Component Analysis. The components that emerged were used as the dependent variables in the remainder of the analysis, described below.

These analyses involved the following steps:

1. First, I ran Tobit and regression analyses for all models in the candidate set without the community variable included.
2. Second, using the results from the Tobit and regression analyses, I calculated AIC values, Δ_i values, and Akaike weights, or model probabilities (w_i). I then ranked the models by their Δ_i values and selected the strongest models according to their w_i values. A probability of 0.05 was selected as a threshold to distinguish the strongest models from those with less supporting evidence. Any models which were dominated by another model were eliminated from the set of strongest models. For example, if a model containing the 'age' variable had stronger evidence than a model containing both 'age' and 'environmental philosophy' variables, the first model was dominant. These evaluations provided a set of strongest models for predicting satisfaction minus the community variable.
3. Third, I ran a parallel analysis for three models containing only the community variable, in its three coding alternatives: community size, nearby restrictions, and OMNR presence, and a model without any explanatory variables. This last model was included to

assess whether there was evidence supporting the inclusion of any community variable. These models were evaluated in the same fashion as those in step two. Models with a probability of 0.05 or higher were identified as the strongest models and carried through in the analysis.

4. Fourth, I created a final candidate model set based on the results of steps two and three. This model set included the strongest models from step two (e.g., model *g*), those same models with each of the three community variables added in (i.e., *g+community size, g+community restrictions, g+OMNR presence*), and the strongest models identified in step three.
5. Fifth, I conducted Tobit model and regression analyses for the candidate models defined in step four. These models were evaluated in the same manner as those in the earlier steps. They were ranked according to their Δ_i values, and selected according to the strength of evidence provided by the probabilities. Those with a probability of 0.05 or higher were identified as the strongest models, and any which were dominated by a stronger model were eliminated. This provided a final set of strongest models, based on information theoretic strength of evidence values, for predicting satisfaction with current forestry road management and desirability ratings for management tools.
6. Lastly, I presented the parameter estimates and standard errors for the identified strongest models, allowing a more in-depth understanding of how each variable is correlated with individuals' satisfaction with current forestry road management. The parameter estimates provided information about the effect sizes, or the strength of the relationship between the explanatory and dependent variables. A negative coefficient indicates an inverse relationship (i.e., the dependent decreases when the independent increases, and vice versa) (Garson, 2009).

Chapter 5: Results

The results of the analyses are divided into four sections. First, the survey responses for the independent and dependent variables are presented. This is followed by descriptive statistics calculated for these variables. The final two sections present the results of the two information theoretic analyses: section three presents the satisfaction analysis, and section four presents the management tool preferences analysis.

5.1 Raw Data

5.1.1 Explanatory Variables

5.1.1.1 Age

As shown in table 5.1, the largest group of respondents were between 40 and 54 years of age. Nearly as many were aged 55 years or older. Combined, roughly 80 per cent of respondents were 40 years old or older. Individuals under the age of 40 accounted for only one-fifth of the total. In 2001, approximately 40 per cent of northern Ontario residents were over the age of 45 (Northern Ontario Local Training and Adjustment Boards, 2002). Thus, even though northern Ontario's population is aging, these results suggest that older residents are more strongly represented in these findings than younger individuals.

Table 5.1

Age Distribution (%) of Respondents

Age (n=298)	Percentage of Respondents
39 years or younger	20.1%
40-54 years	40.8%
55 years or older	39.1%

5.1.1.2 Community of Residence

About one-third of respondents lived in Wawa (Table 5.2). Manitouwadge (22.2%), Hornepayne (16.1%), and Marathon (12.9%) were also well represented by the respondents. Dubreuilville (7.9%) and White River (5.7%) made up the smallest percentages of the respondents. This distribution suggests that Marathon was slightly underrepresented, as it had the largest populations of all the communities. The remaining proportions reflected their population sizes (Statistics Canada, 2006).

Table 5.2

Percentage of Respondents from Different Communities in Wawa District

Place of residence (n=292)	Percentage of Respondents
Wawa	35.1
Manitouwadge	22.2
Hornepayne	16.1
Marathon	12.9
Dubreuilville	7.9
White River	5.7

Table 5.3 displays the distribution of respondents between communities as per the hypotheses: community size, access restrictions around the community, and OMNR presence within a community. Just under half of the respondents lived in large-sized communities, while the rest were about evenly split between small and medium-sized communities. One quarter of respondents lived in the communities identified as having the greatest amount of access restrictions around the community (i.e., Dubreuilville and Hornepayne), and over half of the respondents lived in a community with an OMNR presence (i.e., Wawa or Manitouwadge).

Table 5.3

Respondents' Distribution Based on Community Size, Degree of Nearby Access Restrictions, and whether there is an OMNR Presence in the Community

	Community Size		Community Road Access Restrictions		OMNR Presence	
Percentage of respondents	Small (under 1500 residents)	29.7%	Many	24%	Yes	57.3%
	Medium (1500-3000 residents)	22.2%	Fewer	75.9%	No	42.6%
	Large (over 3000 residents)	48%				

5.1.1.3 Recreational Activities

Over 80 per cent of respondents used forestry roads for recreation (Fig. 5.1). The most commonly pursued activities were fishing and ice fishing, gathering resources for personal use

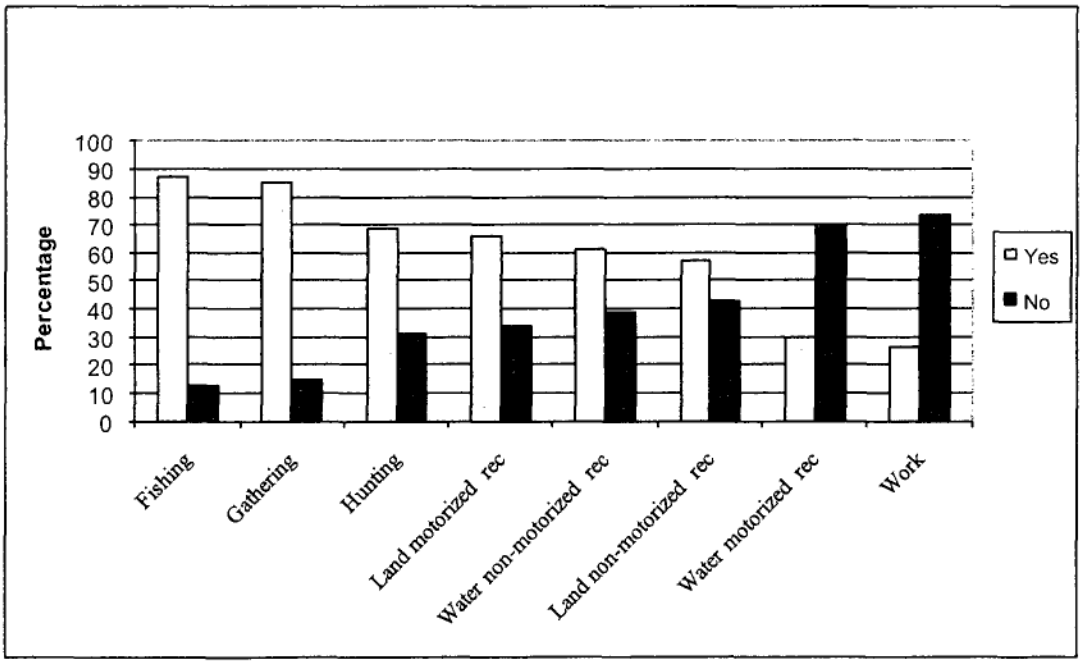

Figure 5.1. Activities pursued by Wawa District residents on forestry roads.

(e.g., berries, firewood), and hunting and trapping. A majority of residents also pursued land-based motorized recreation and land and water-based non-motorized recreation from roads. Both water-based motorized recreation (e.g., motor boating) and work-related activities (e.g., trapping) were pursued by over one-quarter of respondents.

In Table 5.4, these results are presented in terms of participation in consumptive recreation, non-consumptive recreation, and motorized land-based recreation. Although participation was slightly higher in consumptive than non-consumptive recreation, participation rates were over 70 per cent for both activities. Almost two-thirds of respondents participated in motorized land-based recreation.

Table 5.4

Respondents' Participation Rates in Recreational Activities

	Participate	Do Not Participate
Consumptive Recreation	78.5%	21.5%
Non-consumptive recreation	72.2%	27.8%
Motorized Land-Based Recreation	66.3%	33.7%

5.1.1.4 Frequency of Use

More respondents used forestry roads fewer than one to two times per week than any other frequency during the winter, spring, and summer (Fig. 5.2). Use was greatest in the fall, when three to five times per week use was cited most by respondents. While winter use was lowest, less than 20 per cent of respondents stated that they never used forestry roads during the winter. The lower winter use could be due not only to reduced activity levels during the winter, but also to other factors such as a lack of road maintenance (e.g., ploughing) rendering roads inaccessible.

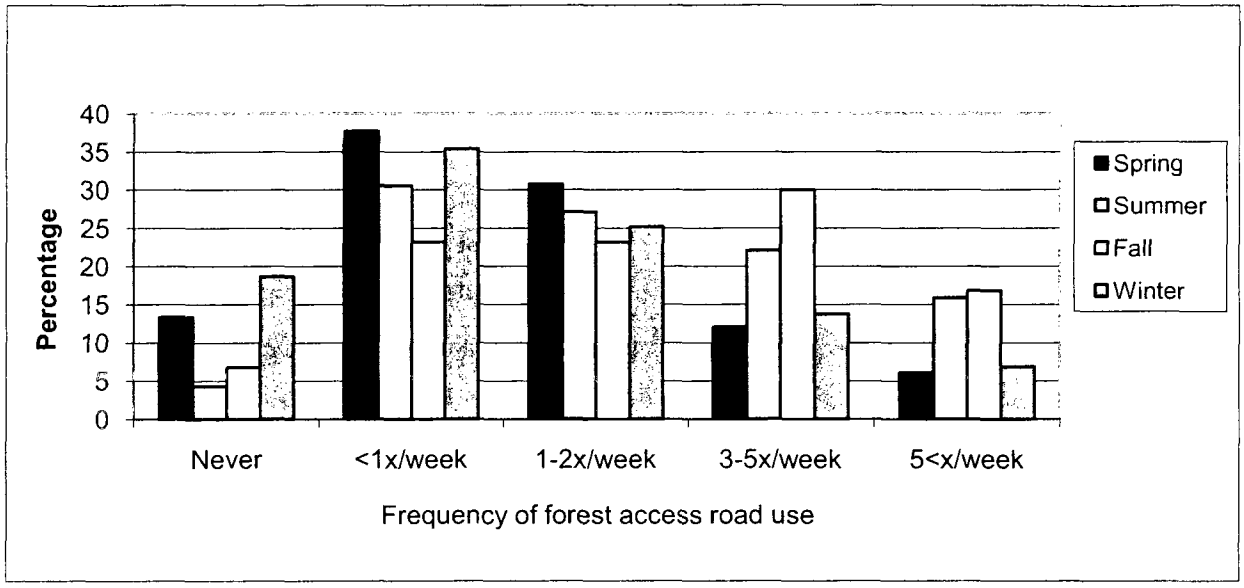

Figure 5.2. Seasonal use of forestry roads by Wawa District residents.

5.1.1.5 Environmental Beliefs

The New Ecological Paradigm scale (Dunlap et al., 2000) was used to gauge the environmental beliefs of the respondents. Table 5.5 presents the frequency distributions for each item, and Table 5.6 presents the mean and standard deviation values for each of the items in the scale. For all but two statements the means indicated a biocentric tendency. The two means indicating an anthropocentric tendency both related to human ingenuity and the ability to use this ingenuity to overcome resource scarcity and environmental problems. This suggests a belief among some Wawa District residents that, given human's ingenuity, resource scarcity is not a significant environmental concern that needs to be addressed.

5.1.1.6 Familiarity

Respondents were asked how familiar they were with different areas that were shown on a map of Wawa District. Many respondents indicated that they were at least somewhat familiar with multiple areas, with greater awareness of areas near their community of residence (Fig. 5.3). The White River Forest (71.8%) and the Algoma Forest (63%) were most familiar to respondents (somewhat or very familiar). While their frequency of use in each specific area is unknown, it is likely that a greater familiarity with an area corresponds to more use within that area. Thus, it is

Table 5.5

Frequency Distributions for the New Ecological Paradigm Scale Likert items. Items measured on 5-level Likert items ranging from -2 (strongly disagree) to 2 (strongly agree) (missing values excluded).

Item	-2 (%)	-1 (%)	0 (%)	1 (%)	2 (%)
We are approaching the limit of the number of people the earth can support	19.8	14.6	19.8	23.1	22.8
Humans have the right to modify the natural environment to suit their needs	33.3	23.3	23.3	14.3	5.7
When humans interfere with nature it often produces disastrous consequences	7.8	13.1	16.3	26.6	36.2
Human ingenuity will ensure that we do not make the earth unliveable	18.0	19.8	21.6	24.8	15.8
Humans are severely abusing the environment	7.1	13.8	16.3	27.0	35.8
The earth has plenty of natural resources if we just learn how to develop them	5.7	13.9	15.4	31.1	33.9
Plants and animals have as much right as humans to exist	4.2	4.2	10.6	21.9	59.0
The balance of nature is strong enough to cope with the impacts of modern industrial nations	35.5	32.6	14.9	13.8	3.2
Despite our special abilities humans are still subject to the laws of nature	3.2	1.4	7.9	33.1	54.3
The so-called "ecological crisis" facing humans has been greatly exaggerated	31.5	23.8	21.2	16.5	7.0
The earth is like a spaceship with very limited room and resources	12.8	13.6	22.0	27.5	24.2
Humans were meant to rule over the rest of nature	40.6	21.9	21.6	8.3	7.6
The balance of nature is very delicate and easily upset	3.2	13.3	14.4	27.4	41.8
Humans will eventually learn enough about how nature works to be able to control it	24.4	27.8	24.1	15.6	8.1
If things continue on their present course, we will soon experience a major ecological catastrophe	7.6	12.2	21.2	28.4	30.6

Table 5.6

Mean Responses to the New Ecological Paradigm Scale Likert items. Items measured on 5-level Likert items ranging from -2 (strongly disagree) to 2 (strongly agree), and alternate items flipped such that -2 represents anthropocentrism, and 2 represents biocentrism in all cases.

Item	Mean	Standard Deviation
We are approaching the limit of the number of people the earth can support.	0.15	1.44
Humans have the right to modify the natural environment to suit their needs.	0.64	1.24
When humans interfere with nature it often produces disastrous consequences.	0.70	1.29
Human ingenuity will ensure that we do NOT make the earth unliveable.	-0.01	1.34
Humans are severely abusing the environment.	0.71	1.28
The earth has plenty of natural resources if we just learn how to develop them.	-0.74	1.22
Plants and animals have as much right as humans to exist.	1.27	1.09
The balance of nature is strong enough to cope with the impacts of modern industrial nations.	0.83	1.15
Despite our special abilities humans are still subject to the laws of nature.	1.34	0.93
The so-called "ecological crisis" facing humankind has been greatly exaggerated.	0.56	1.28
The earth is like a spaceship with very limited room and resources.	0.37	1.33
Humans were meant to rule over the rest of nature.	0.80	1.26
The balance of nature is very delicate and easily upset.	0.91	1.17
Humans will eventually learn enough about how nature works to be able to control it.	0.45	1.24
If things continue on their present course, we will soon experience a major ecological catastrophe.	0.62	1.24

probable that these two areas had the greatest recreational use by residents. Respondents were least familiar with the Nagagami and Big Pic Forests, and thus, Wawa area recreationists might use these areas the least. However, the reasons underlying these lesser use levels were not analyzed. It is plausible that use is lower in these regions given factors such as distance from communities and minimal access, but if these factors change (e.g., development of new access roads), use and familiarity may increase accordingly.

