Mapping Recreation Use Patterns and Forest Values: A Canadian Boreal Forest Case Study

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Abstract

People attribute values to the places they use for forest recreation. Such values are often difficult to access and even more difficult to incorporate in forest management and planning. As potential sources of conflict in forest management, understanding the different values attached to specific forest places is important for resource managers. Past research has tended to focus on survey-based methods of eliciting these values and has largely neglected both their contextual nature and spatial distribution. More recently, several projects have explored a wider variety of elicitation methods and experiment with various ways of spatially representing forest values.

Developments in Geographic Information System (GIS) technology and especially its accessibility through the World-Wide-Web have led to significant growth in the use of public participation GIS (ppGIS). This growth is occurring in both developed and developing nations where the spatial representation of physical and social attributes is central to planning issues. Although problems still remain in terms of accessibility and ease of use, the rapid growth of this technology and its increasing success in enhancing public involvement processes in managing natural resources has assured its place in planning technology.

This study focused on understanding the nature and mapping the spatial distribution of forest values in the Boreal forest surrounding five northwestern Ontario communities. A web-based survey was created using GIS-maps and a list of forest values to allow participants to mark locations in the study area and indicate their associated values. The survey provided respondents with the flexibility to mark specific sites (e.g., fishing spots), linear features (e.g., rivers) and also areas (e.g., lakes). Moreover, respondents were able to choose a scale that was most appropriate for their mapping purposes. However, due to low internet speeds in the communities, some participants encountered difficulties with loading the map and using the mapping tools. To

overcome this issue, a paper version of the survey was provided. A random sample of 750 people was invited to participate in the web-survey (50%) or in the paper survey (50%). The online and paper survey response rates were respectively of 31 per cent and 21 per cent.

The survey responses were used to produce a density map showing the spatial pattern of valued places, a High Use Areas map and associated forest values within these areas. Analyses of forest values and use characteristics (i.e., activity and frequency of use) of the sites helped to interpret the use patterns on the map. The spatial representation of the values assigned to special places in a working forest, allowed the integration of recreational values and use characteristics into forest planning at the local and regional levels. Several High Use Areas were located in specially designated management areas that recognise the importance of recreational use. The remaining High Use Areas occur along major access roads for industrial forestry which highlights the significance of forestry operations in providing access to forests to local recreationists. The recognition of these High Use Areas and their characteristics provides important information for including recreational perspectives into forest and land use planning.

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Table of Content

List of Figures

List of Tables

List of Acronyms Used

CR	Conservation Areas
DRM	Dog River-Matawin
EMA	Enhanced Management Area
GIS	Geographic Information System
ppGIS	Public Participation GIS
LCC	Local Citizens Committee
HUA	High Use Areas
NGO	Non-Governmental Organisation
NW	North West
OMNR	Ontario Ministry of Natural Resources
PP	Provincial Parks
ROS	Recreation Opportunity Spectrum
SRPF	Spatial Recreation Planning Framework
WWW	World Wide Web

Chapter 1: Introduction

1.0 Origins of value conflicts

Many Ontarians attach great importance to nature-based activities including passive nature-related activities such as wildlife viewing, and more active pursuits such as recreational fishing or hunting (DuWors, Villeneuve, & Filion, 1999). Through these diverse nature-based activities, Ontarians observe, interact, and experience recreational settings. These interactions and experiences result in "the attribution of meaning and the valuing of specific landscapes and places" (Brown, 2005, p.18) that enables a site (undifferentiated space) to become a "place" (Brown, 2005) (Refer Figure 1.1).

Brown (2005) notes that the social and cultural background of each individual affects the mix and values weightings for different settings. Moreover, during the different interactions with the environment humans will develop attachment to or emotional bonds with places (Brown, 2005). This concept has different names within the literature: sense of place (Lynch, 1960; Tuan, 1974; Williams, Patterson, Roggenbuck, & Watson, 1992; Brown, 2005) or place attachment (Tuan, 1974; Williams, et al., 1992; Hailu, Boxall, & McFarlane, 2005; Gunderson, & Watson, 2007). This attachment leads to the construction of "special places" (Refer Figure 1.1). Because of this attachment for "special places" and divergence in values (economic or ecologic vs. e.g. recreational), land use conflicts between forest production and non-productive activities may develop (Refer Figure 1.1).

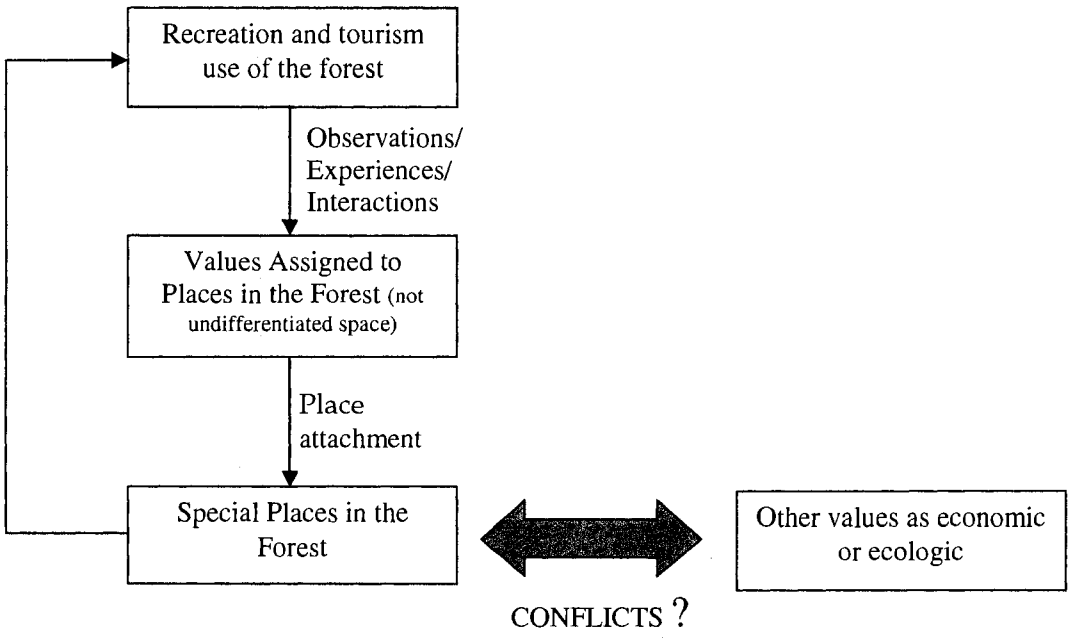

Figure 1.1: Origins of Value Conflicts

The concept of place attachment, comprising place dependence (i.e. the function of this place to achieve a specific goal) and place identity (i.e. the emotional attachment to the site (e.g. belongingness, rootedness) (Gunderson, & Watson, 2007; Hailu, et al., 2005; McIntyre, Yuan, Payne, & Moore, 2004), is undergoing a resurgence of interest among recreation and tourism researchers. Whereas the theory of place attachment is well developed, the integration of the concept into recreation and tourism planning is only now beginning to be explored (Brown, 2005). For a long time planning processes have been using spatial representation of concepts in mapping physical and economic parameters. By spatially representing places, the concept of place attachment can be included appropriately in planning that facilitates negotiation in conflict situations.

1.1 Integrating Recreational and Tourism Values in Forest Planning

One way to facilitate negotiation and resolution of land-use conflicts is to incorporate recreation proactively in the forest planning process instead of dealing with them reactively on a case-by-

case basis. To find solutions for these conflicts, researchers have used the integration of public involvement in management planning processes (Brown, 2003; 2005; 2006; Gunderson, & Watson, 2007; 2006; McIntyre et al., 2004). This public involvement has the goal of creating a means whereby different users are able to be involved in negotiating a satisfactory planning outcome for an area in which they have an interest.

The will to include the different users of the forest within the planning process exists already. However, the focus is mainly on resources (e.g., the Recreation Opportunity Spectrum providing information about the supply) and neither the forest industry nor the Ontario Ministry of Natural Resources (OMNR) really consider recreation in the planning process nor are they required to. Nevertheless, Local Citizen's Committees (LCCs) exist and are involved in assisting "the plan author and the interdisciplinary planning team in the preparation of the Forest Management Plan" (Algoma Forest Local Citizens Committee, 2008). Most of these LCCs have someone representing Crown land recreation however, a major criticism of the LCC's is that members are appointed by the MNR District Manager from within different interest groups, so they are not open to anyone willing to be part of them (personal communication with Jeff Moore, October 6th 2008). Tourism is considered within forest management planning processes, as direction and advice are provided by the Ontario's Tourism and Forestry Industry Memorandum of Understanding (MOU) and the Management Guidelines for Forestry and Resource-based Tourism (Forest Management Branch, 2008). The forest managers, the resource-based tourism industry, and the Ontario government were involved in the development of the MOU and the Guidelines (Forest Management Branch, 2008). However, many of the values used by the tourist industry are business specific and are established to pursue business interests (Forest Management Branch, 2001) and do not compensate for the lack of information on recreational

use attached to specific sites and on how this use interacts with forest activities. The integration of a recreational value dimension in planning can influence positively the nature of public involvement and the quality of the outcomes (McIntyre, et al., 2004; More, Averill, & Stevens, 1996). Recreational and tourism values relate to more than just the use of the forest for a specific purpose (e.g., hunting or hiking), they are complex constructs influenced by diverse life contexts and experiences. They lead an individual to identify his or her "special places" and if threatened, these places may be the focus of conflicts. Knowing these places and the values attached to them can aid in substitution concerns, e.g. can people easily move from one place to another when access is closed? Such knowledge can inform planning decisions and potentially avoid conflicts. This thesis argues that the elicitation and mapping of the values attached to places is a constructive way to incorporate proactively the recreational and tourism needs of individuals and communities into forest planning processes.

A previous project by McIntyre et al. (2004), conducted in the Dog River-Matawin Forest to the west of Thunder Bay, as part of the Ontario Living Legacy: Lands for Life Program elicited and mapped the forest values of residents and tourists using a combination of focus groups, mapping, and surveys (McIntyre, et al., 2004). A Spatial Recreation Planning Framework (SRPF) for Crown Lands was developed in this project. This framework combined a Recreation Opportunity Spectrum (ROS) approach with users' values in the forest planning process (Yuan, et al., 2004). The ROS as defined from resource criteria as access, size or naturalness does not allow a consistent predictive relationship between recreation opportunities and the actual setting in which they occur (McIntyre, et al., 2004). Thus, the ROS does not provide information on recreation demand. Integrating users' values and their mapping, allows the understanding of the actual uses of the forest (i.e., locations and characteristics). Users' values do not relate to supply

but to demand based on public preferences for recreational opportunities. The SRPF brings together the supply (ROS) and the demand (values) and permits their integration in the planning process (Yuan, McIntyre, Moore, & Hunt, 2006).

1.2 A spatial representation of forest values

This study focuses on recreation values within the boreal forest near five northwestern Ontario communities: Red Rock, Nipigon, Schreiber, Terrace Bay and Marathon. The main goal is to answer the following question: What is the nature and spatial pattern of forest values attached by residents of these communities to sites within the study area?

In the following chapters, I will first explore the existing literature on the topic. I will then consider the strengths and limitations of previous research on eliciting and mapping values to set the methodological context for this study. Then, the methods used in the project will be described. To conclude, I will present the results and discuss them in the final chapters.

Chapter 2: Literature Review

2.0 Introduction

This chapter begins with a discussion of existing literature on outdoor recreation in northern Ontario and on eliciting and mapping values. Then the concepts of value and place are considered, clarifying the focus of the study. Finally, different methods and applications of elicitation and mapping values and their benefits and limitations in directing the choices and considerations made in the study are explored.

2.1 Recreation in northern Ontario

Nature-related activities and more specifically outdoor recreation activities are important to Canadians. Harshaw, Sheppard & Kozak (2007) reported that according to the 1996 *Nature Survey* "84.6% of Canadians aged 15 and older participated in one or more nature-related activities; of these, 43.7% engaged in outdoor recreation activities in natural areas". In 1996, 56.3% of the user days for outdoor activities took place in forested areas outside parks and protected areas (Williamson, Hoscheit, & Luttrell, 2002; Harshaw, et al., 2007).

The activity patterns of northern Ontarian residents illustrate the importance of outdoor recreation for the general Canadian population. Forested areas and nature in general are within short distances of residential areas and provide a rich variety of easily accessible opportunities for nature-based recreation.

These same opportunities are also attractive to visitors to the area. In 2002, 6.3 million visitors from Canada, the U.S.A. and overseas were traveling in northern Ontario, 61 per cent of these visitors participated in outdoor activities (FEDNOR, 2002). Compared with southern Ontario, where only 38 per cent of visitors engaged in nature-based pursuits. Northern Ontario is "Ontario's nature-based destination" (FEDNOR, 2002). Forty seven per cent of tourists visiting

northern Ontario enjoyed fishing or hunting during their stay (FEDNOR, 2002). Northern Ontario also appeals to travelers interested in water-based recreational activities (e.g., canoeing, kayaking and white water rafting). According to FEDNOR (2002), the top five outdoor activities among northern Ontario visitors while on their trip (Refer Table 2.1) are fishing (55%), hiking/backing in wilderness settings (54%), wildlife viewing (53%), motor-boating (53%) and canoeing/kayaking (52%). Hunting comes in tenth position (20%), however, these visitors represent 59 per cent of all hunters in the province. Research indicates that northern Ontarian residents differ from tourists in their pursuit of activities. Hunt and McFarlane (2002) found day hiking was the most popular activity followed by fishing, wildlife viewing, motor-boating or jet-skiing and hunting (Refer Table 2.1). Residents place hunting in fifth position (in contrast with the tenth position for tourists). As demonstrated by Hunt and McFarlane (2002) fishing is about equally popular with northern Ontarians and tourists however, hunting is much more popular with locals.

Table 2.1: Tope five outdoor activities among northern Ontario visitors and northern Ontarian

Top 5 outdoor activities	**Among Northern Ontario visitors (FEDNOR, 2002)**	**Among Northern Ontarians (Hunt & McFarlane, 2002)**
1	Fishing	Day Hiking
2	Hiking/Backing in wilderness settings	Fishing
3	Wildlife viewing	Wildlife viewing
4	Motor-boating	Motor-boating or Jet-skiing
5	Canoeing/Kayaking	Hunting

While day hiking can be pursued all year round, temporal aspects affect the pursuit of the next four most popular activities among northern Ontario residents. While fishing (open water and ice) can occur any time of year, seasonal closures exist for some species: in the study area

walleye (*Sander vitreus*) season starts the third Saturday in May and ends April 15th, the brook trout (*Salvelinus fontinalis)* season starts January 1st and ends on Labour day (September 3rd) and the lake trout (*Salvelinus namaycush)* season starts January 1st and ends September 30th (Fish & Wildlife Branch, 2008; personal communication with Len Hunt, June 2nd, 2008). Wildlife viewing happens all year but, the hibernation of some species might reduce its frequency during winter. Motor-boating and jet-skiing take place approximately between May and November (i.e., after ice melt and before ice formation). Hunting occurs in the fall with season regulations depending on the species and weapons (i.e., bow and arrow vs. gun). In northern Ontario, the season starts with black bears (*Ursus americanus*) August 15th and ends for all species between October 31st or December 15th (Fish & Wildlife Branch, 2008; personal communication with Len Hunt, June 2nd, 2008). Moose (*Alces alces)* hunting is particularly appreciated in the study area, an important date is the opening of the resident gun season for moose starting the second Saturday in October (personal communication with Len Hunt, June 2nd, 2008).

In a study conducted by Hunt and McFarlane (2002), over 60 per cent of northern Ontarian respondents visited Crown lands while recreating. Potential conflicts between the recreationists and the forest industry may exist (Hunt, Twynam, Haider, & Robinson, 2000). These authors found that logged settings affect nature-based recreation differently. Consumptive and motorised activities are well suited to logged settings, while physically demanding non-consumptive activities are better suited to unlogged areas. Consumptive and motorised activities are dependent on forest roads and logged areas to provide access, terrain and better visibility for hunting (Hunt, et al., 2000; Bottan, Hunt, Haider, & Rodgers, 2001). This understanding is crucial for proactively integrating recreation and values into the forest planning process.

2.2 Values

Researchers in natural resource management have interpreted values in a variety of ways. Tindall (2003) described values as culturally and emotionally informed orientations about desirable and appropriate standards for judging appropriate actions and goals. Values can also be considered to be broad fundamental beliefs (Zinn & Manfredo, 1998), acting as the foundation for an individual's and norms (Manfredo et al., 2003), or as shared beliefs about acceptability of a specific action or situation (Zinn & Manfredo, 1998; Vaske & Donnelly, 2002). This study uses Brown's (1984) definition that values are expressed preferences for one thing or situation over another. He distinguished two types of values; "held" and "assigned". Brown defined held values as "an enduring concept of the preferable which influences choice and action" (p. 132). Held values are general values (e.g., beauty) shaped by diverse factors related to life contexts, experiences and circumstances (e.g., individual or group concern) (McIntyre, et al., 2004). Both instrumental and non-instrumental held values exist (Bengston, & Xu, 1995). The concept of instrumental values (comprising economic/utilitarian and life support values) arises from the utility attached to an object such as a forest in attaining human ends (Bengston, & Xu, 1995). On the other hand, the concept of non-instrumental values (aesthetic and moral/spiritual values) "focuses on the worth of something as an end in itself rather than a means to some end" (Bengston, & Xu, 1995, p.5). Bengston and Xu suggest that held values for forests have shifted over the last 15-20 years from a utilitarian to a more biocentric focus. While held values are useful to understand societal changes, they are less useful for forest and land use planning (McIntyre, et al., 2004) as they are not site or area specific. Held values guide people's decisions (More, et al., 1996) and thus have an influence on assigned values.