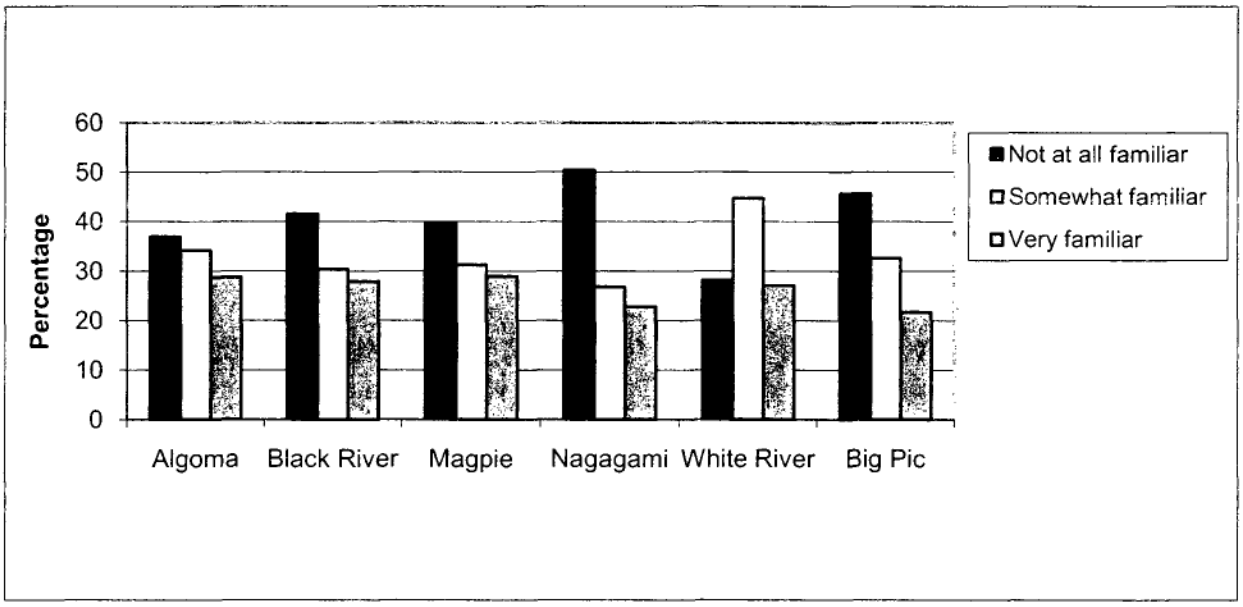

Figure 5.3. Familiarity of Wawa District residents with regions of Wawa District.

Figure 5.4 shows how familiar respondents were with their surrounding area as identified from reported community of residence. Over 50 per cent of respondents were very familiar with their surrounding area while one third were somewhat familiar and less than 10 per cent were not at all familiar.

5.1.2 Dependent Variables

5.1.2.1 Satisfaction

Few respondents indicated satisfaction with the current management of forestry roads in the Wawa area (Fig. 5.5). In fact, 48 per cent of respondents expressed dissatisfaction, and 25 per cent expressed satisfaction. The remaining 27 per cent were neutral.

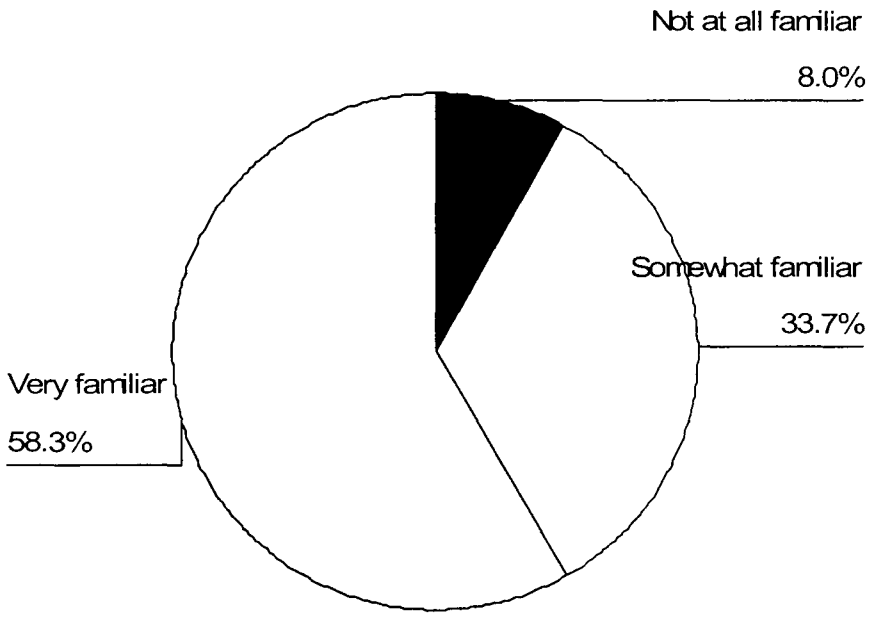

Figure 5.4. Wawa District residents' familiarity with their surrounding area.

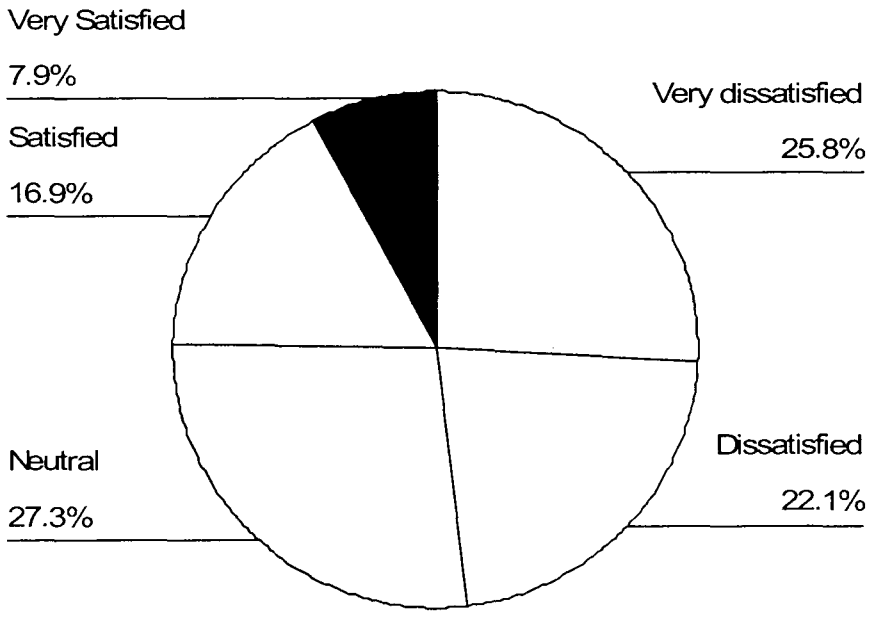

Figure 5.5. Wawa District residents' satisfaction with current forestry road management.

5.1.2.2 Management Tool Preferences

Local residents rated the desirability of 11 different tools and controls for managing road access on a scale from very desirable (+2) to very undesirable (-2). On average, local residents rated only natural abandonment as desirable, with a mean of 0.24, and winter roads as neutral, with a mean of 0.07 (Fig. 5.6). However, over one quarter of respondents rated these tools as undesirable, suggesting that disagreement existed among residents with using these tools.

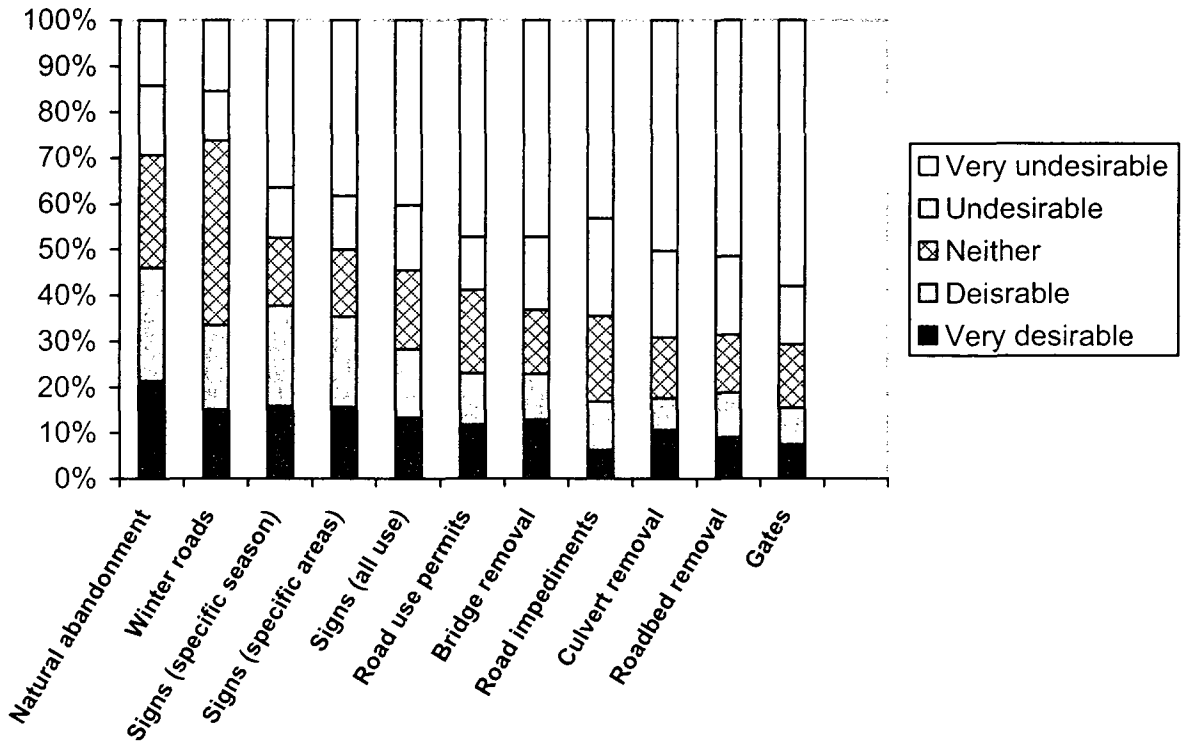

Figure 5.6. Wawa District residents' evaluations of road access tools and controls.

Respondents rated the remaining tools and controls at varying levels of undesirability. Signs were rated next as most desirable, albeit with an average rating of somewhat undesirable (means from -0.30 to -0.53). Signs that restricted either specific areas (e.g., lakes) or areas for specific seasons were more desirable than were signs that restricted all road use, which were rated as undesirable or very undesirable by a majority of respondents. Physical decommissioning tools were less desirable than were signs although they were more desirable than gates. Desirability ratings for bridge and culvert removal, placing road impediments on roads, and

removing the roadbed were rated about as equally undesirable (means ranging from -0.75 to -0.92). Finally, gates were most undesirable (mean of -1.06) with almost 70 per cent of respondents rating them as undesirable or very undesirable.

5.1.2.3 Principal Component Analysis

A principal component analysis (PCA) was conducted to reduce the initial eleven management tools. Before conducting this analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was calculated to confirm that PCA was appropriate. Kaiser (1974) explained that values in the 0.90s were 'marvellous,' in the 0.80s 'meritorious,' in the 0.70s 'middling,' in the 0.60s 'mediocre,' in the 0.50s 'miserable,' and below 0.5 'unacceptable.' The KMO value was 0.853, indicating that the data set contains sufficient correlation coefficients to justify using a PCA approach.

The number of components extracted was determined by selecting those with eigenvalues greater than one. Three components with sufficiently high eigenvalues emerged from the analysis and these components accounted for 72.7 per cent of the total variance in management tool preferences (Table 5.7).

Table 5.7

Total Variance Explained of Management Tool Evaluations (Initial Eigenvalues)

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	5.192	47.196	47.20
2	1.669	15.173	62.37
3	1.133	10.296	72.67
4	0.813	7.392	80.06
5	0.575	5.230	85.29
6	0.475	4.321	89.61
7	0.409	3.716	93.32
8	0.258	2.349	95.67

Component	Initial Eigenvalues		
9	0.204	1.855	97.53
10	0.182	1.650	99.18
11	0.009	0.822	100.00

By identifying the items loading heavily on each component (i.e., the rotated component scores; Table 5.8), it was clear that there were logical divisions between the components. The first component represented "physical decommissioning tools" and it included bridge removal, culvert removal, roadbed removal, and road impediments. The second component was labelled "regulatory tools" because it included signage, road use permits, and gates. The third component represented "passive management approaches" and it included natural abandonment and winter roads. The component scores were saved for each of the three components using regression estimates, and these became the dependent variables for the subsequent regression analyses.

Table 5.8

Rotated Component Matrix for Management Tools and Controls Principal Component Analysis (Rotation Method: Varimax with Kaiser Normalization: Loadings less than 0.40 were surpressed)

	Component		
	Physical Decommissioning	Regulatory	Passive Management
Roadbed Removal	0.884		
Culvert Removal	0.874		
Bridge Removal	0.858		
Road Impediments	0.730		
Signs Restricting Specific Areas		0.886	
Signs Restricting Seasonal Use		0.860	
All Signs		0.854	

	Component		
	Physical Decommissioning	Regulatory	Passive Management
Gates	0.426	0.591	
Permits		0.530	
Natural Abandonment			0.807
Winter Roads			0.755

5.2 Descriptive Statistics

The following table summarizes the sample sizes, means, and standard deviations (where relevant) for all variables (dependent and independent) for the analyses of satisfaction and management tool preferences (Table 5.9). Given the relatively uninformative regression means and standard deviations for PCA extracted components (mean = 0.000, standard deviation = 1.000 in all cases), Table 5.9 instead presents the information for the variable loading most heavily on each component. For physical definition the values provided are the mean and standard deviation for roadbed removal. Signs restricting specific areas and natural abandonment are used to represent regulatory tools and passive management, respectively. This method provides a sense of the overall importance of each of the three broad categories to residents.

5.3 Satisfaction Analysis

5.3.1 Overview

A Tobit model analysis was run on the twenty initial models (excluding community) identified through the process described in Chapter 4. A parallel analysis was conducted for three models containing only the community variable and the null model (i.e., all other independent variables were excluded). Lastly, the models with the greatest evidence from both were combined in one analysis to identify the strongest models.

Table 5.9

Descriptive Statistics for all Independent and Explanatory Variables.

Label	Definition	Mean	Standard deviation	Sample Size
Age	Age (-1 to 1)	0.190	0.747	289
Comm_size	Community size (-1 to 1)	0.180	n/a	279
Comm_rest	Community – nearby restrictions (1=many, -1=less)	-0.520	n/a	279
Comm_OMNR	Community – OMNR presence (yes=1, no=-1)	0.147	n/a	279
Cons_rec	Consumptive recreation (yes=1, no=-1)	0.571	n/a	303
Noncon_rec	Non-consumptive recreation (yes=1, no=-1)	0.444	n/a	259
Mot_rec	Motorized land-based recreation (yes=1, no=-1)	0.326	n/a	258
Freq_use	Frequency of use (0 to 6.5)	2.07	1.65	261
Env_beliefs	Environmental beliefs (-2 to 2)	0.505	0.573	287
Famil	Familiarity with one's area (-1 to 1)	0.504	0.641	264
satis	Satisfaction (-2 to 2)	-0.412	1.255	267
Phys_decom	Physical decommissioning tools (-2 to 2)	-0.970	1.340	198
Reg_tools	Regulatory tools (-2 to 2)	-0.475	1.497	198
Pass_mgmt	Passive management approaches (-2 to 2)	0.231	1.328	198

5.3.2 Community Variable Excluded

Table 5.10 presents the number of variables (K), log likelihood (LL), AIC, ΔAIC, w_i, and McFadden's rho^2 values (ρ^2). The models were ranked according to increasing ΔAIC values, the models with model probabilities (w_i) of 0.05 or higher were identified as the strongest models, and the rest were eliminated. Any model that was dominated by a stronger model was removed (i.e., crossed out). For example, if a model containing the 'age' variable had stronger evidence than a model containing both 'age' and 'environmental philosophy' variables, the second model was eliminated, regardless of its probability. Only dominated models with a probability of 0.05 or higher were identified, as any others were already eliminated based on their probability.