Brown (1984, p.233) describes assigned values as "the expressed relative importance or worth of an object to an individual or group in a given context". Evaluations of assigned values are made through "implicit or explicit comparisons with other objects" (More, et al., 1996). For forest values, the evaluator will compare different sites and areas of forests he or she knows and then select a site based on his or her preference for a (some) site(s) among others for a specific type of recreation. Assigned values are, therefore, particularly useful for forest and land use planning and provide a close connection to the study of "special places".

2.3 Place

Other researchers have described values as subjective and revealing "specific relationships between a particular person or group" and a particular site (More, et al., 1996, p.400). This subjectivity is also perceived in the definition of values as "direct or indirect qualities of natural systems that are important to the evaluators" (Satterfield, 2001, p.332). Environmental values are thus influenced and constructed by the diverse life contexts (e.g. culture, politic situation or psychological states) and experiences of the particular individual or group (Davies, 2001) with the site. The interactions between a site and humans, experiencing and thus creating special relationships with it, lead to the attribution of values. The change in relationship allows the site to become a place (Brown, 2005), such as reported by Gunderson (n.d.; 2006). Tuan (1975, p.152) describes "*place* as a center of meaning constructed by experience". These values, associated with the diverse interactions among humans and between humans and the natural environment will create a *sense of place* (Brown, 2005). In other words, place attachment will be created. Place attachment may be focused on place dependence (i.e. the function of this place to achieve a specific goal) and/or place identity (i.e. the emotional attachment to the site (e.g.

belongingness, rootedness)) (Gunderson, n.d.; Hailu, et al., 2005; McIntyre et al., 2004). In this way, places become 'special' to the individual and are valued or preferred over others.

2.4 Eliciting and Defining Forest Values

The constructivist approach which views values as unique to the individual and context argues that researcher-determined, de-contextualised lists of values that are used commonly in forest value surveys (Gunderson, n.d.) fail to adequately represent the full range of context specific values attached to forest sites by people who use them. For this reason, researchers who ascribe to a constructivist approach prefer qualitative procedures to elicit values (Davies, 2001; McIntyre, et al., 2004).

Qualitative methods help to determine context-related values more adequately in a specific region (Gunderson, & Watson, 2007; McIntyre, et al., 2004). These values can then be used in follow-up surveys in the same region to provide a more generalisable assessment of value characteristics for a particular forest or region (McIntyre, et al., 2004). For a previous project carried out in the boreal forest, west of Thunder Bay, ON, McIntyre, et al. (2004) elicited forest values using focus groups. Participants were asked to evoke and describe experiences and stories related the specific places in the forest. A second phase of this same study provided participants with an opportunity to point out directly on maps their "special places" and the values associated with them. This study was focused on places within the boreal forest in northern Ontario and provided a useful set of values for use in their study.

Interpretative approaches involve interviews with key informants (e.g. hunters, fishers, motorised and non-motorised recreationists, cottagers, tourism operators, environmental and tourism NGO's) and community members to elicit forest values (McIntyre, et al., 2004). A combination of purposive and snowball sampling seems to be the most efficient way to access

key informants, (i.e., purposefully selected interviewees). For example, member of a cottage association are first approached and using their networks (i.e., snowballing) the informant base is expanded (Gunderson, n.d.).

Although these methods provide great insights and rich information about the values of the studied region, qualitative approaches present the limitation that the small sample limits generalisation beyond the specific context and sample (Brown, 2005). For example, with focus groups only a limited amount of spatial data is obtained, which limits the potential integration of the results into broad-scale planning.

2.5 Mapping Forest Values

Recent studies by Brown (2003; 2005; 2006; Brown & Alessa, 2005) have attempted to address the small sample size issue associated with qualitative values mapping studies. By using survey methods, Brown (2003; 2005; 2006) accessed a more diverse and larger sample of the target population, which provided reliable findings and facilitated their integration into planning processes. A description of the methods he used for mapping values through surveys is now presented.

The distribution of the survey followed the standard procedure of Dillman (3 stages, i.e., sending of survey package, reminder, and complete survey package if necessary) (Dillman, 1978). The survey package containing a cover letter that explained the project, the survey instrument that included a map of the study area, and stickers that allowed the participant to locate and rank the values assigned to a specific site. The task of ranking values differed within the studies. One task asked respondents to allocate a certain rank based on a $100 value for each point marked on the map (Brown, 2005). The second task provided a list of six predefined rated dots for each value that were weighted from 50 (highest) to 5 (lowest) (Brown, 2005).

For the efficiency of the survey, Brown (2005) noted the importance of considering map aspects such as: "size, scale, colour, use of colour, and landscape features to include for reference." However, response rates to his surveys were low (ranging from 32% to 18%). Brown speculated that several factors influenced the response rate including time of the year, familiarity with the area, the complexity of the task, and the age and geographic literacy of participants. Other reasons might include the use of a pre-determined list of 'held' values, rather than a contextually-based set of 'assigned' values which would be more directly relevant to the study site. Gunderson and Watson (2007) argued that by asking respondents to rank predetermined values, researchers may miss essential meanings. This set of values corresponds to a held value. In addition, while 'held' forest values may well be suitable at the forest level, assigned values are more appropriate for evaluating specific forest sites (McIntyre, et al., 2004). Qualitative methods help to determine context-rooted values more adequate to a specific region (Gunderson, & Watson, 2007; McIntyre, et al., 2004). These values can then form the basis for the development of a values scale specific to that same region (McIntyre, et al., 2004).

The data analysis by Brown, was done using ArcView Spatial Analyst that converted the data to raster data (grids) by calculating the density of point locations. Each value was then associated with a density grid and the creation of descriptive maps of landscape values and their spatial densities was then possible (Brown, 2005; Brown, 2006). The exportation of the density grids to SPSS allowed a regression analysis of the data (Brown, 2006). One way to integrate these data into the planning process was to combine the different value maps to identify areas of agreement and disagreement with land use activities in the landscape (Brown, 2005). For instance, land use development is not well suited to support wilderness values. Overlaying the

landscape values can allow the creation of a system of ranking of potential land use activities (Brown, 2005).

Besides the fact that this method of surveying by mail evoked a low response rate, it is also time consuming for researchers, as this method also required that data be transferred from the paper maps to GIS. Moreover, the use of dots limited the interpretation as dots provide no flexibility concerning the size or shape of the area (Brown, 2005). The scale of the map provided was also problematic as it was fixed for all individuals and did not allow respondents to choose the most appropriate scale to indicate their special places.

Recently, researchers (Carver, Evans, Kingston, & Turton, 2000; Carver, Evans, Kingston, & Turton, 2001; Carver, Evans, & Fritz, 2002; Evans, Kingston, Carver, & Turton, n.d.) have begun using web-based map approaches to address these shortcomings.

2.6 Web-based surveys

Ghose (2001, p. 142) argued that "electronic technology is the fastest and surest way to access, transfer, and manipulate spatial information." Indeed, the use of this technology facilitates analysis and interpretation of data. For researchers, it also provides better access to information for participants and a more interactive and popular way of being involved in a survey (Carver, et al., 2000; Carver, et al., 2001; Carver, et al., 2002). The use of World-wide Web (WWW) has revealed that by being able to explore spatial and non-spatial information about an issue under study and by allowing experimentation with the data, participants have a better understanding of the situation and are more willing to get involved (Carver, et al., 2000). Web-based mapping toolset is argued to not only make the problem more concrete but also to make the process interactive and fun, and thus more popular than a paper survey (Carver, et al., 2001).

Through these approaches, participants can mark an area or a site and add commentaries or assign some criteria to a place (Carver, et al., 2000). Therefore, the WWW has a strong potential as survey tool by making them more interesting to the public. Moreover, the use of an electronic format allows ease of data processing and a better quality of information that is "unbiased" (Evans, et al., n.d.) by the necessity for researchers to transfer data from paper maps to GIS. Using web-surveys with GIS maps, enables participants the flexibility to mark the areas not only as specific sites but also to indicate linear features such as roads or rivers and also area features such as lakes or forest tracts. This flexibility may produce a more realistic and accurate representation of the spatial pattern of valued places used by participants.

Despite these obvious advantages internet use also has some limitations. Its potential is restricted to people with an easy access to and familiarity with internet (Carver, et al., 2000). Low income groups or older people may not have internet at home and the latter may not be able to use computers and internet without assistance (Carver, et al., 2000). Beyond these, non-participation biases may be present in terms of gender, and differences of access depending on the level of education, the social background (Carver et al., 2000; Carver et al., 2001) or the residency, i.e., urban versus rural residency (Statistics Canada, 2006). With adequate planning, however, many of these limitations can be overcome or reduced.