Of the five models with a model probability (w_i) above 0.05, Models 6, 8, and 11 were dominated and were eliminated. This left Models 14 and 16 as the strongest models in the candidate set. This indicates that, of the variables considered, individuals' environmental beliefs and frequency of use of forestry roads were the most strongly linked to satisfaction.

Table 5.10

Satisfaction Results for Tobit Model Analysis for the Candidate Models without the Community Variable (variables included in the models are in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]ρ^2
Model 14 {Freq_use}	**2**	**-331.428**	**666.9**	**0.0**	**0.310**	0.005
~~**Model 8 {Noncon_rec, Freq_use}**~~	**3**	**-331.288**	**668.6**	**1.7**	**0.132**	0.002
Model 16 {Env_beliefs}	**2**	**-332.591**	**669.2**	**2.3**	**0.098**	0.001
~~**Model 6 {Mot_rec, Env_beliefs}**~~	**3**	**-331.784**	**669.6**	**2.7**	**0.080**	0.001
~~**Model 11 {Cons_rec, Env_beliefs}**~~	**3**	**-332.107**	**670.2**	**3.3**	**0.060**	0.000
Model 5 {Env_beliefs, Age}	3	-332.352	670.7	3.8	0.046	0.000
Model 9 {Noncon_rec, Env_beliefs}	3	-332.589	671.2	4.3	0.036	-0.001
Model 17 {Mot_rec}	2	-333.604	671.2	4.3	0.036	-0.002
Model 2 {Noncon_rec, Mot_rec, Env_beliefs}	4	-331.780	671.6	4.7	0.030	-0.002
Model 13 {Famil}	2	-333.828	671.7	4.8	0.028	-0.002

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5] ρ^2
Model 20 {None}	1	-335.018	672.0	5.1	0.024	-0.003
Model 3 {Con_rec, Noncon_rec, Env_beliefs}	4	-332.106	672.2	5.3	0.022	-0.003
Model 1 {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs}	8	-328.292	672.6	5.7	0.018	-0.004
Model 19 {Cons_rec}	2	-334.301	672.6	5.7	0.018	-0.004
Model 10 {Noncon_rec, Mot_rec}	3	-333.583	673.2	6.3	0.013	-0.005
Model 4 {Age, Famil}	3	-333.656	673.3	6.4	0.013	-0.005
Model 7 {Noncon_rec, Famil}	3	-333.824	673.7	6.8	0.010	-0.005
Model 15 {Age}	2	-334.894	673.8	6.9	0.010	-0.006
Model 18 {Noncon_rec}	2	-335.018	674.0	7.1	0.009	-0.006
Model 12 {Cons_rec, Noncon_rec}	3	-334.290	674.6	7.7	0.007	-0.007

[1]K = Number of parameters, [2]LL = Log Likelihood, [3]AIC = Akaike's Information Criterion, [4]w_i = Akaike Weight (model probability), [5] ρ^2 = Adjusted McFadden's rho-squared

The remaining statistics reinforce the conclusions drawn from the model probabilities. The two strongest models had ΔAIC values below two, indicating substantial support. The remaining models with model probabilities of 0.05 or higher all had ΔAIC values below four, the threshold indicating considerably less support than the strongest models. Although Model 5 also had a ΔAIC value below four, it was not considered one of the strongest models given its probability below 0.05. The remaining models all had ΔAIC values of 4 or higher, indicating considerably less support than the strongest models. However, none of these models provided a good fit. While a ρ^2 value above 0.2 is considered very satisfactory, Model 14, the strongest model, had the highest ρ^2 value of only 0.005.

One might anticipate that, because frequency of use and environmental philosophy were strong predictors independently of one another, they would be even stronger together. However, the initial correlation matrix showed that these two variables are highly correlated, and thus, they were not included together.

5.3.3 Community Variable

I now consider community, temporarily setting aside the frequency of use and environmental belief variables. Table 5.11 presents the results for the Tobit model analysis conducted for the three models containing the community variable that was coded in three ways: according to size, access restrictions, and presence of OMNR office. The null model was also included, to assess whether evidence existed to support including the community variable in predictive models.

Table 5.11

Satisfaction Results for Tobit Model Analysis for Models with only the Community Variable and the Null Model (type of community variable shown in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]ρ^2
Model 21 {Comm_size}	3	-326.650	659.3	0.0	0.982	0.016
Model 22 {Comm_rest}	2	-329.643	663.3	4.0	0.018	0.010
Model 23 {Comm_OMNR}	2	-331.994	668.0	8.7	0.000	0.003
Model 20 {None}	1	-335.018	672.0	12.7	0.000	-0.003

The notation is defined in Table 5.10.

The community size model (Model 21) had overwhelming support and no other model was retained. These conclusions are supported by the ΔAIC values, which indicate strong support for Model 21, considerably less support for Model 22, and less support for Model 23. The null model had the least support. These results suggest that of the three community characteristics considered, population size is most relevant to residents' satisfaction with forestry road management.

Although the McFadden's ρ^2 values supported the findings, they were low for all four models. Model 21, the strongest model, had a McFadden's ρ^2 value of only 0.016, well below the threshold to conclude that a model is satisfactory.

5.3.4 All Surviving Models

Table 5.12 presents the results for the Tobit model analysis conducted for the strongest models identified in the previous two steps, with the surviving variables being frequency of use, environmental philosophy, and community coded by size.

Table 5.12

Satisfaction Results for Tobit Model Analysis for Models Containing All Surviving Variables (variables included in the models are in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]ρ^2
Model 14a {Freq_use, Comm_size}	4	-325.278	658.6	0.0	0.387	0.017
Model 16a {Env_beliefs, Comm_size}	4	-325.468	658.9	0.3	0.333	0.017
Model 21 {Comm_size}	3	-326.650	659.3	0.7	0.272	0.016
Model 14 {Freq_use}	2	-331.428	666.9	8.3	0.006	0.005
Model 16 {Env_beliefs}	2	-332.591	669.2	10.6	0.002	0.001

The notation is defined in Table 5.10.

All three of the models with model probabilities above 0.05 included the community size variable. Their ΔAIC values indicated similar levels of support for each model. The ΔAIC values for the remaining two models indicated either considerably less support than the strongest models, or essentially no support at all.

The McFadden's ρ^2 values showed a steady decrease with increasing ΔAIC value. However, as with the previous calculations, none of the values were high enough to be considered satisfactory, with the values for the strongest models only being 0.017 and 0.016.

The presence of the size of community variable in the three top models indicated that community size was an important predictor of satisfaction with current access road management. The community size variable was strongest when combined with the other two variables identified earlier: frequency of use and environmental philosophy. This suggests that community size by itself matters, but the model was improved with the inclusion of the two additional variables.

5.3.5 Strongest Models

I turn now to the fitted parameters. Table 5.13 presents the parameter estimates and standard errors for the three identified strongest models.

Table 5.13

Parameter Estimates and Standard Errors (in Brackets) for the Identified Strongest Models in the Satisfaction Analysis (variables included in the models are in parentheses)

		Model 14a {Freq_use, Comm_size}	Model 16a {Env_beliefs, Comm_size}	Model 21 {Comm_size}
Constant		-0.176	-0.607	-0.434
		(0.223)	(0.197)	(0.162)
Sigma		1.724	1.725	1.736
		(0.118)	(0.118)	(0.119)
Env_beliefs		N/A	0.338	N/A
			(0.220)	
Freq_use		-0.139	N/A	N/A
		(0.084)		
Comm_size	Large	0.537	0.564	0.608
		(0.156)	(0.153)	(0.152)
	Medium	0.425	0.463	0.486
		(0.180)	(0.178)	(0.178)

In all models, the positive parameter estimates for the community size variables indicated that satisfaction was generally higher amongst residents of larger communities. The negative coefficients for the frequency of use variable indicated that satisfaction was negatively associated with frequency of use (i.e., satisfaction decreased as frequency of use of access roads increased). Lastly, the positive coefficients for environmental philosophy indicated that satisfaction was positively correlated with a biocentric orientation. In other words, satisfaction was higher amongst residents tending towards a biocentric than an anthropocentric orientation for environmental beliefs. These conclusions must be tempered by the low predictive value of any of these models, as reflected in the ρ^2 values.

5.4 Desirability of Access Management Tools and Controls

5.4.1 Physical Decommissioning

This analysis explored what variables were best able to predict individuals' desirability ratings for physical decommissioning tools. One component that emerged from the PCA reflected physical decommissioning tools (i.e., roadbed removal, bridge removal, culvert removal, and impediments). The PCA estimated scores for physical decommissioning for each respondent were regressed against the twenty initial models which did not include the community variable. A parallel analysis was conducted for the three models containing only the community variable and the null model. Lastly, the models with the greatest evidence from both analyses were combined to identify the overall strongest models.

5.4.1.1 Community Variable Excluded

Table 5.14 presents the results of the linear regression conducted on the initial set of candidate models. The strongest models are identified in bold, and any of these that are dominated by another were removed (i.e., crossed out).

Including all potential independent variables in the analysis (Model 1) had very strong evidence with a model probability of 0.953 and an adjusted R^2 of 0.181, thus accounting for roughly 18 per cent of the variation in desirability ratings for physical decommissioning tools. In contrast, the second strongest model, Model 2, had a ΔAIC value of 8.2, probability of 0.016, and an adjusted R^2 of 11.2 per cent indicating considerably less support for this model than model 1. Similarly, the ΔAIC values for all remaining models indicated either considerably less or no support. These results suggest that all of the variables considered had a roughly equivalent influence on residents' evaluations of physical decommissioning tools.

5.4.1.2 Community Variable

I next examined whether desirability ratings for physical decommissioning tools depended on community of residence. Table 5.15 presents the results of the regression conducted for the three models containing only the community variable that was coded according to size, access restrictions, OMNR presence, and the null model.

Table 5.14

Physical Decommissioning Regression Results for the Candidate Models without the Community Variable (variables included in the models are in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]AR^2
Model 1 {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs}	8	-188.481	392.9	0.0	0.953	0.181
Model 2{Noncon_rec, Mot_rec, Env_beliefs}	4	-196.568	401.1	8.2	0.016	0.112
Model 10 {Noncon_rec, Mot_rec}	3	-197.562	401.1	8.2	0.016	0.107
Model 8 {Noncon_rec, Freq_use}	3	-198.631	403.2	10.3	0.006	0.094
Model 6 {Mot_rec, Env_beliefs}	3	-198.971	403.9	11.0	0.004	0.090
Model 17 {Mot_rec}	2	-200.359	404.7	11.8	0.003	0.079
Model 3 {Cons_rec, Noncon_rec, Env_beliefs}	4	-198.776	405.6	12.7	0.002	0.086
Model 14 {Freq_use}	2	-201.785	407.5	14.6	0.001	0.061
Model 11 {Cons_rec, Env_beliefs}	3	-201.050	408.1	15.2	0.000	0.064
Model 12 {Cons_rec, Noncon_rec}	3	-201.093	408.1	15.2	0.000	0.063
Model 9 {Noncon_rec, Env_beliefs}	3	-202.130	410.2	17.3	0.000	0.050
Model 16 {Env_beliefs}	2	-203.564	411.1	18.2	0.000	0.038
Model 19 {Cons_rec}	2	-203.826	411.7	18.8	0.000	0.035
Model 5 {Env_beliefs, Age}	3	-202.958	412.0	19.8	0.000	0.039
Model 18 {Noncon_rec}	2	-205.214	414.4	21.5	0.000	0.017
Model 20 {None}	1	-206.972	416.0	23.1	0.000	0.000
Model 7 {Noncon_rec, Famil}	3	-205.161	416.3	23.4	0.000	0.011
Model 15 {Age}	2	-206.714	417.5	24.6	0.000	-0.003
Model 13 {Famil}	2	-206.883	417.8	24.9	0.000	-0.006
Model 4 {Age, Famil}	3	-206.623	419.3	26.4	0.000	-0.009

[1]K = Number of parameters, [2]LL = Log Likelihood, [3]AIC = Akaike's Information Criterion, [4]w_i = Akaike Weight (model probability), [5]AR^2 = Adjusted r-squared

Table 5.15

Physical Decommissioning Regression Results for Models including only the Community Variable and the Null Model (type of community variable shown in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]AR^2
Model 23 {Comm_OMNR}	2	-204.727	413.5	0.0	0.359	0.023
Model 22 {Comm_rest}	2	-204.815	413.6	0.1	0.341	0.022
Model 21 {Comm_size}	3	-204.371	414.7	1.2	0.197	0.021
Model 20 {None}	1	-206.972	416.0	2.5	0.103	0.000

The notation is defined in Table 5.14.

All three models that included a community variable had model probabilities above 0.05, and all had similar, yet poor, model fit values ranging from 0.023 for the highest to 0.021 for the lowest. While model 20 included no independent variables, it had a probability above 0.05 suggesting some evidence existed that community did not matter for evaluations of desirability for physical decommissioning tools.

5.4.1.3 All Surviving Models

Table 5.16 presents the results for the regression analyses for the strongest models identified in the previous two steps. The surviving variables included all of the originally included variables, and the three variations of the community variable. The null model was also included.

Only the models containing all independent variables (with or without the community variable) had model probabilities of 0.05 or higher. The strongest model, Model 1c, contained all the variables along with the community OMNR presence variable, indicating that this is the most relevant aspect of community. This model explained 19.4 per cent of the variation in desirability ratings of residents for physical decommissioning tools. The second strongest, Model 1, contained all variables except for the community variable, and it accounted for 18.1 per cent of the variation. The ΔAIC values for both of these models indicated substantial support. All remaining models were dominated by Model 1. Although adding the 'community restrictions' to

Table 5.16

Physical Decommissioning Regression Results for Models Containing the Surviving Variables (variables included in the models are in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]AR^2
Model 1c {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs, Comm_OMNR}	9	-186.768	391.6	0.0	0.487	0.194
Model 1 {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs}	8	-188.481	392.9	1.3	0.254	0.181
~~**Model 1b {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs, Comm_rest}**~~	9	-187.814	393.7	2.1	0.170	0.183
~~**Model 1a {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs, Comm_size}**~~	10	-187.500	395.0	3.4	0.089	0.180
Model 23 {Comm_OMNR}	2	-204.727	413.5	21.9	0.000	0.023
Model 22 {Comm_rest}	2	-204.815	413.6	22.0	0.000	0.022
Model 21 {Comm_size}	3	-204.371	414.7	23.1	0.000	0.021
Model 20 {None}	1	-206.972	416.0	24.4	0.000	0.000

The notation is defined in Table 5.14.

Model 1 would increase the model fit slightly, the ΔAIC and probability values provided weaker evidence for that option than for Model 1 without community. Thus, including the community access restrictions or size variables would result in weaker evidence for these models. The models including only the community variables had the weakest evidence, with model probabilities of <0.001, ΔAIC values indicating essentially no support, and low model fit values.

5.4.1.4 Strongest Models

Table 5.17 presents the parameter estimates and standard errors for the two strongest models. The directions of effect for the common variables were the same for both models. First,

different types of recreation displayed different effects on the perceived desirability of physical decommissioning tools. Individuals who pursued consumptive recreation and/or motorized recreation generally found physical decommissioning less desirable than those who did not pursue these activities. Individuals who pursued non-consumptive recreation, however, viewed physical decommissioning tools as more desirable than those who did not. Second, older individuals found physical decommissioning tools less desirable than did younger individuals. Third, respondents tending towards a biocentric orientation found physical decommissioning tools as more desirable than did other respondents. Fourth, greater frequency of use of access roads was correlated with lower desirability ratings of physical decommissioning tools. Familiarity showed the opposite effect in that, as familiarity increased, individuals found physical decommissioning tools more desirable. Lastly, the positive coefficient for community indicated that desirability ratings of physical decommissioning tools were higher amongst residents of communities with than without an OMNR presence. However, much of the variability in evaluations remained unexplained by this analysis.