Approaches to overcome these deficiencies have included: free access to computers and internet in public places such as libraries, community centres, council buildings, schools, universities or businesses (Carver, et al., 2000; Carver, et al., 2001); training and assistance in these public places (Carver, et al., 2001); tutorials incorporated in the web-based surveys; and the use of appropriate language and presentation (Carver et al., 2001). As with new technology

generally, the implementation of the web-based map survey will need to place particular focus on issues of accessibility and ease of use through extensive pre-testing with target groups.

2.7 Research Questions

By using and interacting with the forest through recreational activities, people assign values to "special places" in the forest and thus become attached to specific sites or localities. Because of this attachment, conflicts can arise between forestry activities and the way people value and use special places. To mitigate these conflicts, the integration of the concept of place attachment into the management process seems crucial.

This research aims to address the following research question: What is the nature and spatial pattern of forest values attached by residents to places within the study area?

To address this question, the study focuses on answering the following questions:

- What are the values attached to the boreal forest and the recreational use patterns of residents who use them?
- Where within the forests is recreational use concentrated? How are areas of high use characterised by recreational activities and the values that residents attach to them?
- What are the implications of the existence, values, and participation characteristics of these high use areas for forest management?

I will also examine some methods-related research questions. These questions will focus on: what are the relative merits of the different survey modes; and do respondents have a propensity to use sites, polygons, or lines to mark important areas?

Chapter 3: Methods

3.0 Introduction

In order to examine residents' values and to explore the recreational use patterns of the boreal forest, a web-based survey approach was adopted. This approach was used as the most efficient way of accessing a representative sample of the residents in the study area.

This chapter describes the study area and the web-based GIS survey, including its construction. The chapter next discusses the sampling approach methods for data collection and analyses.

3.1 The study Area

The study area (Figure 3.1 and 3.2) encompasses the southern portions of the Black Sturgeon, Lake Nipigon and Kenogami Forest Management Units and includes the Lake Superior Shoreline Enhanced Management Area (EMA). The southern boundary of the study area is defined by the Lake Superior shoreline. The western and eastern limits and the northern extent of the study area were arbitrarily defined because the actual recreation ranges of the residents were unknown. The study area includes the communities of Red Rock, Nipigon, Schreiber, Terrace Bay and Marathon.

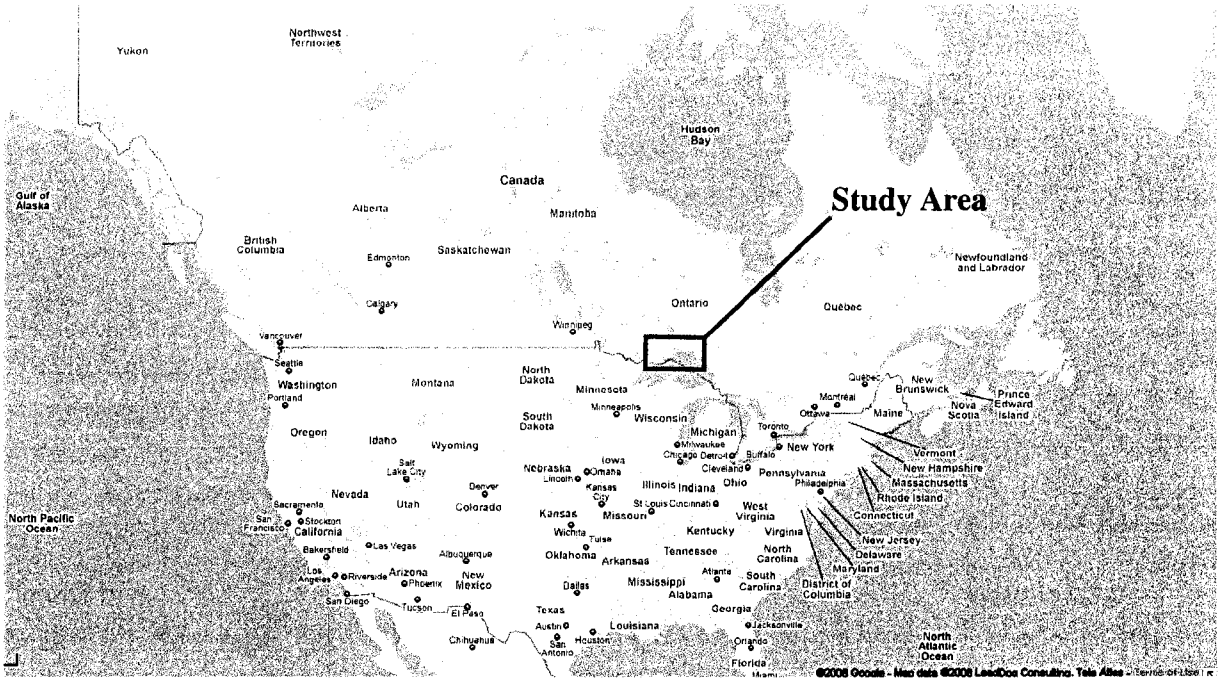

Figure 3.1: Context map of the study area (Google – Map data 2008 LeadDog Consulting, Tele Atlas)

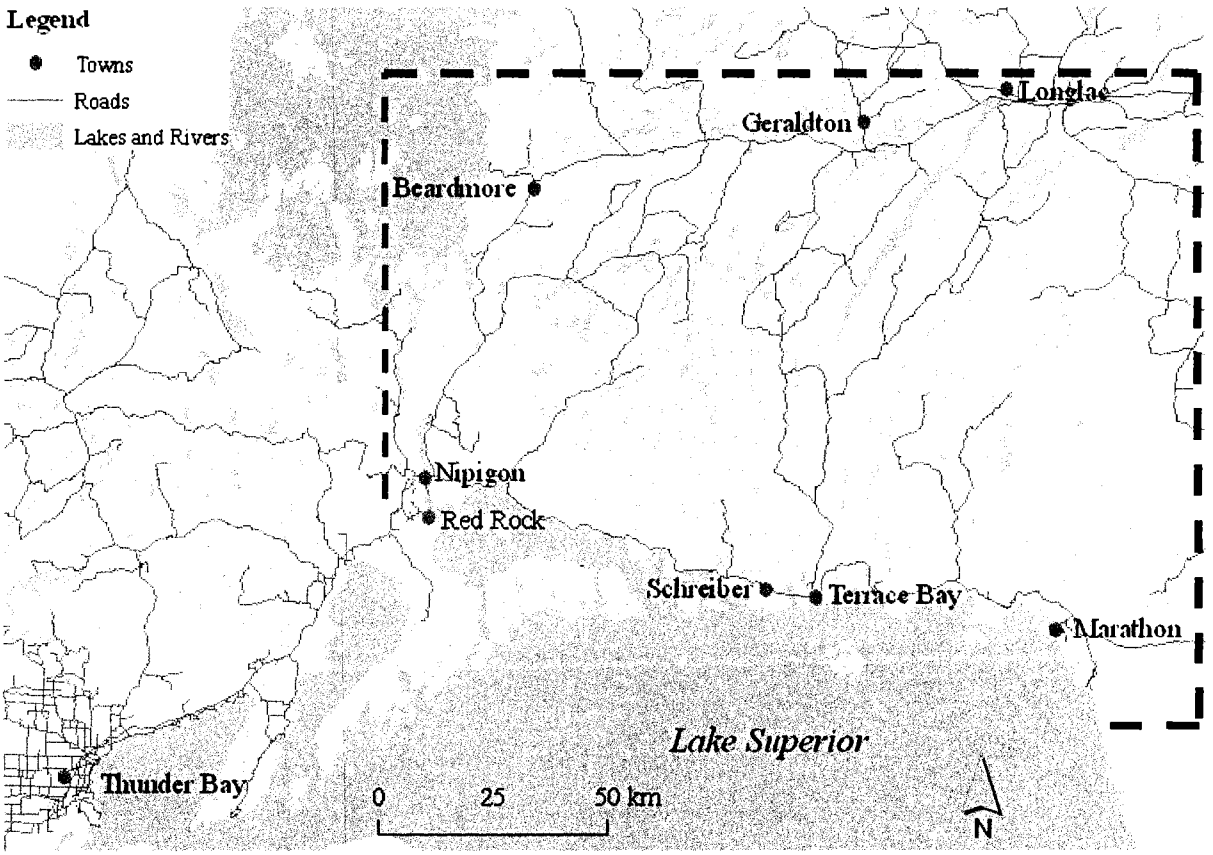

Figure 3.2: Map of the study area

3.2 The Survey

To capture a large and diverse sample of the target population, a quantitative approach using a web-based GIS survey was used in this project. The survey was designed to collect information on socio-demographics (e.g., gender, age, place of residence) and use experience (e.g., frequency and season of use, type(s) of activity). The participants were also asked to mark and locate on a map, sites, areas, or routes that they had used and to rate each mark on seven value statements using a 5-point importance scale (5 = very important). Because of the context of the boreal forest and the proximity and cultural and physical similarities between the study areas (northern Ontario: East and West of Thunder Bay), the values list from the Dog-River Matawin boreal forest area of NW Ontario (McIntyre, et al., 2004) was used for this survey. These values are holistic views of place and include *Family Recreation* (comprising Lakes and Bequest values), *Wilderness & Solitude, Adventure, Fishing & Hunting* (encompassing Friends, Social and Access values), *Lots of things to do* (importance of Access), *Wildlife* and *Other Values* (more general values such as learning, economic, sacred, feeling at home and management). They were derived from a qualitative study and are thus grounded in the same context as the study area in this project (Refer Appendix 2 for a copy of the survey).

The web-survey was developed so that individuals could return to their previously entered data and add new data. A survey requesting feedback on the web-tool, was also included (Appendix 3).

Survey development

The development of the mapping tool has primarily involved the Geomatics Division of the Ontario Ministry of Natural Resources (OMNR), Thunder Bay. While my focus was on creating the survey, trialing and getting feedback on the tool (see the data collection: First stage),

Geomatics addressed the technical development. The delivery of the survey was managed through the CARIS server in the School of Forestry & Forest Environments (Dr. Ulf Runnesson), Lakehead University. After many revisions the tool was distributed in its final version in September to residents in the region between Red Rock and Marathon.

3.3 Phase 1: Piloting the Survey (refer Figure 3.3)

In late spring and early summer (May/June) of 2007, a pilot study of the web-based survey was undertaken. Initially, two phases of sampling were used to inform people about the project, establish contacts and get feedback on the content and construction of the web-survey. A purposive sampling was used to access key informants and their networks within the five communities of Red Rock, Nipigon, Schreiber, Terrace Bay and Marathon.

Initially, the sample was limited to community officers from the main towns and OMNR employees. Later the sampling was extended to include members of recreation groups and clubs (e.g., cross-country skiers, snow-mobilers, hunters, fishers). In-person meetings, phone calls, and interviews were used to disseminate the web-site address to allow individuals to access and provide feedback on the survey design. Feedback on the map information, the drawing tools, the questions and on difficulties with using the website were provided allowing improvements to the web-survey during July and August prior to full implementation in the fall of 2007. Individuals indicated that the use of the term 'special place' could bring resistance to participation, as people could be unwilling to share their "secret spots" (e.g., fishing spots). It was therefore decided to look first at identifying use places and then at assigning values to these places.

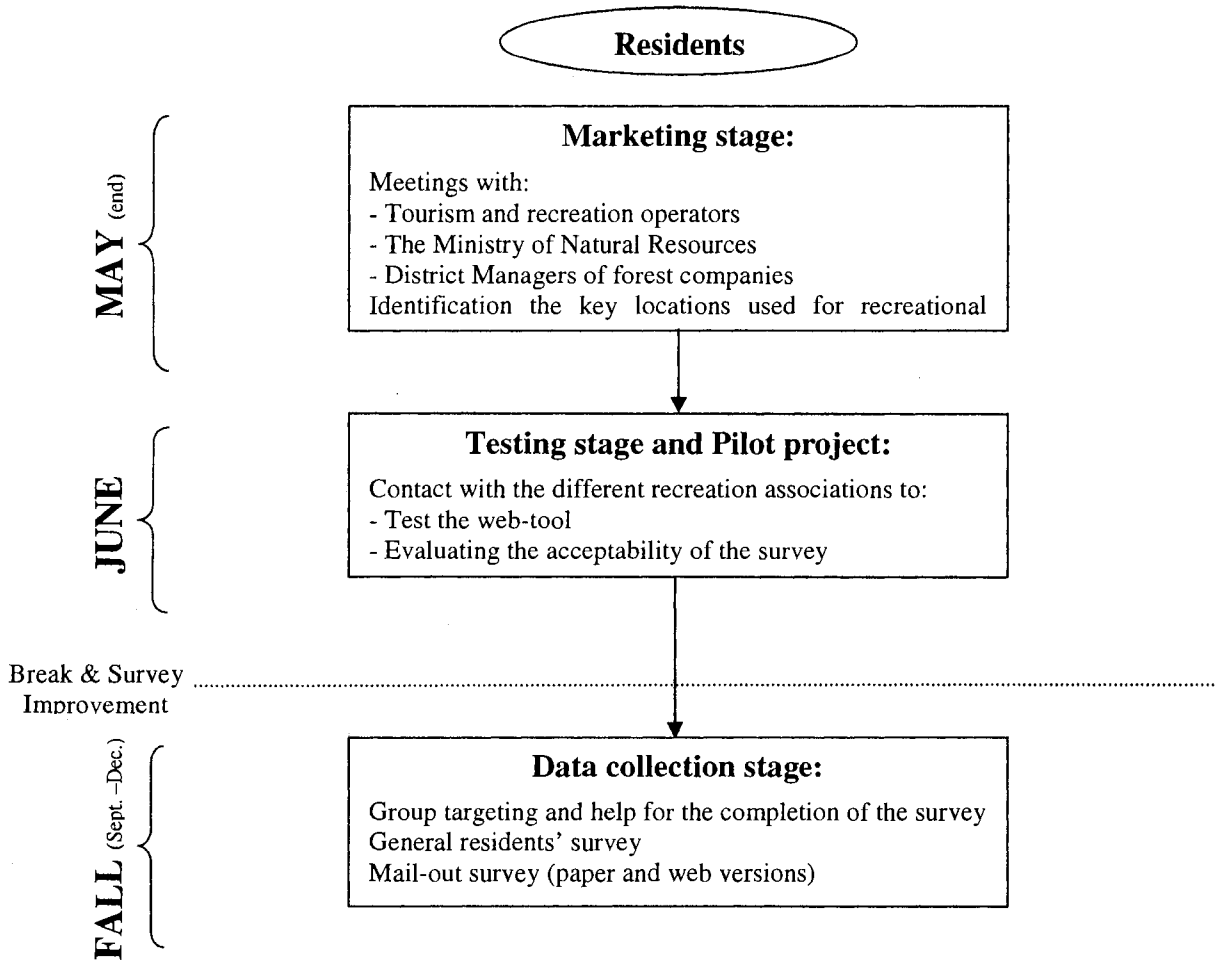

Figure 3.3: Implementation of the Pilot project

3.4 Phase 2: Data collection (Fall 2007)

In the fall of 2007, the full survey was implemented (see Figure 3.3). During this implementation, the survey was administered to a sample of residents in the five communities. Potential participants were made aware of the survey through posters and flyers distributed in shops, restaurants and bars, online local newspaper, television (Terrace Bay and Schreiber local television) and radio (interview by CBC) advertisements.

Moreover, open-houses were organised to introduce residents to the project and to familiarise them with the GIS web-survey. As access to computers and the WWW was possibly

difficult for low income or older people, the availability of computers and internet access in public places such as community centres and libraries was well publicised.

Feedback revealed difficulties with the web-site that provided less than optimal loading speeds and response capability. A paper version of the survey was made available to overcome technical difficulties, to ensure the highest possible response rate and to facilitate access to the survey.

A list of 750 residents and their contact information were selected from a data base purchased from *info***USA**. To maximise the spatial coverage, the selection of the 750 persons was stratified according to the population distribution from Census data in the five communities (see Table 3.1). The percentages of population in each major community in the study area were established and these values were then used to select a random sample from each of the five communities.

Table 3.1: Population and Sample distribution among the study area

Communities	**Population distribution (in persons) (according to Census Data)**	**Sample distribution (in persons)**
Red Rock	1063 (11.5%)	86 (11.5%)
Nipigon	1752 (19.0%)	142 (19.0%)
Schreiber	901 (9.8%)	74 (9.8%)
Terrace Bay	1625 (17.7%)	132 (17.7%)
Marathon	3863 (42.0%)	316 (42.0%)
Total area	9204 (100.0%)	750 (100.0%)

Source: Statistics Canada (2007)

Administration of the survey (Figure 3.4)

The random sample of 750 residents selected from the five communities, was randomly divided into two equal groups (375 in each) and stratified for the five communities by the Census distribution (Table 3.1). Residents received a letter introducing the project and inviting them to

participate with a notification of the web-site address. Additionally, the mail-out sample received a paper version of the survey (including a colour map) and a consent form (375 residents). In all cases, the sampled individuals were instructed that they could use the other mode for the survey (Figure 3.4). Both groups (web and paper surveys) received three postcard reminder contacts to maximise responses (Dillman, 2000) (Figure 3.4).