Table 5.17

Parameter Coefficients and Standard Errors (in Brackets) for the Strongest Physical Decommissioning Models (variables included in the models are in parentheses)

	Model 1c {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs, Comm_OMNR}	Model 1 {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs}
Constant	-0.014	0.039
	(0.202)	(0.201)
Cons_rec	-0.158	-0.187
	(0.147)	(0.148)
Noncon_rec	0.196	0.197
	(0.096)	(0.096)
Mot_ rec	-0.250	-0.232
	(0.090)	(0.090)

	Model 1c {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs, Comm_OMNR}	Model 1 {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs}
Age	-0.206	-0.177
	(0.105)	(0.105)
Env_beliefs	0.173	0.206
	(0.129)	(0.129)
Freq_use	-0.140	-0.152
	(0.051)	(0.051)
Famil	0.378	0.368
	(0.148)	(0.149)
Comm_OMNR	0.138	N/A
	(0.077)	

5.4.2 Regulatory Tools

This analysis explored which variables were best able to predict individuals' perceived desirability of regulatory tools. The dependent variable, 'regulatory tools,' emerged from the PCA and included signage and road use permits. The PCA estimated scores for regulatory tools for each respondent were regressed against the twenty initial models which did not include the community variable. A parallel analysis was conducted for the three models containing only the community variable and the null model, and the strongest models from each set were combined.

5.4.2.1 Community Variable Excluded

Table 5.18 presents the results of the linear regression conducted on the initial set of candidate models. The strongest models were identified in bold, and any of these that were dominated by another were removed (i.e., crossed out).

Table 5.18

Regulatory Tools Regression Results for the Candidate Models without the Community Variable (variables included in the models are in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]R^2
Model 14 {Freq_use}	**2**	**-204.163**	**412.3**	**0.0**	**0.462**	0.084
~~**Model 8 {Noncon_rec, Fre_use}**~~	**3**	**-203.957**	**413.9**	**1.6**	**0.208**	0.080
~~**Model 1 {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs}**~~	**8**	**-199.398**	**414.8**	**2.5**	**0.132**	0.104
Model 6 {Mot_rec, Env_beliefs}	**3**	**-205.242**	**416.5**	**4.2**	**0.057**	0.064
Model 11 {Cons_rec, Env_beliefs}	3	-205.713	417.5	5.2	0.034	0.059
Model 17 {Mot_rec}	2	-207.007	417.9	5.6	0.028	0.049
Model 2{ Noncon_rec, Mot_rec, Env_beliefs}	4	-205.237	418.5	6.2	0.021	0.058
Model 3 {Cons_rec, Noncon_rec, Env_beliefs}	4	-205.705	419.4	7.1	0.013	0.052
Model 16 {Env_beliefs}	2	-207.781	419.6	7.3	0.012	0.039
Model 10 {Noncon_rec, Mot_rec}	3	-206.955	419.9	7.6	0.010	0.043
Model 19 {Cons_rec}	2	-208.557	421.1	8.8	0.006	0.029
Model 5 {Env_beliefs, Age}	3	-207.582	421.2	8.9	0.005	0.035
Model 9 {Noncon_rec, Env_beliefs}	3	-207.759	421.5	9.2	0.005	0.032
Model 12 {Cons_rec, Noncon_rec}	3	-208.485	423.0	10.7	0.002	0.023
Model 13 {Famil}	2	-209.909	423.8	11.5	0.001	0.011
Model 20 {None}	1	-211.216	424.5	12.2	0.001	0.000
Model 4 {Age, Famil}	3	-209.876	425.7	13.4	0.001	0.004
Model 7 {Noncon_rec, Famil}	3	-209.903	425.8	13.5	0.001	0.004
Model 15 {Age}	2	-211.181	426.3	14.0	0.000	-0.006
Model 18 {Noncon_rec}	2	-211.216	426.4	14.1	0.000	-0.007

The notation is defined in Table 5.14.

Four models had a probability above 0.05. However, Models 8 and 1 were dominated by Model 14, leaving only Models 14 and 6 as the strongest models, although considerably less support existed for Model 6 with a ΔAIC greater than four.

The strongest model, Model 14, contained only the frequency of use variable, suggesting that this variable was the strongest predictor of individuals' desirability ratings of regulatory tools. This model accounted for 8.4 per cent of the variation in preference for this component. Model 6 contained the motorized land based recreation and the environmental belief variables. Thus, these variables were predictors of perceived desirability for regulatory tools when combined, accounting for 6.4 per cent of the variation.

5.4.2.2 Community Variable

I next assessed whether the desirability ratings of regulatory tools depended on community of residence. Table 5.19 presents the results of the regression conducted for the three models containing only the community variable, coded according to size, access restrictions, OMNR presence, and the null model.

Table 5.19

Regulatory Tools Regression Results for Models Containing only the Community Variable and the Null Model (type of community variable shown in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]R^2
Model 21 {Comm_size}	3	-207.555	421.1	0.0	0.741	0.035
Model 20 {None}	1	-211.216	424.5	3.4	0.135	0.000
~~**Model 22 {Comm_rest}**~~	2	-210.877	425.8	4.7	0.071	-0.002
~~**Model 23 {Comm_MNR}**~~	2	-211.215	426.4	5.3	0.052	-0.007

The notation is defined in Table 5.14.

All three of the community variables had model probabilities above 0.05. However, the ranking was the reverse of that for physical decommissioning. In this case, community size was

the strongest predictor, followed by access restrictions, and lastly OMNR presence. This ranking was consistent with the findings from the satisfaction analysis.

The null model was the second strongest model and it dominated those containing the community access restrictions and OMNR presence variables. None of the R^2 values were high with the best model explaining only 3.5 per cent of the variation in regulatory tool ratings.

5.4.2.3 All Surviving Models

Table 5.20 presents the results for the regression analysis conducted for the strongest models identified in the previous two steps, with the surviving variables including frequency of use, motorized land-based recreation, environmental philosophy, and community size, along with the null model.

Table 5.20

Regulatory Tools Regression Results for Models including all Surviving Variables (variables included in the models are in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]R^2
Model 14a {Freq_use, Comm_size}	4	-201.113	410.2	0.0	0.636	0.109
Model 14 {Freq_use}	2	-204.163	412.3	2.1	0.223	0.084
Model 6a {Mot_rec, Env_beliefs, Comm_size}	5	-202.865	413.7	3.5	0.111	0.081
Model 6 {Motorized_rec, Env_beliefs}	3	-205.242	416.5	6.3	0.027	0.064
Model 21 {Comm_size}	3	-207.555	421.1	10.9	0.003	0.035
Model 20 {None}	1	-211.216	424.5	14.3	0.000	0.000

The notation is defined in Table 5.14.

Three models had probabilities above 0.05. The null model was the weakest model, indicating that the identified variables provided some benefit for predicting regulatory tool desirability ratings. The strongest model, Model 14a, combined frequency of use and community size. This model explained 10.9 per cent of the variation in regulatory tool ratings. Frequency of use (Model 14) was the second strongest model, explaining 8.4 per cent of the variation. These

results indicated that, while frequency of use was a good predictor of the perceived desirability of regulatory tools, it was improved when combined with the community size variable.

The final model with a probability above 0.05 (Model 6a) included three variables: motorized land-based recreation, environmental philosophy, and community size. This model explained 8.1 per cent of the variation in regulatory tool ratings.

5.4.2.4 Strongest Models

Table 5.21 presents the parameter estimates and standard errors for the three strongest models. Frequency of use had a negative effect on desirability evaluations for regulatory tools among residents. The effect of community was not straightforward. The positive and negative coefficients for these variables suggested that desirability rankings were highest amongst residents of large communities, lowest amongst residents of medium-sized communities, and mid-range for residents of the smallest communities. The only type of recreational pursuit found to impact regulatory tool desirability ratings was motorized land-based recreation. Individuals who pursued motorized land-based recreation found regulatory tools less desirable than those who did not. Finally, respondents tending towards a biocentric orientation found regulatory tools more desirable than did others. While some support exists for each of these effects, the strongest model only explained 11 per cent of the variation.

5.4.3 Passive Management

This analysis explored the variables that best predicted individuals' perceived desirability of passive management tools. The dependent variable, 'passive management,' emerged from the PCA and represented natural abandonment and winter roads. The PCA estimated scores for passive management for each respondent were regressed against the twenty initial models, and a parallel analysis was conducted for the three models containing only the community variable and the null model. The strongest models from each were then combined.

Table 5.21

Parameter Coefficients and Standard Errors (in Brackets) for Strongest Regulatory Tool Models (variables included in the models are in parentheses)

		Model 14a {Freq_use, Comm_size}	Model 14 {Freq_use}	Model 6a {Mot_rec, Env_beliefs, Comm_size}
Constant		0.229	0.336	-0.180
		(0.132)	(0.127)	(0.131)
Mot_rec		N/A	N/A	(-0.190)
				(0.087)
Env_beliefs		N/A	N/A	(0.218)
				(0.143)
Freq_use		-0.188	-0.190	N/A
		(0.052)	(0.050)	
Comm_size	Large	0.027	N/A	0.044
		(0.098)		(0.101)
	Medium	-0.204		-0.169
		(0.110)		(0.110)

5.4.3.1 Community Variable Excluded

Table 5.22 presents the results of the linear regression conducted on the initial set of candidate models. The strongest models are identified in bold, and any of these that were dominated by a stronger model were removed (i.e., crossed out).

Ten models had model probabilities over 0.05, but eight of these were dominated by the null model (the model with the second most evidence). The strongest model, Model 13, contained only the familiarity variable. However, this best model only had an adjusted R^2 of 0.01. No evidence existed to support any other independent variables.

Table 5.22

Passive Management Regression Results for the Candidate Models without the Community Variable (variables included in the models are in parentheses)

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]AR^2
Model 13 {Famil}	2	-212.762	429.6	0.0	0.133	0.010
Model 20 {None}	1	-214.038	430.0	0.4	0.109	0.000
~~**Model 14 {Freq_use}**~~	2	-213.195	430.5	0.9	0.085	0.005
~~**Model 4 {Age, Famil}**~~	3	-212.339	430.6	1.0	0.081	0.009
~~**Model 7 {Noncon_rec, Famil}**~~	3	-212.559	431.1	1.5	0.063	0.006
~~**Model 16 {Env_beliefs}**~~	2	-213.564	431.1	1.5	0.063	-0.000
~~**Model 15 {Age}**~~	2	-213.616	431.2	1.6	0.060	-0.001
~~**Model 17 {Mot_rec}**~~	2	-213.636	431.2	1.6	0.060	-0.001
~~**Model 6 {Mot_rec, Env_beliefs}**~~	3	-212.781	431.5	1.9	0.052	0.003
~~**Model 18 {Noncon_rec}**~~	2	-213.780	431.5	1.9	0.052	-0.003
Model 8 {Noncon_rec, Freq_use}	3	-213.059	432.1	2.5	0.038	-0.000
Model 19 {Cons_rec}	2	-214.027	432.1	2.5	0.038	-0.007
Model 5 {Env_beliefs, Age}	3	-213.246	432.5	2.9	0.031	-0.003
Model 9 {Noncon_rec, Env_beliefs}	3	-213.361	432.7	3.1	0.028	-0.005
Model 10 {Noncon_rec, Mot_rec}	3	-213.437	432.8	3.2	0.027	-0.006
Model 11 {Cons_rec, Env_beliefs}	3	-213.564	433.1	3.5	0.023	-0.007
Model 2{Noncon_rec, Mot_rec, Env_beliefs}	4	-212.668	433.3	3.7	0.021	-0.002
Model 12 {Cons_rec, Noncon_rec}	3	-213.746	433.4	3.8	0.020	-0.010
Model 3 {Cons_rec, Noncon_rec, Env_beliefs}	4	-213.352	434.6	5.0	0.011	-0.011
Model 1 {Age, Freq_use, Famil, Cons_rec, Noncon_rec, Mot_rec, Env_beliefs}	8	-210.154	436.3	6.7	0.005	0.004

The notation is defined in Table 5.14.

5.4.3.2 Community Variable

I next examined whether the desirability ratings of passive management approaches depend on community of residence. Table 5.23 presents the results of the regression conducted for the four models containing only the community variable, coded according to size, access restrictions, OMNR presence, and the null model.

Table 5.23

Passive Management Regression Results for Models Containing only the Community Variable and the Null Model

Model	[1]K	[2]LL	[3]AIC	ΔAIC	[4]w_i	[5]AR^2
Model 20 {None}	1	-214.038	430.0	0	0.484	0.000
~~**Model 21 {Comm_size}**~~	3	-213.006	432.0	2	0.178	0.000
~~**Model 22 {Comm_rest}**~~	2	-214.038	432.1	2.1	0.169	-0.007
~~**Model 23 {Comm_MNR}**~~	2	-214.037	432.1	2.1	0.169	-0.007

The notation is defined in Table 5.14.

The null model had the strongest evidence, suggesting that community had no effect on the evaluations of desirability for passive management tools. Given the lack of evidence for the community variable, the initial analysis with community excluded serves as the final analysis, and the strongest models identified in that analysis become the strongest overall models.

5.4.3.3 Strongest Models

Table 5.24 presents the parameter estimates and standard errors for the two strongest models. The only independent variable included in either of these models was familiarity with one's own area. As with the physical decommissioning analysis, the perceived desirability of passive management approaches increased with familiarity with an area. This variable accounted for 1 per cent of the variation in the perceived desirability of passive management approaches.

Table 5.24

Parameter Coefficients and Standard Errors (in Brackets) for the Strongest Passive Management Models (variables included in the models are in parentheses)

	Model 13 {Famil}	Model 20 {None}
Constant	-0.177	-0.019
	(0.130)	(0.084)
Famil	0.249	N/A
	(0.156)	

Chapter 6: Discussion

At this point, it is useful to consider the analyses of satisfaction and management tool preferences together. Of themselves, the satisfaction results can indicate whether a group is more or less satisfied than others, and why. Combining this information with the group's relative preferences for different management tools, should provide a better guide for managers in their decisions. For example, if a dissatisfied group rated regulatory tools as more desirable than physical decommissioning, it would imply that their satisfaction levels could be increased by relying more heavily on signage, road permits, and gates, and less so on roadbed removal, road impediments, and water crossing removals.

This chapter is organized as follows. First, to set the context for the remaining discussion, overviews of the satisfaction and management tool analyses are provided. This includes a discussion of possible explanations for the low predictive abilities of the models. Next, I discuss each hypothesis, based on the corresponding explanatory variable(s). Consistency with, and divergence from, past research are discussed, as are possible explanations for the findings. Third, I outline likely future trends in management preferences. I conclude with a discussion of management implications and suggestions.

6.1 Satisfaction and Management Tool Evaluation Overviews

6.1.1 Overview

Overall, residents were dissatisfied with current forestry road management, and rated all the tools apart from natural abandonment and winter roads as undesirable. Given the current state of conflict over roads and road management in Wawa District (Hunt et al., 2009), it is not surprising that about half of the respondents expressed dissatisfaction or extreme dissatisfaction with current management. Only one quarter of respondents were satisfied, and the rest were neutral.

Before continuing, it is important to note that the response rate for this study was 36 per cent. Fowler (1984) cautioned that response rates between 20 and 30 percent are typically not representative of the sampled population, because "people who have a particular interest in the subject matter are more likely to return mail questionnaires that those who are less interested" (p.49). He further warned that response rates below 20 per cent are unlikely to provide any credible statistics about the population as whole. This response rate of 36 per cent is above the

critical thresholds defined by Fowler, but is low enough that the following discussion should be prefaced by the caution that the results may be biased towards particular interest groups, rather than be fully representative of all Wawa District residents.