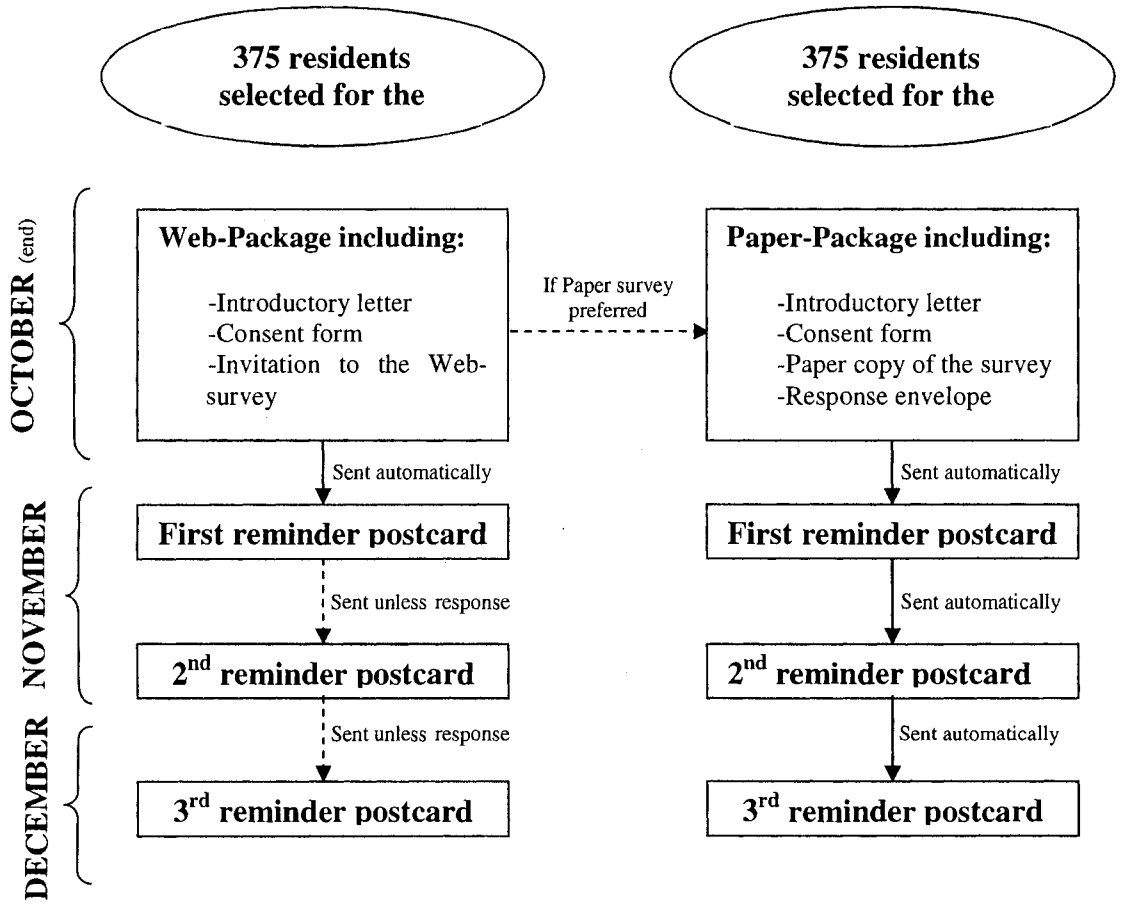

Figure 3.4: Implementation of the Data collection, second phase

3.5 Data analyses

The data were analysed in two ways. First, the values attached to sites by respondents were mapped using density distributions in ArcGIS that enabled exploration of the distribution of recreational use and identification of High Use Areas (Refer Figure 3.5). The forest values, site characteristics and use data were analysed using Microsoft Excel and SPSS (Refer Figure 3.5).

These analyses enabled the recognition of the respondents' broad spatial patterns of recreational use in the area and the associated activities, relative value ratings, and seasonal preferences.

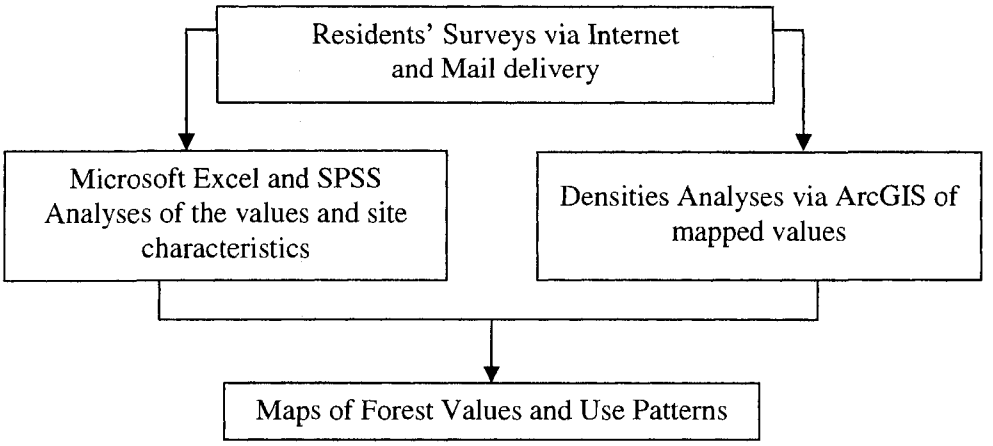

Figure 3.5: Schematic Analyses Design

3.5.1 The GIS Mapping Methods

The mapping analysis was first undertaken using a density analysis procedure in ArcGIS. A density analysis allows the creation of a map representing the overlapping and concentrations of the sites designated by respondents on the maps. A density function is available in ArcGIS for data points and lines. However, this density analyses function in ArcGIS is not available for polygons. It was, therefore, necessary to create an alternative design to reproduce the required functions.

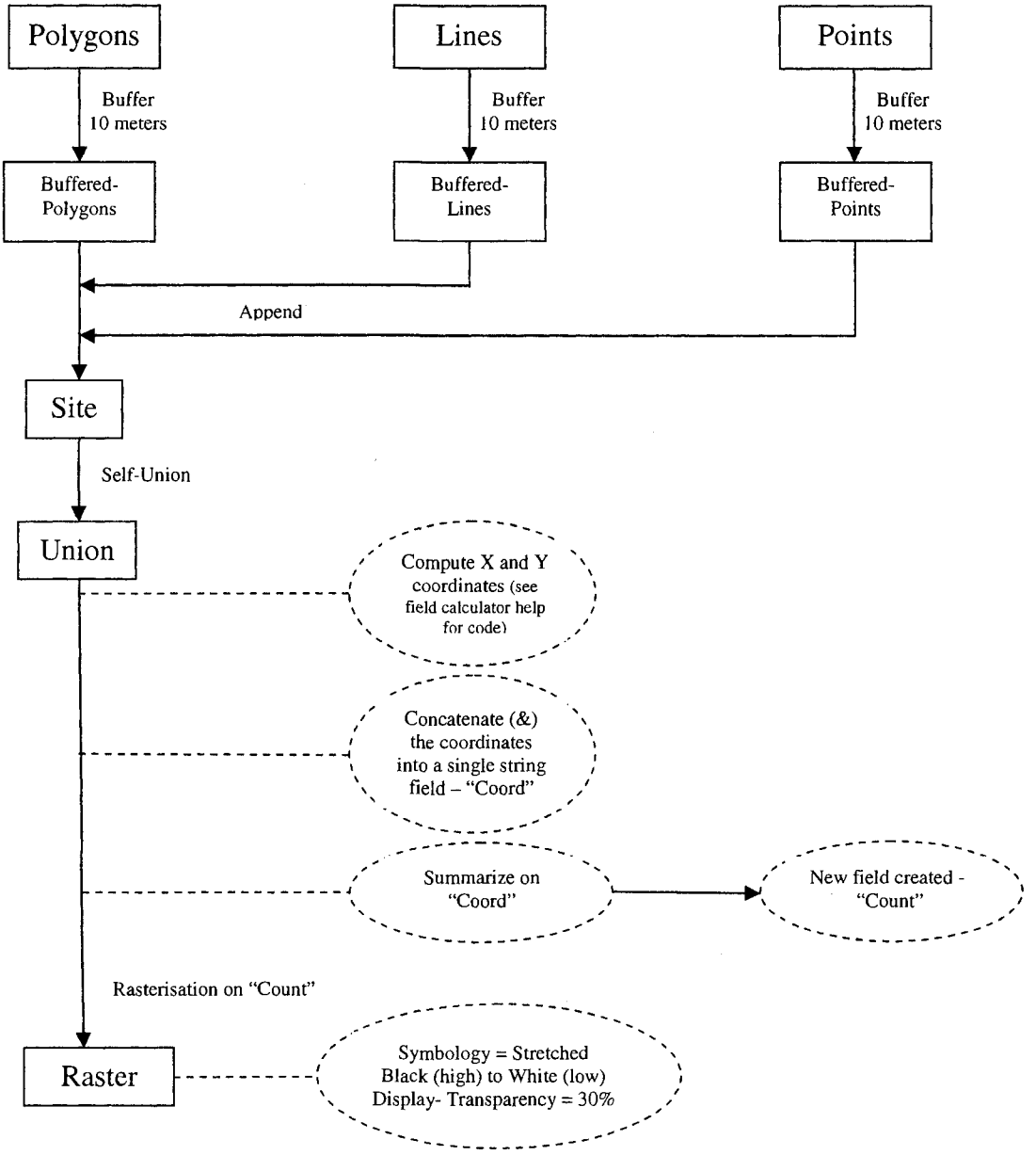

Figure 3.6: Density analysis Design in ArcGIS

Three layers (called "Polygons", "Lines" and "Points") comprising the data from the Web and Paper surveys were produced which included all the polygons, lines and points designated. Buffering the data was required to convert the line and point layers to polygon layers so they could be combined to each other and analysed. A 10-meter buffer around each mapped site was chosen to increase the consistency of the information, assuming that the mapping of specific sites