6.1.2 Satisfaction

The satisfaction ratings were poorly explained by any of the models considered here. Nonetheless, some of the explanatory variables did relate to respondents' satisfaction. The ones that were retained in the strongest models were community size, frequency of use, and environmental beliefs. Community size and pro-environmental beliefs were positively correlated with satisfaction, while higher frequency of use was associated with lower satisfaction. Thus, while not explaining much of the variation in satisfaction, the results provided some insights into residents' characteristics and forestry road use patterns that related to satisfaction.

6.1.3 Management Tool Evaluations

Given the high levels of dissatisfaction, it is not surprising that management tool desirability rankings were also generally low. Respondents rated the desirability of tools and controls on a scale from very desirable (+2) to very undesirable (-2) (Figure 3.7). On average, they only rated natural abandonment and winter roads tools as desirable (means of 0.24 and 0.07, respectively). Likely, the lack of control over access with these tools made them desirable to many people. Users can be charged and face consequences for noncompliance with signage but, in contrast, natural abandonment and winter roads merely make travel difficult, with no negative repercussions. While the same can be said of other physical decommissioning tools (e.g., berms, impediments), these differ in that they are actions taken specifically to impede travel, and thus, may be considered more antagonistic than passive management approaches. However, over one-quarter of residents rated these tools as undesirable, suggesting that substantial disagreement exists about the acceptability of even these tools.

Of the remaining tools and controls, signs were rated next as most desirable with an average rating of somewhat undesirable (means from -0.30 to -0.53). Signs that restrict either specific areas (e.g., lakes) or areas for specific seasons were significantly more desirable than were signs that restricted all road use, which were rated as undesirable or very undesirable by over 50 per cent of respondents. Physical decommissioning tools were less desirable than were signs, although they were more desirable than gates. Desirability ratings for bridge and culvert

removal, placing road impediments on roads, and removing the roadbed were all rated about equally undesirable (means ranging from -0.75 to -0.92). Gates were the most undesirable (mean -1.06) with almost 70 per cent of respondents rating them as undesirable or very undesirable.

The explanatory power of the models was strongest for physical decommissioning (19%) and regulatory (11%) tools, but very weak for the passive management ones (1%). Nonetheless, the analyses indicated that all of the hypotheses had at least some support. In fact, they were all associated with the desirability ratings for physical decommissioning tools, with size being the relevant aspect of a community. For the regulatory tools, all variables except familiarity, pursuit of consumptive recreation, and pursuit of non-consumptive recreation were significant, with size being the relevant aspect of community once again. For the passive management tools, only the model containing the familiarity variable had support over the null model.

The relationships between the explanatory variables and the evaluations were consistent across all types of tools and controls. Community size, pro-environmental beliefs, familiarity with one's area, and the pursuit of non-consumptive recreation were positively correlated with desirability ratings. High frequency of use, age, and the pursuit of consumptive or motorized land-based recreation were associated with lower desirability ratings.

6.1.4 Possible Explanations of Models' Low Predictive Abilities

The low predictive values could result from a number of factors, related to both the study design and the study context. This is true for both the satisfaction and the management tool analyses.

Both the satisfaction and tool evaluation analyses may have suffered from the scales used to measure them. Each used five discrete levels, ranging from highly dissatisfied to highly satisfied, and very undesirable to very desirable. Given the generally low satisfaction of respondents, this measurement approach led to nearly 50 per cent of respondents being classified as 'extremely dissatisfied' or 'dissatisfied'. A scale which measured finer gradations of dissatisfaction might have uncovered more information about the degrees of dissatisfaction and their causes. Similarly, most management tools were classified as 'undesirable' or 'very undesirable,' where in fact there could be finer degrees of 'undesirability' that a more precise measure would have captured. However, as noted previously, Dawes (2008) concluded that five, seven, and ten point Likert scales produce very similar results, suggesting that this change may

not reveal additional relationships. Nonetheless, the high proportions of dissatisfied respondents and undesirable tools suggest that it would be worthwhile to further explore the gradations within these ratings.

Second, it is also plausible that the context of this study is related to the low predictive ability of the models. Most previous studies that have identified relationships between user characteristics and road management preferences were conducted in a wildlife-conservation context. Consequently, it could be that some of these relationships differ, or are weaker, in Wawa District's primarily remote tourism context. This possibility is supported by Clark et al.'s (1984) findings that road-based recreationists considered road closures implemented to preserve hunting quality less acceptable than those implemented for wildlife protection. This idea is explored further throughout this chapter.

Similarly, there may be important influential factors in this context that were not identified in previous studies. For example, Hunt et al. (2009) found that fairness of process, fairness of decision-making, scarcity of resources, and respect for other users all influenced road access conflicts. Consequently, these factors might affect satisfaction and the more specific evaluations of management tool desirability as well, and are worth exploring. As well, other variables might relate to the economic context of the study. For example, differences may be related to individuals' employment sectors (e.g., service industry versus resource extraction). Finally, a variety of other research themes such as preferred recreation settings (e.g., the recreation opportunities spectrum) (e.g., Buist & Hoots, 1982) or recreational motivations (e.g., Mills, 1985) may be related to satisfaction and access tool desirability ratings.

Finally, there was also evidence in this study that different users may have been dissatisfied for opposing reasons. For example, the results suggested that consumptive recreationists found physical decommissioning tools less desirable than others, while non-consumptive recreationists found them more desirable. This suggests that consumptive recreationists' satisfaction could potentially be increased by reducing the use of physical decommissioning tools, while non-consumptive recreationists might prefer increasing their use. Therefore, both groups were dissatisfied, but potentially for different reasons. The structure of the current study does not discriminate between them, and so cannot properly explain these ratings.

6.2 Support for Hypotheses

6.2.1 Age

I hypothesized that older individuals may be less satisfied and view restrictive management tools as less desirable than would younger ones. The results provided no support for the hypothesis that age would influence satisfaction, and weak support for the hypothesis that it would influence the perceptions of management tool desirability. It was included only in the strongest model for physical decommissioning tools, where it was negatively related to desirability.

These results displayed some consistency with past studies. McFarlane et al. (2007), Vaske et al., (2001), and Jurowski et al. (1995) all found that younger individuals were more supportive of protection-oriented management than older individuals. They have found that the former are more supportive of restrictions implemented for wildlife protection (McFarlane et al), and environmental protection-oriented management in United States National Forests (Vaske et al.) and United States National Parks (Jurowski et al.).

The results of this study provided some support for the speculation that because older individuals have more direct experience with recreating on Crown land before tourism-oriented access restrictions were implemented, they evaluated restrictive management tools more negatively than did younger individuals. Although the causal effect cannot be identified, if this is correct then the absence of stronger support for the effect of age might arise from the age distribution of the respondents. Only 20 per cent of respondents were under the age of forty. Given that the District Land Use Guidelines were developed in the 1980s (Hunt et al., 2009), this means that over four fifths of the respondents had the opportunity to recreate on Crown land in Wawa District prior to the implementation of tourism-oriented access restrictions. Hence, the age effect might be masked due to an insufficient representation of younger individuals. Alternatively, it is also true that older individuals have had twenty to thirty years to adapt to these changes. It is possible that, having witnessed the decline of resource extraction sectors, some older individuals may better understand the importance of economic diversification and the importance of supporting tourism. In this case, the influence of past experience would be less pronounced.

The context of the study might play a role as well. The other studies described that identified age as an important variable (Jurowski et al., 1995; McFarlane et al., 2007; Vaske et

al., 2001) were all conducted in situations where restrictions were implemented for environmental reasons, and all noted the link between younger individuals and increased biocentrism. If the importance of age is closely linked with biocentric orientations, the effect might not be as strong in this primarily economic context.

Hunt et al. (2000) cautioned that the reasons for significant relationships between age and other variables are difficult to establish. In the case of this study, there could be a true difference between generations, suggesting that as the younger generation ages and replaces the current older generation, their perspectives will become the majority view, and the overall perceptions of desirability will rise. Of course, this is assuming that future generations continue to evaluate management tools more desirably than the current older generation. On the other hand, these differing evaluations could arise from experiences that people gather as they age, in which case they might find physical decommissioning tools progressively less desirable. Alternatively, the effect of age could be a combination of the two tendencies. However, in the case of Wawa District there seems to be a logical argument that evaluations are related to direct recreational experiences on Crown land, suggesting that individuals who have always been faced with restrictions will not necessarily find management tactics less desirable as they age.

6.2.2 Community of Residence

I hypothesized that individuals' satisfaction and desirability ratings would be related to their home community, and investigated three different characteristics of it: community size (i.e., population), the degree of access restrictions in the vicinity of the community, and whether or not there was an OMNR office in the community. The results partially supported this hypothesis. Community size was related to individuals' satisfaction levels and the desirability ratings of regulatory tools. An OMNR presence within a community was related to the desirability ratings of physical decommissioning tools. Surprisingly, the amount of restrictions surrounding a community did not emerge as an important factor for any analysis. This result is contrary to Hunt et al. (2009) who suggested that the physical and managerial context of a community, including the proportion of area that was affected by access restrictions, was a prime source of road access conflicts in Ontario.

In terms of community size, residents of larger communities had higher satisfaction levels and viewed regulatory tools as more desirable than did residents of smaller communities. Although causality cannot be confirmed, this provides some support for the hypothesis that

larger communities have a broader economic base and thus, their residents will see greater value to protect remoteness for tourism purposes. Arguably, residents of smaller, less diverse communities would have more incentive to support initiatives to broaden economic opportunities than would residents of larger communities. However, residents' perceptions that tourism operators do not bring adequate community benefits (Hunt et al., 2009) likely negate any additional support that residents of smaller communities may have.

These results are consistent with McFarlane et al. (2007) and Kellert et al. (1996) who found that support for access restrictions differed between individuals from tourism-dependent rural communities and resource-extraction dependent rural communities. Although the communities in this study were not clearly defined as resource-dependent versus tourism-dependent, the greater satisfaction and desirability ratings amongst residents of larger communities with broader economic bases indirectly supports these earlier findings.

An OMNR presence within a community proved important for the desirability ratings for physical decommissioning tools. The desirability ratings were higher amongst residents of communities with an OMNR presence, suggesting that a visible agency presence has a positive influence on individuals' perceptions of access management tools.

The above findings are consistent with John Locke's social contract theory, which theorizes that laws can only be legitimate if they seek to achieve the common good, and argued that, should the government act against the interest of the people, the 'social contract' between the government and the people can be dissolved (Friend, 2004). In this case, if individuals live in a larger community where the positive effects of government actions are apparent (e.g., social programs), the contract will likely be upheld as the government is seen to be acting in the best interest of the people. However, in communities where the main visible governmental effects are perceived to be violating this contract, such as road restrictions, residents will be more likely to oppose, and violate, governmental actions and regulations. Similarly, a visible OMNR presence could be enhancing the perception that the agency is in tune with the local community and working on its behalf. However, if this relationship is true, it is surprising that satisfaction was not influenced as well, and is, therefore, worth further exploration.

In sum, the influences of both community size and an OMNR presence support past findings that road access conflicts varied between communities based on the different managerial, physical, and social contexts of communities (Hunt et al. 2009). However, as with

the age variable, these results do not confirm the causality of the relationships. We do not know, for example, if an OMNR presence within a community has a direct effect on desirability ratings, or if it is correlated with another factor that has the true influence on opinions. Nonetheless, community size and an OMNR presence can serve as surrogates for the true underlying factors, until such time as they are confirmed as the direct influencers or the underlying factors are identified more precisely.

6.2.3 Pursuit of Recreational Activities

As discussed in section 2.5, I hypothesized that residents' satisfaction levels and management tool evaluations would be correlated with participation in consumptive recreation, motorized land-based recreation, and non-consumptive recreation. I hypothesized that participation in consumptive or motorized recreation would be associated with lower satisfaction and evaluations, while non-consumptive recreation would be correlated with higher satisfaction and desirability ratings.

Interestingly, pursuit of the different recreational activities was not related to overall satisfaction, but it was associated with the desirability ratings of physical decommissioning and regulatory tools. As per the hypotheses, individuals who pursued consumptive recreation and/or motorized land-based recreation activities rated restrictive management tools less desirable than did others. Conversely, residents who pursued non-consumptive activities rated them as more desirable than did others. These differences in desirability perceptions suggest that the satisfaction results may not capture the true differences between the groups because, as mentioned earlier, consumptive/motorized and non-consumptive recreationists may be dissatisfied for different, or even opposite, reasons. Alternately, both groups could be dissatisfied for the same reason, but still have differing support for management tools. For example, residents who participated in motorized recreation, consumptive recreation, or non-consumptive recreation all disagreed with the statements that road access decisions, and the decision-making processes, are fair, supporting Hunt et al.'s (2009) findings that the perceived fairness of past decisions and decision-making processes is a source of road access conflicts. Thus, the dissatisfaction of all three groups could be arising from the perceived fairness of road access management processes and decisions, rather than differing management preferences.

The results of this study also suggested that mode of travel is related to evaluations of desirability. In particular, non-consumptive recreationists (i.e., non-motorized) evaluated

restrictive access tools as more desirable than others, while recreationists traveling via motorized vehicles evaluated these tools as less desirable than others. These findings are consistent with past findings that off-road vehicle users are the most strongly opposed to temporary and permanent road closures (McFarlane et al., 2007), and that hunters' preferences regarding the level of access vary according to their mode of travel (e.g., truck, ATV, on foot) (Hunt et al., 2005). Also worth noting is that these findings and those of past studies suggest that categorizing activities as consumptive, non-consumptive, and motorized may be an oversimplification, as recreational activities can be a mix of different categories. For example, hunters (consumptive) who travel by foot (non-consumptive) have different preferences than hunters who travel via motorized means.

6.2.4 Familiarity

As discussed in section 2.5, I hypothesized that increasing familiarity would be associated with lower satisfaction levels and desirability ratings for management tools. The results did not support a link between familiarity and satisfaction. Although the results did support a relationship between familiarity and management tool evaluations, the direction was opposite than hypothesized. Rather, familiarity was positively associated with evaluations of both physical decommissioning tools and passive management approaches.

These results have both consistencies and inconsistencies with past research. First, previous studies have concluded that greater familiarity is associated with less willingness to substitute sites, or setting resistance (e.g., Wynveen et al., 2007). Assuming that an unwillingness to switch recreational sites would lead to lower evaluations of management tactics restricting access to said sites, it seems to be reasonable to anticipate that more familiar individuals would find these tactics less desirable. However, this was not the case, as more familiar respondents rated physical decommissioning tools as more desirable than others. Conversely, the higher ratings of passive management tools could be considered consistent with past studies, in that more familiar individuals would consider passive management approaches the least adversarial, as they do not attempt to physically impede travel, nor do they prohibit travel through regulations.

Peden and Schuster (2008) and McFarlane and Boxall (1996) both found that higher familiarity was associated with lower evaluations of management. Again, the management tactic results can be considered both consistent (passive management approaches) and inconsistent

(physical decommissioning tools) with these findings. However, given these past findings. it is surprising that the current study did not reveal satisfaction differences between familiarity levels.

While this finding could reflect a true lack of correlation between familiarity and satisfaction, it could also relate to McFarlane's (2004) findings that campers on Crown land sites generally have more familiarity with the site than campers at more developed sites. Consistent with those findings, the results of this study showed that over 50 per cent of respondents were very familiar with the area around their community, one third were somewhat familiar, and less than 10 per cent were not at all familiar. Consequently, if any differences amongst familiarity levels exist they may have been missed given the overwhelming proportion of residents that are somewhat or very familiar with the areas in question. However, these findings also suggest that, whether or not differences amongst familiarity levels do exist, as per McFarlane's findings, most individuals recreating on Crown land in Wawa District believe they are are quite familiar with the area. Hence, it is likely not worthwhile to focus on differences between familiarity levels, as there is little variation in familiarity among the recreationists on the landscape.