could have been more or less accurate depending on the participant. After conversion of the data to polygon layers, each of these layers (i.e., point, line and polygon layers) could be appended to each other generating a new polygon layer, called "Sites", encompassing all localities. This final layer (Sites) was then self-unified, the X and Y coordinates computed and then concatenated into a single string field, which allowed all the data to be summarised on this new field. These different steps allowed a division into smaller polygons each of them related to a count number of how many people marked this specific division. This layer was then rasterised (cellsize (X; Y): 0.001 decimal degrees (dd); 0.001 dd) using the count field. This provided a density map of the area that represented density of use using a gradient from white to black, where a darker tone indicated a high density of use (see Figure 3.6). This procedure resulted in a map of the Recreational Use Patterns.

From this map, using an appropriate criterion, a map of High Use Areas (HUA) was produced. The operation required selecting the divisions marked by at least eight respondents. Eight seemed to be the best trade off between precision and aggregation patterns and was for this reason the criterion chosen. Considering the responses/total population ratio of 1/45 (i.e., 201 responses received for a total population of 9,205 residents), the criterion of at least eight respondents is thus representative of at least 366 persons.

3.5.2 General site description analysis

Using Microsoft Excel, frequency distributions of the individual forest values, activities and frequency of use by season were produced to allow a general description of the relative importance of the various values and to describe the recreational use by residents of the area. Respondents were asked to nominate the three top activities in which they participated at each site they marked on the map. The list of 38 recreational activities was classified based on the

frequency of nomination and on the similarities between activities into seven main categories of consistent sizes: 'Fishing', 'Hiking' (including also Biking activities); 'Hunting' (including also Trapping activities); 'Water Sports'; 'Camping' (including also Cottaging); 'Winter Sports' (including also Motor Sports); and 'Nature & Relaxation'. These seven activity categories were used in all subsequent analyses.

For each site marked on the map and each season, respondents were also asked to rate their frequency of use based on the following scale: "never", "less than1", "1 – 2", "3 – 5" and "more than 5" times per week.

3.5.3 Forest Values and Recreation Use Characteristics analyses

The K-Means Cluster Analysis procedure (SPSS 16-0) was used to categorise the individual sites on the basis of the seven value categories (*Family Recreation*, *Wilderness & Solitude*, *Adventure*, *Fishing & Hunting*, *Lots of things to do*, *Wildlife* and *Other values*). Prior to clustering, all value ratings were converted to Z-scores to normalise the distributions and thus ensure consistency across categories (George & Mallery, 2003). Cluster analyses use variables, in this case, the Z-scores value categories, as criteria for agglomerating the individual sites into relatively homogenous groups (Norušis, 1990, p.B-155). K-means clustering is one partitioning technique (Steinley, & Brusco, 2008) that attempts to reduce the within-cluster errors, by providing externally isolated and internally cohesive clusters (Cormack, 1971). The choice of four clusters in the analysis provides significantly different and cohesive groups of comparable size. Studying these clusters allows the common and differing characteristics of the various sites in terms of forest values to be determined (Norušis, 1990, p.B-155).

The discriminant analysis procedure (SPSS 16.0) was used to determine the value characteristics of the clusters. For known distinct groups, a discriminant analysis can be used to

predict membership on the basis of a series of discriminating variables (George, & Mallery, 2003, p.278). In this case, the groups are the four clusters and the discriminating variables are the seven forest values. This procedure allowed the key discriminating values for each cluster to be determined and to assess the validity of the clusters.

The frequency of site use by season in the different clusters was analysed using a one-way ANOVA procedure (SPSS 16-0). As explained previously the frequency of use was categorised in five classes of use per week and per season ("never", "less than 1", "1 to 2", "3 to 5" or "more than 5"). ANOVA provides comparisons of sample means (George, & Mallery, 2003, p.144). Using a one-way ANOVA, the means of one dependant variable, i.e. in this case the frequency of use, and one independent variable (i.e., the clusters) are compared revealing significant differences (George, & Mallery, 2003, p.144). The Scheffé test was used to determine more precisely which clusters were significantly different from each other (George, & Mallery, 2003, p.144).

Using these procedures, it was possible to assign a specific site to a particular cluster and hence, associate it with a particular set of forest values, mix of recreation activities, and use characteristics by season. Assignment of specific sites to High Use Areas (HUAs) enabled the recognition and characterisation of these areas in terms of these same variables.

3.6 Ethical considerations

Ethical concerns related to the use of web-based surveys have been noted as susceptible to excluding older people and those from lower income groups. This issue was addressed by facilitating access to computers and assistance in public venues (e.g., libraries and community centres) and using a paper survey mode.

Prior to participation, a letter informed the residents of the project and of the use of the data as an input in planning recreation opportunities in the forests and waters surrounding their community. Before proceeding to the survey, participants were required to agree to participate and thus to give their free and informed consent. Participants were also informed of their right to withdraw from the survey at any time or to decline to answer any specific question. The cover letter and consent form are attached as Appendix 1.

The survey did not request information enabling identification of the respondent. Socio-demographic and use characteristics are reported as aggregate data in reports and publications. If a participant wished to re-visit the web-survey he/she needed to provide a confidential 'username'. Also, any participant wishing to receive reports or maps and/or gave permission to be contacted in a follow-up, he/she was asked to provide an email or mailing address. These addresses were kept in a secure place, separate from the data, and were used only for the purposes agreed and by the persons designated on the web-site and will be destroyed at the end of the project. Map data are presented in reports and publications only as recreational use patterns and High Use Areas, hence, maintaining the confidentiality of individual sites or locations.

No potential harm or risks to the participants were perceived from this study. The participants were not put at risk or deceived. Data will be stored in a secure place at Lakehead University for a period of 7 years. No personal information is stored with these data.

The proposal for this project was peer reviewed by my supervisor Norm McIntyre and my other committee members: Len Hunt and Mike Yuan. Their approval is attached as Appendix 4. My supervisor and the other committee members participated in my study. Moreover another

graduate student Kimberley Whitmore helped at various stages of data collection. The letter confirming her understanding of the ethic procedures is provided (Appendix 5).

The research results maps and a summary of the final research findings will be made available to all participants through the Centre for Tourism and Community Development Research website. Data and results from this project will be incorporated in the EFPS project (*Reducing uncertainty of wood supply through better understanding of recreation use: An application of the Spatial Recreation Planning Framework*). A hard copy of the final thesis will be available in Lakehead University Patterson Library and the research findings will be disseminated to the academic community through conferences and the publication in professional and academic journals.

Chapter 4: Results

4.0 Introduction

The purpose of this project was to better understand how residents value their forests by exploring the recreation use patterns and meanings associated with the boreal forests in the region from Red Rock to Marathon in NW Ontario.

This chapter provides a comparative analysis of the response rates based on the place of residence of the participants. Subsequently, the recreational use patterns of the participants were studied using ArcGIS. The recreational use patterns were produced from the resulting density map. Finally, the values and the activity and use characteristics of the different sites were explored to provide a description of the recreational use patterns.

4.1 Response Rates and Characteristics of Respondents

A random cluster sampling technique was adopted for this study. The basis of the cluster sampling was the relative proportions of potential respondents in each of the five communities (Red Rock, Nipigon, Schreiber, Terrace Bay and Marathon). Respondents were chosen randomly from a mailing list (*info***USA**) within each of these clusters.

At the time of the mail out no external attention was given to the study (i.e., no radio or poster advertisements), it is then assumed that no contamination of the sample occurred. 400 persons were considered for the web-survey sample, 375 persons contacted by mail and approximately 25 contacted during the first phase of the project. Although people were given the option to fill out the alternative version of the survey, it is assumed that participants who chose the alternative mode for the survey were balanced between the two samples. The web-based survey attracted 122 responses from the 400 initial contacts, giving a response rate of about 31

per cent. In contrast, the paper survey response rate was 21 per cent (79 responses from 375 contacts).