6.2.5 Frequency of Use

As discussed in Section 2.5, I hypothesized that increasing frequency of use of forestry roads for recreation would be associated with lower satisfaction and lower desirability ratings. This hypothesis was supported, as frequency of use was negatively correlated with both satisfaction and the evaluations of physical decommissioning and regulatory tools.

It is interesting to note that the results differed from those of familiarity, which was positively associated with the evaluations of physical decommissioning tools and passive management approaches. This is surprising given previous studies that have applied past use variables to measure familiarity (e.g., McFarlane & Boxall, 1996). The results of this study support the notion that frequency of use and familiarity are not interchangeable, but rather represent distinct constructs with different associations to satisfaction and management tactic evaluations.

That aside, these results are consistent with past studies. First, some researchers have identified a negative association between past experience and willingness to substitute recreation sites. For example, Wynveen et al. (2007) concluded that experience use history was negatively predictive of campers' willingness to substitute, and Moore and Graefe (1994) identified frequency of use as a significant predictor of place dependence. This study's findings that greater

frequency of use is associated with lower satisfaction and ratings for physical and regulatory restrictive tools was consistent with the notion that these users would resist changing sites.

These results are also consistent with earlier findings that greater past experience leads to more negative evaluations of environmental and social conditions. In particular, White et al. (2008) found that greater past experience was associated with lower evaluations of environmental and social impacts, but concluded that this effect was particularly pronounced on social impacts (i.e., depreciative behaviour and recreation conflict). These findings support this earlier work, in that road access restrictions are at the centre of most current road access conflicts. If more frequent users are more sensitive to these conflicts, it follows that they will find restrictive management tools less desirable than less frequent users. Although not directly comparable given the different measures used, this conclusion appears consistent with Schreyer et al. (1984), who concluded that experience use history is associated with higher perceptions of conflict. While some studies did not support this link (e.g., Ramthun, 1995; Vaske et al., 1995), this study supports the hypothesis that use frequency is associated with greater sensitivity to recreation conflicts.

These findings are again consistent with earlier research exploring the links between past use and management evaluations. Hammitt and McDonald (1983) were some of the first researchers to study this relationship, and this study's findings are consistent with their conclusions that more experienced users were the most opposed to regulatory control of their behaviour. Similarly, Schreyer et al. (1984) found that current management was evaluated least favourably by those with the most on-site experiences. The low satisfaction and evaluations in this study supported those conclusions.

However, Schreyer et al. (1984) also found that this same group was most in favour of managerial control in general, and provided some speculative reasons why that may be relevant in contexts such as Wawa District. They suggested that frequent users may feel that current managerial objectives are not in their best interest, but rather are focused more on the needs of "outsiders." Therefore, they may evaluate current management negatively, but support the notion of stricter managerial control with different objectives. Although this study did not evaluate residents' support for managerial control in general, it is easy to see the parallels between these two situations. The access conflicts in Wawa District stem partly from the beliefs that the restrictions are implemented for the benefit of tourism operators, which are believed not to bring

adequate benefits to the local communities to merit this degree of protection (Hunt et al., 2009). If Schreyer et al.'s speculations are correct, there could be a dramatic shift in management support should the managerial objectives become such that residents perceive them to be in their best interest.

6.2.6 Environmental Beliefs

As discussed in section 2.5, I hypothesized that pro-environmental beliefs would be correlated with higher satisfaction and management tool evaluations, and measured these beliefs using the *New Ecological Paradigm* scale. The results supported this hypothesis in all analyses apart from the desirability of passive management tools, in which this variable was not included in the strongest models.

This result is consistent with, and enhances, past research. While most research has concluded that environmental beliefs influence support for environmental-protection orientated management (e.g., Arlinghaus & Mehner, 2004b; Jurowski et al., 1995; Winter, 2005; Vaske et al., 2001), this study demonstrated that this effect holds true in contexts where restrictions were implemented to protect economic values. This suggests that biocentric-oriented individuals value protecting remoteness regardless of the reason for the protection. However, the overwhelming dissatisfaction and low management tool evaluations of residents suggest that the positive effects of a biocentric-orientation are negated by factors associated with lower satisfaction and more negative evaluations, such as frequency of use. The influence of environmental beliefs may be weaker in this context than in an explicitly environmental context, such as conservation of a threatened species, and therefore, these effects were overshadowed by stronger influences in the opposing direction. Conversely, in an environmental context the link between biocentrism and higher satisfaction and evaluations might be stronger, and overpower factors that are associated with lower satisfaction and evaluations.

6.3 Future Trends

The results discussed above provide a snapshot of the current situation in Wawa District. However, societal values, beliefs, and attitudes are not static. They evolve over time, and as they evolve they bring with them changing management preferences and support. While we can safely say that these perspectives will change, it is challenging to predict just *how* they will change. However, if managers are able to identify trends and anticipate likely changes, it can assist with

long-term planning and ensure that the direction of resource management and the direction of societal values are compatible.

By considering both past research and the context in Wawa District, it is possible to speculate on likely values and attitudes shifts over the coming years. First, evolving economic bases could impact attitudes and, consequently, management preferences. The economic landscape in northern Ontario is changing: the traditional forest industry is declining (Ontario Forestry Coalition, 2008), diverse economic activities such as renewable energy are emerging, and communities that have traditionally relied on forestry are working to expand into other areas, including resource-based tourism. For example, Dubreuilville's 2004-2014 Strategic Plan for community development includes a focus on developing the road-based tourism industry (Soanbert Corp., 2004). Considering the results of this study, we can anticipate that, if communities successfully diversify their economic bases and further integrate tourism into the mix, and ensure that the community benefits are communicated to local residents, attitudes will begin to change and evaluations of restrictive access tools will improve. It is unlikely, however, that any Wawa District communities will become primarily or wholly dependent on tourism, and, therefore, managers may never see the same level of support for restrictions found by McFarlane et al. (2007) and others. Nonetheless, increasingly positive attitudes and support can be anticipated with the changing economic landscape, as long as the increased tourism is benefiting the local communities.

Second, declining populations in Wawa District communities (Statistics Canada, 2006), could impact residents' satisfaction levels and management tool evaluations. The influences of such a decline are uncertain, and could have positive or negative impacts. In particular, declining populations will likely result in fewer recreationists on Crown lands. While this change may not alter the remaining residents' perspectives, the reduced number of recreationists could lead to fewer conflicts between recreationists and remote tourism operators. However, the impacts of a declining population are very speculative. For example, if the remaining residents are highly attached to particular areas that are utilized by remote tourism operators, conflict may not decline significantly. As well, if the downturn in the forest industry results in population losses instead of economic diversification, residents' satisfaction and management tool evaluations may not be positively influenced by changing economies. Similarly, if populations decline largely from youth emigration, the average age will increase. Given the negative correlation between age and

management tool evaluations, this change could lead to increasingly negative evaluations. However, some researchers have suggested that as urban residents migrate to rural areas as cottagers or retirees, they will bring with them more biocentric beliefs and shift the dominant perspective in the community towards the biocentric end of the spectrum, leading to greater support for conservation-oriented management in these areas (Clendenning, Field, & Kapp, 2005). This immigration phenomenon may be especially prevalent in Wawa and Marathon, communities that are attractive to cottagers given their proximity to Lake Superior (e.g., Mihell, in press), and in Manitouwadge, given its emphasis on attracting retirees (Ontario Ministry of Northern Development and Mines, 2003).

Third, past research has found that environmental beliefs in general (Dunlap & van Liere, 1978), and values about public forests specifically (Bengston et al., 1999), are shifting from primarily anthropocentric to more biocentric, and management preferences for forests are changing accordingly. Therefore, we can anticipate that residents of Wawa District may also experience a shift in environmental beliefs. However, it is not clear if this shift will influence management preferences as significantly as has occurred in other areas (e.g., Jackson, 1986; Jurowski et al., 1995), as the positive influence of environmental beliefs seemed to be overshadowed by the influences of opposing factors in this study. Overall, it is difficult to predict if shifting environmental beliefs will have a strong enough influence to noticeably affect management preferences in Wawa District, but the combined influences of changing economic activities and shifting societal beliefs could result in more substantial preference changes than either factor in isolation.

Likely related to the expected shift in society's environmental beliefs, some researchers are predicting that we will also see a parallel shift in the dominant recreational activities with greater numbers of people choosing non-consumptive, non-motorized options (e.g., Jackson, 1986). Currently, consumptive and motorized activities are the most popular outdoor recreation activities in Wawa District, with up to 80 per cent of respondents participating in these activities. Slightly fewer respondents (70%) indicated participation in non-consumptive activities. As well, ATV use has been increasing over recent years (Outback ATV Club, 2007). Thus, if this speculation proves true, the current ATV trend will slow and the recreational mosaic in Wawa's Crown forests will be altered, with the number of consumptive recreationists decreasing and the non-consumptive recreationists growing. This has a number of potentially significant impacts for

Wawa District. First, a positive impact may result in increased satisfaction and higher management tool evaluations, as evidenced by the results of this study. However, researchers have found that non-consumptive recreationists have a lower tolerance for logged settings than do consumptive recreationists. Thus, a movement towards non-consumptive recreation could lead to lower satisfaction levels of residents given the heavily logged nature of northern Ontario's forest regions. It could also lead to increased perceptions of crowding if use becomes concentrated in selected areas not impacted by logging activities, which in turn could negatively impact satisfaction. As discussed above, this could result in higher evaluations of restrictive management tools, if residents perceive these tools as means to limit use in their preferred areas.

6.4 Key Messages and Management Implications

6.4.1 Key Messages

The results of this study confirm that Wawa District residents are not a homogeneous group with respects to their satisfaction with forestry road management and their evaluations of road access tools and controls. Satisfaction and management tool evaluations vary amongst residents, and these variations can be partially related to individuals' characteristics, environmental beliefs, and forestry road use patterns. Although much of the variation remains unexplained, these results help managers to understand and to predict how individuals will respond to changes in access management.

Wawa District managers are dealing with a population largely over the age of forty that is split relatively evenly between the largest communities and the small/medium sized ones. One quarter of respondents lived in the communities identified as being surrounded by the highest levels of access restrictions, and approximately 60 per cent lived in a community with an OMNR presence. Many residents used forestry roads frequently for recreation, and over half indicated that they are very familiar with their local area. Approximately 80 per cent of individuals pursued consumptive recreation activities, and 66 per cent pursued motorized land-based recreation. Roughly 70 per cent of respondents pursued non-consumptive activities. An overwhelming majority of residents were dissatisfied with current forestry road management. Efforts to improve satisfaction levels are important to the goal of enhancing residents' experiences in the District, and, as mentioned in section 2.1, will hopefully help managers meet the necessary compliance standards to ensure adequate protection for tourism, ecological,

cultural, and economic values.

The large proportion of residents that recreate on Crown land and use forestry roads for their recreational pursuits suggests that a managerial focus on enhancing recreationists' experiences will have a positive impact on residents' overall satisfaction levels and management tool evaluations. The results of this study will better enable managers to provide quality experiences for recreationists by tailoring management approaches to specific user groups.

6.4.2 Management Implications

While knowing how satisfaction and management tool evaluations vary amongst users is key to enhancing experiences and satisfaction, incorporating this knowledge into management plans is challenging, given the need to balance social considerations with many other values. Bengston and Fan (1999) emphasized the challenge of developing policies that reflect a diversity of values in an increasingly pluralistic world. Economic interests must also be accommodated, each of which has its own needs. Unlike in most previous studies, the context in Wawa District is further complicated by the substantial presence of remote tourism on the landscape, and the District's commitment to enhance both remote tourism and public Crown land recreation as primary activities in the area (OMNR, 1983).

There are two general planning approaches Crown land managers can pursue: broad scale planning and site specific planning. Both of these methods are currently being applied in northern Ontario. Similar in the sense that both processes aim to identify, protect, and balance the values in the area, there are, nonetheless, some important differences.

Notably, broad-scale approaches are prescriptive. Managers define standard access prescriptions for a broad area, and implement them at specific sites within that area. Conversely, under a site specific approach, individual approaches are developed for each situation. Both approaches can be implemented proactively. A concern with site-specific approaches is that they are reactive if they are implemented only after problems are identified, but they are proactive if access management plans are negotiated through the forest management planning process prior to the roads being developed.

The site-specific approach lets managers tailor strategies to localized situations, whereas the broader, prescriptive approach may miss important variations across the landscape. There are likely distinct sites frequented by varying user groups within a large area, but a broad approach applies the same prescription to all areas. Similarly, remote tourism operators may have different

tolerance levels toward public recreationists, and may be willing to accept less restrictions or a lower compliance rate than are implemented under a prescriptive approach. Similar differences could hold true for other values as well, be they ecological, economic, or otherwise. A broad approach requires that the prescriptions are suitable for the most sensitive sites in the area, which could lead to unnecessarily restrictive policies in less sensitive regions. Thus, there is a strong argument for the site-specific approach, which allows for access plans tailored specifically to individual situations, in terms of the levels of compliance necessary, the size of the buffer zone surrounding the protected value, and the specific access tools employed. Indeed, the Management Guidelines for Forestry and Resource-Based Tourism advocate a site specific approach, with Resource Stewardship Agreements developed between forestry companies and tourism operators on a case-by-case basis (OMNR, 2001).

Hunt et al.'s (2009) results also supported the argument for site-specific approaches. As they explained, both broad-scale and site-specific approaches are being applied in northern Ontario. A broad, prescriptive approach is the current strategy in Wawa District (OMNR, 1992). For example, equivalent access restrictions are implemented for most remote tourism lakes across the District (apart from those in the areas added to the District after the Land Use Guidelines were adopted). Meanwhile, a site-specific approach is the process currently used in northwestern Ontario's OMNR Dryden District. Interestingly, the levels of reported conflict between residents and remote tourism operators were much higher in Wawa District than in Dryden District. These differences in conflict levels suggest that a site-specific approach may be better able to develop acceptable and effective management strategies than a broad-scale one.

However, in practice a site specific approach is more onerous to implement. Not only does it require additional human and financial resources to consider each case individually, but it also demands a more detailed understanding of use patterns and area residents' characteristics. Thus, while managers should strive for a more individualized approach, the broad scale approach described is still preferable to not considering user preferences at all, and this is a good start while improving knowledge and working towards site-specific management, and improving understanding of when a broad scale approach might be needed and vice versa.

The results of this study can be used to inform both broad-scale and site specific planning processes. First, managers should note that one half of respondents supported the notion of physically separating incompatible uses on the landscape, suggesting that there is some support

for dedicating certain areas for specific types of recreation, but indicating that some opposition should be expected as well. With that in mind, managers can use the findings to develop access management plans that are most acceptable to the user groups in the area. By profiling the users and area residents surrounding an area, they can use this study to gain an initial understanding of the perspectives of these individuals, and their likely responses to access management strategies, and tailor the plans to the specific audience.

Education and communication strategies can be used to complement both broad-scale and site specific planning processes. Wawa resource managers may be inclined to disregard signage, a common education and communication approach, and possibly other educational strategies, as previous researchers have suggested that educational signage is most effective in ecological rather than social contexts (Hendricks et al., 2001), and therefore, may not be effective in Wawa District's remote-tourism context (Hunt & Hosegood, 2008). However, communication is more than just posting signage, and managers should consider a comprehensive, coordinated approach to conveying rationales for actions. In particular, two main education and communication themes that may be effective in Wawa District emerged from this and previous studies. They are identified in the following paragraphs.

First, this study concluded that desirability ratings were higher amongst residents of larger communities. This supports the hypothesis that a broader economic base leads to greater support. However, Hunt et al. (2009) concluded that residents do not feel that local communities receive much economic benefit from remote tourism operations, while operators feel that the benefits are there but the public does not recognize them. Together, these imply that one effective approach could be to quantify the economic benefits of tourism operations to the nearby communities, and to disseminate that information to residents. If the benefits are significant, understanding the degree to which remote operations impact local communities would likely increase residents' satisfaction with management and evaluations of management tactics.

Second, past studies have confirmed that many individuals support restrictions implemented for environmental protection measures (e.g., McFarlane et al., 2007). Residents of Wawa District, on the other hand, seem to assume that all restrictions in their district are implemented for remote tourism reasons. This suggests that Wawa District managers should ensure that, in cases where restrictions are implemented wholly or partially for ecological reasons, the rationale for the restrictions is publicized. The positive association between

biocentrism and satisfaction and evaluations identified in this study support the hypothesis that there will be greater support for ecologically-oriented restrictions. Of course, managers should be cautious not to use ecological reasons to mask underlying remote tourism values, as in the long term this would likely degrade public trust in the OMNR and further decrease support for OMNR implemented regulations.

A current example of ecologically-related regulations and restrictions is the OMNRs newly developed Caribou Conservation Plan (OMNR, 2010b). While specific management actions have yet to be defined, it is probable that there will be some restrictions on human use in sensitive areas to protect this species and its habitat. In such cases, managers may be able to enhance support by emphasizing the ecological rationale underlying the restrictions.

Lastly, managers should be encouraged by the finding that an OMNR presence in a community is associated with higher satisfaction and evaluations. This result suggests that managers should emphasize building an OMNR presence within the Wawa District communities, and should consider placing some additional focus on developing positive community relations. Had this result been the opposite (i.e., an OMNR presence related to more negative views of access management), it would have suggested that the OMNRs overall approach was having a negative impact and should be reassessed and revised.

6.4.3 Other Management Considerations

It is important to briefly recognize that while the above discussion relates primarily to the subject of thesis (i.e., residents' satisfaction with access management and desirability evaluations), managers must balance residents' satisfaction with other factors not considered by this study. For example, managers also need to consider the level of protection accorded to the identified values in an area, and ensure that the access plan will provide adequate protection. Thus, managers must consider not only the desirability, but also the effectiveness, of access tools and controls. As well, managers need to consider the practicality of different management options in a given situation. For example, regulatory tools such as signage and road permits often require more active management than physical decommissioning approaches, which may make such tools impractical in some cases. In sum, this study provides information on one aspect of forestry road management, but must always be considered in concert with other values and management issues.

6.5 Summary

Interestingly, Wawa District is currently furthering its broad scale planning approach by developing a comprehensive broad scale approach incorporating all areas of the District equally through the CLUAH process (CLUAH, 2006). As discussed in this chapter, the current literature and guidelines suggests that a site-specific approach is best suited to enhancing satisfaction and management tool evaluations. Admittedly, however, the CLUAH process is a much more involved process leading to the broad landscape plan. The planning process began in 2003, and stakeholders have been involved throughout. It will be interesting to see how much public support there is for the access plans developed through this process. If public support and satisfaction increase, then this approach may become a new model for management. While the upfront work is onerous, if it is successful then the ongoing work will be less time and resource intensive than a purely site-specific approach. Employing this approach would not negate the benefits of implementing a complementary communication approach, which could be beneficial in both broad scale and site specific approaches.

Chapter 7: Conclusion

The goals of this study were to contribute to the research fields of forestry road management, recreation satisfaction, and recreationists' management preferences, and to provide practical information for managers in Wawa District, Ontario. The study complemented existing studies regarding recreationists' satisfaction and management preferences. In this chapter, I provide a brief overview of the work conducted and the results obtained, and provide some suggestions for future studies that would enhance or complement this work. I conclude with some final words about the forestry road management, and how the results of this study can assist in the planning process.

7.1 Study Overview

I examined residents' satisfaction with current forestry management in Wawa District, northern Ontario, and their desirability evaluations of specific road management tools using a social survey. I also evaluated the associations between residents' characteristics and use patterns and their satisfaction levels and management tool evaluations. The variables considered were age, community of residence, recreational activities pursued, frequency of use of forestry roads for recreation, familiarity with one's surrounding area, and environmental beliefs.

7.2 Findings Overview

On average, residents were dissatisfied with current management and considered all management tools apart from winter roads and natural abandonment as undesirable. However, satisfaction and management tool evaluations did vary with residents' characteristics and use patterns on forestry roads. All of the explanatory variables considered were associated to some degree with satisfaction and/or management tool evaluations, but some of the associations were in the opposite direction than hypothesized.

Age: There was weak support for the hypothesis that age is negatively correlated with management tool evaluations, as it was included in the strongest model in the physical decommissioning tools analysis. There was no support for the hypothesis that age is correlated with satisfaction.

Community of Residence: The results supported the hypothesis that management tool evaluations and satisfaction are positively correlated with community size. This aspect of community was

included in the strongest models in the satisfaction and regulatory tools analyses. There was some support for the hypothesis that an OMNR presence in a community is positively correlated with management tool evaluations. This variable was important in the physical decommissioning tools analysis. There was no support for the hypotheses that the degree of restrictions around a community is correlated with either satisfaction or management tool evaluations.

Frequency of use: The results supported the hypothesis that frequency of use of forestry roads for recreation is associated with satisfaction and management tool evaluations, in the direction hypothesized. Frequency of use was negatively correlated with satisfaction, physical decommissioning tool evaluations, and regulatory tool evaluations.

Familiarity: There was some support for the hypothesis that familiarity is correlated with management tool evaluations, but in the opposite direction than expected. It was positively correlated with the evaluations of physical decommissioning tools and passive management approaches. There was no support for the hypothesis that familiarity is correlated with satisfaction.

Recreational Pursuits: The results provided some support for the hypothesis that recreational pursuits are correlated with management tool evaluations, but no support for the hypothesis that activities and satisfaction are correlated. As expected, participation in consumptive or motorized recreation was associated with lower management tool evaluations, while participation in non-consumptive recreation was associated with higher evaluations.

Environmental Beliefs: The results supported the hypotheses that pro-environmental beliefs are positively correlated with residents' satisfaction and management tool evaluations. This variable proved important in all analyses apart from the desirability of passive management approaches.

However, the results showed that much variability in satisfaction ratings and management tool evaluations remained unexplained. Satisfaction ratings were poorly explained, and only models with frequency of use, environmental beliefs, and community size had any support over the null model. The explanations of desirability ratings were better for both physical decommissioning and regulatory tools, but were weak for passive management approaches. All of the explanatory variables were included in the strongest model for understanding desirability ratings for physical decommissioning tools, including the community variable related to population size. The strongest models for the regulatory tools analysis included frequency of use, community size, environmental beliefs, and participation in motorized land-based recreation

variables. Only the model with the familiarity variable had any support over the null model in the passive management analysis.

The low predictive values could result from a number of factors, related to both the study context and the study design. First, it is possible that the low predictive ability of the variables is related to the context of this study. Most previous studies that have identified relationships between user characteristics and road management preferences were conducted in a wildlife-conservation context. It is, therefore, plausible that some of these relationships differ, or are weaker, in Wawa District's primarily economic context.

Second, there may be important influential factors in this context that were not identified in previous studies. For example, Hunt et al. (2009) found that fairness of process, fairness of decision-making, scarcity of resources, and respect for other users all seemed to affect conflict over road access. Consequently, these factors might affect satisfaction and also the more specific evaluations for desirability of tools. Other factors may relate to the economic context of the area.

Third, there was also evidence in this study that different users were dissatisfied for opposing reasons. The structure of the current study does not discriminate between them, and cannot properly explain these ratings.

Fourth, the scale used for satisfaction could also be limiting the predictive ability of the results, if it led to an oversimplified grouping of individuals with varying levels of dissatisfaction. It is also possible that a similar issue occurred with the management tool desirability ratings, if respondents rated most, or all, tools as undesirable, when in fact there are greatly differing levels of undesirability that were not well represented.

Recognizing the low predictive abilities of the variables, the results, nonetheless, demonstrated that the different explanatory variables had different effects on satisfaction and perceptions of desirability. They showed that both satisfaction and desirability ratings are associated with residents' characteristics and recreational pursuits. Indeed, all of the explanatory variables that were considered were associated with satisfaction and/or perceptions of desirability by Wawa District residents. Community size, frequency of use, and environmental beliefs were important for satisfaction ratings. Community size, OMNR presence within a community, age, frequency of use, recreational activities pursued, familiarity, and environmental beliefs were all associated with management tool desirability.

Community size and environmental beliefs were positively associated with both

satisfaction and desirability ratings, while frequency of use was negatively associated with both. Age and the pursuit of consumptive or motorized land-based recreation were associated with lower desirability ratings, while familiarity and the pursuit of non-consumptive recreation were positively associated with the ratings.

7.3 Implications and Future Research

Understanding how user characteristics relate to satisfaction and management tool evaluations can help managers to understand and to predict how changes in access management might affect different segments of residents. Such knowledge can also help managers provide quality experiences for more participants by tailoring management approaches to specific user groups. Although much variation remained unexplained, if managers have a clear profile of area residents, they can use the results of this study to begin to understand how satisfaction and regulatory preferences are likely to vary amongst residents and apply this insight to assist with developing the most acceptable access management plans. However, given the low predictability of the model from the current study, it would useful to increase knowledge about the influential factors and the characteristics of these users. In this regard, future studies could build on this research in a variety of ways.

First, it would be interesting to use a different measure of satisfaction. As discussed, it is possible that some of the variation in satisfaction levels and management tool evaluations was overlooked because respondents were limited to 5-point scales. This future research might provide a more precise understanding of satisfaction levels and management tool evaluations, and may reveal the importance of additional explanatory variables that did not emerge in this study.

Second, it would be worthwhile to examine potential influential factors beyond those considered in this study. Although using different measures of satisfaction and desirability may reveal additional subtleties with the variables included in this study, it would be very surprising if this change would fully explain satisfaction levels. Thus, it would be valuable to identify other factors influencing satisfaction levels and perceptions of desirability, which could be combined with the results of this study to create a more complete picture of satisfaction and opinions in Wawa District. As mentioned, the factors affecting road access conflict that Hunt et al. (2009) identified (i.e., fairness of process, fairness of decision-making, scarcity of resources, and respect for other users) might also affect satisfaction and the more specific evaluations for

desirability of tools, and are worth exploring further.

Third, the high numbers of frequent users and the high levels of familiarity suggest that there are likely high levels of place attachment within the District. It would useful to identify specific locations to which users feel particularly strong attachment, and to delve deeper into these bonds. Identifying those areas that are of particular importance to specific groups of recreationists, and understanding the nature of this importance, can help managers who are developing zoning plans and management strategies.

Fourth, it would be useful to explore the reasons for dissatisfaction of consumptive versus non-consumptive recreationists. Does one group desire less restrictions while the other would prefer more, as speculated here, or do they share similar views?

Fifth, it would be useful to study the perspectives of groups other than residents. For example, it would be interesting to explore tourists' perceptions of access management and related issues.

Sixth, as discussed, Wawa District is in the process of developing a comprehensive, broad-scale zoning strategy. Given that this is a pilot project, it would useful to re-evaluate residents' satisfaction levels and management tool evaluations once this management strategy has been in place for a few years to determine whether it has had a positive, negative, or neutral influence on residents' perspectives.

Seventh, it would be interesting to explore access issues from a broader perspective, considering how these issues are (or are not) indicative of larger socio-economic regional issues. Although not discussed in-depth in this thesis, some of these issues were alluded to: namely, the decline of traditional forestry industries, the appearance of new stakeholders in the region (e.g., renewable energy proponents), and the subsequent immigration of new citizens into northern communities. If established citizens are viewing these changes with trepidation, it may be affecting how they respond to management strategies. Direct deterrents such as gates may be perceived as strong symbols of unwanted government intrusion into the lives of Northerners. While this is all speculation at this stage, it would be interesting to formally explore the links between these broader macro-issues and residents' responses to management plans.

Lastly, more knowledge of the effectiveness of different management tools is a key component of developing appropriate access strategies. There is currently little information available on the effectiveness of tools apart from signs. Therefore, more research is needed in

this area to fill this important gap. This would not be a direct extension of the current study, but useful complementary work.

7.4 Final Words

I conclude with a reminder of the OMNR's commitment to the inclusion of all interested parties in resource management processes and decisions (Environmental Registry, 2010). While this study does not negate the importance of providing for the participation of all interested parties in individual resource management planning and decision-making, the results can, nonetheless, assist managers in anticipating the preferences, and likely responses, of different segments of Wawa District residents towards the road access aspect of resource management.

In sum, forestry road management requires an integrated approach and a careful balance of economic, ecological, social, and cultural values. Developing the most effective and acceptable access plans demands an understanding of all values on the landscape, the effectiveness of possible management tools, area residents' profile and use patterns, and how these are likely to influence satisfaction and management tool evaluations. Maintaining current knowledge on the Wawa District population and the ties with satisfaction and management tool evaluations will allow managers to adapt and respond to the changing perspectives of their constituency.

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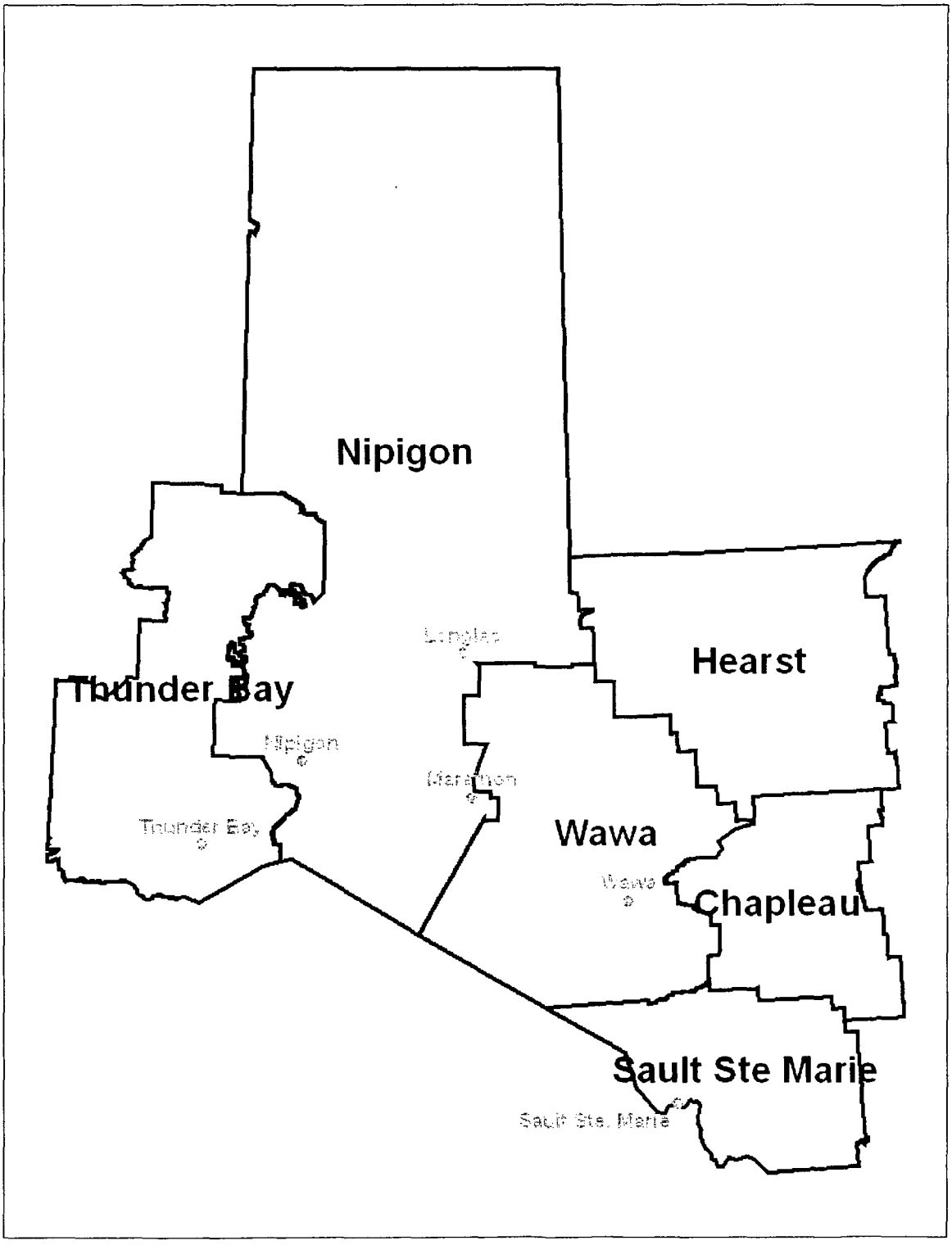
Appendix A: OMNR District Boundaries



Appendix B: Cover Letter

Dear Potential Participant:

I am writing to ask your help in a study on the management of logging roads. This study is looking at user preferences for different logging road management options in Wawa District. This study is being conducted by Lakehead University, in partnership with the Ontario Ministry of Natural Resources (MNR).

You are part of a random sample of northern Ontarians living in the MNR Wawa District. We want to hear from individuals like you about your views, experiences, and thoughts about logging roads within Wawa District. Since only a sample of individuals is being contacted, your response is very important to us.

Staff from the MNR will use the results of this study to better understand the views that residents have towards logging road management. This information will assist individuals working on land use and forest management planning efforts with Wawa District.

Your answers are completely confidential and will be released as summaries in which no individual's answers can be identified. A unique number is located on the return envelope. We use the number to avoid mailing reminders to individuals that have completed the survey. Once your survey has been returned it is separated from the envelope, and the link between your name and the survey number is permanently deleted.

The survey is voluntary, and you may at any time choose not to answer one or more questions or to stop completing the survey. However, you can help us very much by taking approximately 25 minutes to share your experiences and views.

All information you provide will be shared only amongst researchers and will be securely stored at Lakehead University for seven years. The findings of this project will be made available to you at your request upon completion of the project. Your name, or any other identifying information, will not be revealed in any published materials. There are no expected risks to you associated with this study.

If you have any questions or concerns, please do not hesitate to contact me at (807) 343-8882 or at kawhitmo@lakeheadu.ca, Dr. Norm McIntyre at (807) 343-8963 or nmcintyr@lakeheadu.ca or Dr. Len Hunt at (807) 343-4007 or len.hunt@ontario.ca. You may also contact Lakehead University's Research Ethics Board at (807) 343-8283.

Thank you for your cooperation!

Sincerely,

Kim Whitmore
Graduate Student

Appendix C: Informed Consent Card

To use the information you provide we are required to obtain your written permission. Please initial the space below, and rest assured that immediately upon receipt of your survey this card will be separated from the survey to ensure anonymity.

By initialing this box, I confirm that I have read and understood the information about this study provided to me by the researcher, and I agree to participate in the Wawa District logging road management study.

Appendix D: Questionnaire

1. **How important are Crown Lands (public, non-park lands) for recreation to you personally?** *(please circle the number that best describes your view)*

Not Important		Somewhat Important		Very Important
1	2	3	4	5

2. **How familiar are you with the following Crown Land areas within Wawa District?** *(please see map on front cover for reference)*

	Not at all familiar	Somewhat familiar	Very familiar
Algoma Forest	1	2	3
Black River Forest	1	2	3
Magpie Forest	1	2	3
Nagagami Forest	1	2	3
White River Forest	1	2	3
Big Pic Forest	1	2	3

3. **Do you use forest access (logging) roads for recreation in Wawa District?**

☐ Yes ☐ No (***Please skip to question 7***)

4. **How often do you usually use logging roads in Wawa District for recreation in each season?** (*please check one box for each season)*

	Never	<1x per week	1-2x per week	3-5x per week	>5x per week
Spring	☐	☐	☐	☐	☐
Summer	☐	☐	☐	☐	☐
Fall	☐	☐	☐	☐	☐
Winter	☐	☐	☐	☐	☐

5. **What activities do you pursue on or from logging roads in Wawa District?** *(please check one box for each activity)*

Yes	No	
☐	☐	Hunting or Trapping
☐	☐	Fishing / Ice Fishing
☐	☐	Other motorized recreation on land (e.g., snowmobile, ATV)
☐	☐	Other motorized recreation on water (e.g., jet ski)
☐	☐	Other non-motorized recreation on water (e.g., canoeing)
☐	☐	Other non-motorized recreation on land (e.g., skiing, hiking)
☐	☐	Work
☐	☐	Gathering (e.g., firewood, berry picking)
☐	☐	Other (please specify) _____

6. Which of the following does your household own? ***(please check one box for each item)***

Own	Do not own

☐	☐	Boat
☐	☐	Canoe or Kayak
☐	☐	Outboard Motor
☐	☐	4 wheel Drive Truck or Sports Utility Vehicle
☐	☐	All terrain vehicle (ATV)
☐	☐	Snowmobile
☐	☐	Other (please specify): _____

7. **Please indicate your level of agreement or disagreement with each of the following statements concerning tourism and recreational aspects of logging roads in Wawa District.** *(please circle the number that best describes your view)*

	Strongly disagree		Neutral		Strongly agree	No opinion
Residents have a right to access and use all of Ontario's Crown (public) lands for all types of recreation	1	2	3	4	5	☐
All roads on Crown lands should be unconditionally open to the public	1	2	3	4	5	☐
Remote areas (areas not accessible with motor vehicles) should exist outside of parks	1	2	3	4	5	☐
Current remote areas should become road accessible	1	2	3	4	5	☐
Concerns of tourism operators are given too much weight when making decisions about logging road access and restrictions	1	2	3	4	5	☐

Concerns of road-based recreationists are given too much weight when making decisions about logging road access and restrictions	1	2	3	4	5	☐
Tourists and tourist operations are important for local economies	**1**	**2**	**3**	**4**	**5**	☐
The decisions about logging road access and restrictions are fair	1	2	3	4	5	☐
The processes used to make decisions about logging road access and restrictions are fair	**1**	**2**	**3**	**4**	**5**	☐
Public road access to remote tourism lakes can negatively impact tourists' experiences	1	2	3	4	5	☐
Restricting access to logging roads to maintain remote areas is a reasonable management tool	**1**	**2**	**3**	**4**	**5**	☐
Current logging road management gives sufficient protection to tourism operations	1	2	3	4	5	☐
***Current logging road management* provides sufficient recreation opportunities for the public**	**1**	**2**	**3**	**4**	**5**	☐

8. **Please indicate your level of agreement or disagreement with the following ideas for managing logging roads and recreation in Wawa District.** *(please circle the number that best describes your view)*

	Strongly disagree		Neutral		Strongly agree	No opinion
Community members should volunteer their time to help	1	2	3	4	5	☐

maintain logging roads						
All public land users should pay fees to help maintain logging roads	1	2	3	4	5	☐
Recreational use of public lands should be planned by separating incompatible uses (e.g., areas with motorized access, wilderness recreation areas, ecologically sensitive areas)	1	2	3	4	5	☐
Recreationists should be encouraged to pursue non-motorized recreation near remote tourism operations	1	2	3	4	5	☐
Liability concerns are a major barrier to community involvement in road and trail maintenance	1	2	3	4	5	☐

9. How satisfied or dissatisfied are you with the current ways that the MNR manages logging roads in Wawa District? ***(please circle the number that best describes your view)***

Very Dissatisfied		Neutral		Very Satisfied	No Opinion
1	2	3	4	5	☐

10. For cases where logging road restrictions are necessary, please rate the desirability or undesirability of each tool. *(please circle the number that best describes your view)*

Tool	Very Undesirable		Neutral		Very Desirable
Natural abandonment (no road maintenance)	1	2	3	4	5

Water crossing removal – removing bridges	1	2	3	4	5
Water crossing removal – removing culverts	1	2	3	4	5
Physical removal of roadbed (making a road impassable to vehicles)	1	2	3	4	5
Road impediments (e.g., ditches, boulders)	1	2	3	4	5
Winter roads (road is only passable in winter)	1	2	3	4	5
Signs restricting all use and areas	1	2	3	4	5
Signs restricting specific areas (e.g., no use of road to access a lake)	1	2	3	4	5
Signs restricting seasonal use (e.g., no use permitted from May 15 to October 15)	1	2	3	4	5
Road use permits (permits are necessary for road use)	1	2	3	4	5
Gates	1	2	3	4	5

11. Would you like to share any thoughts about the different tools available to implement logging road access restrictions?

_____

_____

_____

_____

12. Please indicate your level of agreement or disagreement with the following statements. *(please circle the number that best describes your view)*

	Strongly disagree		Neutral		Strongly agree	No opinion
We are approaching the limit of the number of people the earth can support	1	2	3	4	5	☐
Humans have the right to modify the natural environment to suit their needs	1	2	3	4	5	☐
When humans interfere with nature it often produces disastrous consequences	1	2	3	4	5	☐
Human ingenuity will ensure that we do NOT make the earth unlivable	1	2	3	4	5	☐
Humans are severely abusing the environment	1	2	3	4	5	☐
The earth has plenty of natural resources if we just learn how to develop them	1	2	3	4	5	☐
Plants and animals have as much right as humans to exist	1	2	3	4	5	☐
The balance of nature is strong enough to cope with the impacts of modern industrial nations	1	2	3	4	5	☐
Despite our special abilities humans are still subject to the laws of nature	1	2	3	4	5	☐
The so-called "ecological crisis" facing humankind has been greatly exaggerated	1	2	3	4	5	☐
The earth is like a spaceship with very limited room and resources	1	2	3	4	5	☐
Humans were meant to rule over the rest of nature	1	2	3	4	5	☐

The balance of nature is very delicate and easily upset	1	2	3	4	5	☐
Humans will eventually learn enough about how nature works to be able to control it	1	2	3	4	5	☐
If things continue on their present course, we will soon experience a major ecological catastrophe	1	2	3	4	5	☐

13. Are you? *(please check the appropriate box)*

☐ Male ☐ Female

14. Please indicate your age *(please check the appropriate box)*

☐ 24 years or less	☐ 40-44 years	☐ 60-64 years
☐ 25-29 years	☐ 45-49 years	☐ 65-69 years
☐ 30-34 years	☐ 50-54 years	☐ 70 years or older
☐ 35-39 years	☐ 55-59 years	

15. What is your postal code?

16. What is the highest level of education you have achieved? *(please check the appropriate box)*

☐ Some primary or high school	☐ Some college or university
☐ Completed high school	☐ Received college/university degree or diploma

☐ Trade or vocational qualification ☐ Received postgraduate degree (e.g., M.B.A.)

17. Are you a member of any of the following groups? *(please check one box for each category)*

Yes	No	
☐	☐	A hunting association
☐	☐	A fishing association
☐	☐	An environmental organization
☐	☐	A motorized recreation association (e.g., ATV, snowmobile)
☐	☐	A non-motorized recreation association (e.g., cross country skiing)
☐	☐	A tourism organization (e.g., NOTO)
☐	☐	Other (please specify): _____

THANK YOU for participating in the Wawa District logging road survey. Your answers to the questions are key to the success of this project. If you have any additional comments or concerns, please feel free to write them on the back cover.

Appendix E: Postcard Reminder

Last week a questionnaire seeking your views about logging road management in Wawa District was mailed to you. Your name was drawn randomly from a list of all Wawa District residents.

If you have already completed and returned the questionnaire to us, please accept our sincere thanks. If not, please do so today. We are especially grateful for your help because it is only by asking people like you to share your opinions that we can understand peoples' road management preferences and consider these preferences in future management plans.

If you did not receive a questionnaire, or if it was misplaced, please call us at 705-856-7107 and we will get another one in the mail to you today.

Appendix F: Final Letter

Dear Participant,

About three weeks ago I sent a questionnaire to you that asked you about your opinions regarding logging road management in Wawa District. To the best of our knowledge, it has not yet been returned.

The comments of people who have already responded include a wide variety of perspectives on road management strategies. We think the results are going to be very useful to District managers and planners.

We are writing again because of the importance that your questionnaire has for helping to get accurate results. It's only by hearing from nearly everyone in the sample that we can be sure that the results are truly representative.

If you think that you should not have received the questionnaire, please let us know the reason on the cover of the questionnaire and return it in the enclosed envelope so that we can delete your name from the mailing list.

A comment on our survey procedures. A questionnaire identification number is written on the return envelope so that we can check your name off of the mailing list when it is returned. The list of names is then destroyed so that individual names can never be connected to the results in any way. Protecting the confidentiality of people's answers is very important to us.

We hope that you will fill out and return the questionnaire soon, but if for any reason you prefer not to answer it, please let us know by returning a note or blank questionnaire in the enclosed stamped envelope.

Si vous preferez completer un sondage en français, s'il vous plait renvoyer le sondage dans l'enveloppe fourni avec FRANÇAIS écrit sur la couverture, et on va t'envoyer une version française.

Sincerely,

Kim Whitmore
Graduate Student

P.S. If you have any questions, please feel free to contact me at (807)-343-8882.

Appendix G: Recreation, Tourism, and Access Beliefs

Table AG.1.

Agreement, Disagreement, and Average Ratings (+2 Strongly Agree and -2 Strongly Disagree) for Statements Related to Recreation, Tourism, and Access.

Statement	Agree (%)	Disagree (%)	Neutral (%)	Mean
Residents have a right to access and use all of Ontario's Crown (public) lands for all types of recreation	79.4	13.4	7.2	1.21
All roads on Crown lands should be unconditionally open to the public	68.4	20.6	11.0	0.84
Remote areas (areas not accessible with motor vehicles) should exist outside of parks	52.7	21.0	26.3	0.52
Current remote areas should become road accessible	36.6	38.0	25.4	0.00
Restricting access to logging roads to maintain remote areas is a reasonable management tool	37.0	45.8	17.2	-0.21
Tourists and tourist operations are important for local economies	66.3	15.5	18.2	0.84
Public road access to remote tourism lakes can negatively impact tourists' experiences	42.5	35.6	21.9	0.06
The processes used to make decisions about logging road access and restrictions are fair	18.0	57.4	24.6	-0.70
Concerns of tourism operators are given too much weight when making decisions about logging road access and restrictions	67.2	16.2	16.6	1.08
Concerns of road-based recreationists are given too much weight when making decisions about logging road access and restrictions	24.2	48.9	26.9	-0.40
The decisions about logging road access and restrictions are fair	19.1	56.8	24.1	-0.66

Statement	Agree (%)	Disagree (%)	Neutral (%)	Mean
Current logging road management gives sufficient protection to tourism operations	57.7	17.8	24.5	0.62
Current logging road management provides sufficient recreation opportunities for the public	34.9	46.7	18.4	-0.23

Appendix H: Beliefs on Access Management Practices

Table AH.1

Agreement, Disagreement, and Average Ratings (+2 Strongly Agree and -2 Strongly Disagree) for Statements Related to Road Access Management Practices.

Statement	Agree (%)	Disagree (%)	Neutral (%)	Mean
Community members should volunteer their time to help maintain logging roads	28.5	41.4	30.1	-0.26
All public land users should pay fees to help maintain logging roads	17.0	64.3	18.7	-0.83
Recreational use of public lands should be planned by separating incompatible uses (e.g., areas with motorized access, wilderness recreation areas, ecologically sensitive areas)	51.3	25.6	23.1	0.31
Recreationists should be encouraged to pursue non-motorized recreation near remote tourism operations	54.0	22.7	23.3	0.50
Liability concerns are a major barrier to community involvement in road and trail maintenance	54.0	22.7	23.3	0.50