Despite the higher response rate in the web survey, it was noted that the web survey provided significantly fewer locations than the web survey, as 122 web responses produced 112 sites whereas, 79 paper survey responses provided 302 sites (see Table 4.1).

Table 4.1: Sites marked on the map by respondents of each survey mode

	Web-survey (N =122)	**Paper survey (N = 79)**
Polygons	46	249
Lines	26	39
Points	40	14
Total sites	**112**	**302**

Analyses of the demographic characteristics of respondents to the combined surveys (web and mail-out) indicated that the spatial distribution of respondents (see Table 4.2) did not differ significantly from the original sample selected (Chi-square= 3.15; df = 4; $p > 0.1$) as determined from the census (Statistics Canada, 2007) distribution, Marathon being slightly under-represented. This was the main criterion used to determine the selection of individuals in the original sample.

Table 4.2: Comparison between the spatial population and the spatial responses

Communities	Sample percentage (according to Census Data)	Response percentage
Red Rock	11.5	10.5
Nipigon	19.0	23.9
Schreiber	9.8	10.5
Terrace Bay	17.7	20.9
Marathon	42.0	30.8

Although the main criterion in sample selection was satisfied there were disparities in both the gender and age distribution of the sample.

Gender representation is quite skewed as women are significantly under-represented in the sample (Chi-square= 7.31; df = 1; $p < 0.01$) (see Table 4.3) as compared to census population estimates.

Table 4.3: Gender comparison of the population versus respondents

Gender	Population percentage	Response percentage
Male	50.1	76
Female	49.9	24

The age distribution of the sample is significantly different (Chi-square= 4.49; df = 2; $p < 0.05$) from the census distribution and revealed an under-representation of those under 40 years old (Table 4.4). Seventy-eight per cent of the sample population has lived in the area for 20 years or more (62% for over 30 years).

Table 4.4: Age comparison of the population versus respondents

Age	Census Population percentage	Response percentage
Age 20 - 39	27.4*	13.5*
Age 40 - 59	50.3	56.5
Age over 60	22.3	29.5

** – indicates differences $p < 0.05$*

In summary, there is confidence in the spatial distribution of respondents to the survey, which was the main criterion on which respondents were chosen. In terms of age and gender the respondent population was not representative of the general population of the area. The lack of representativeness of the sample with regard to the age and gender is challenging for the generalisation of the results to the study area population. However, the male domination of responses may well reflect the actual demographic of involvement in outdoor recreation in the area.

4.2 GIS Mapping of Recreational Use Sites for the Study Area

The first stage in the analysis was to map the broad recreational use patterns in the area. Initially, a map was created using density analyses within ArcGIS to show the recreational use patterns of residents of the study area.

4.2.1 Recreational Use Patterns for the Study Area

This map[1] (Figure 4.1) shows the most heavily used areas of the study area. A grayscale was used, where a darker tone indicated a high density of use. Spatial patterns of higher use were distinguishable along the Lake Superior shore, the highways and forest roads (around Red Rock, Nipigon, Schreiber, and Terrace Bay), and along the Nipigon River and Lake Nipigon. No high

[1] To create these maps, no sites were excluded from the analyses. A sensitivity analysis of this assumption showed that the overall pattern changed slightly when excluding the bigger sites (Refer Appendix 6).

density areas around Marathon were indicated. This result may have arisen because only a few roads in the area north of Marathon exist and, as a result, access is quite restricted. This interpretation was supported by observations from the web-survey data and contacts with people from Marathon indicated that residents tended to travel east and outside the study area for recreation purposes. However this result might also be a consequence of the slight under-representation of residents from Marathon.

The map also shows the spatial extent of recreational use from people living in the communities (see Figure 4.1). Between Red Rock and Terrace Bay, the recreation use of areas by residents was limited to about 150km north of Hwy 17 and as far west as Lake Nipigon (Figure 4.1). Around Marathon, people did not travel north but rather spread to the east and south. As indicated previously, no high density use areas are located around Marathon. This distribution shows the maximum distances that most people are willing to travel for recreation.

In summary, most people are willing to travel up to 150km north where forest roads provide access and west as far as Lake Nipigon. The recreational range of people living in the communities allows a relatively precise definition of the study area.

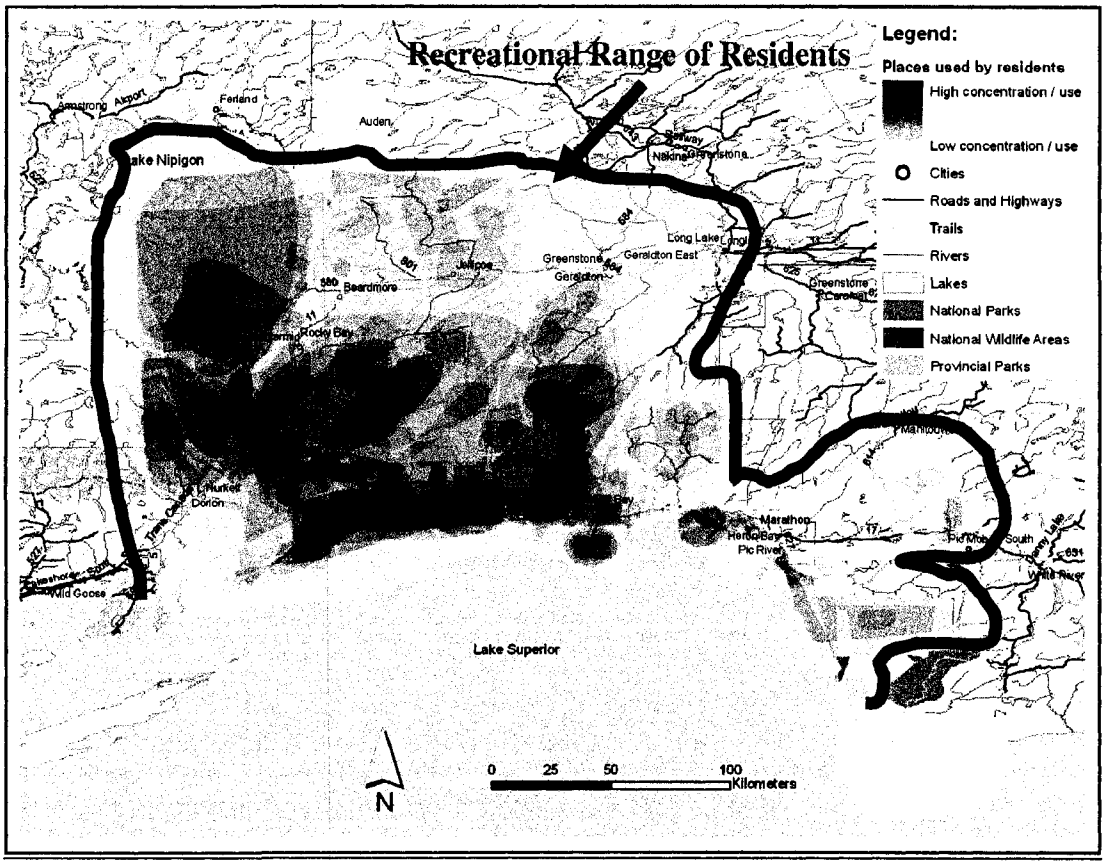

Figure 4.1: Map of the Recreational Use Patterns

4.3 Values, Activities and Frequency of Use by Season in the Study Area

The second stage of the analysis sought to establish the values that residents attach to the boreal forest, the range of activities they participate in, and how often they use the forest and in what seasons.

4.3.1 Values for the Study Area

For each site marked on the map, respondents were asked to rate the importance of seven values (*Family Recreation*, *Wilderness & Solitude*, *Adventure*, *Fishing & Hunting*, *Lots of things to do*, *Wildlife* and *Other values*) on a 5-point importance scale where 1 was "extremely unimportant" and 5 "extremely important". An analysis of the average importance was used to identify the values that residents attach to the boreal forest (see Figure 4.2). *Fishing & Hunting* values overall were rated as the most important (Mean Value = 3.55). The value was ranked as second

on the importance scale is the *Wilderness & Solitude* value (Mean Value = 3.4). Next, came the *Family recreation* (Mean Value = 3.2), closely followed by the *Wildlife* (Mean Value = 3.1) and *Adventure* (Mean Value = 3.0) values. The *Lots of things to do* value was rated as less important (Mean Value = 2.4) than were the previous values. The *Other*, more general values (e.g. learning, economic, sacred, feeling at home and management) was rated as unimportant (Mean Value = 1.4).

Comparisons of the rating of the seven values between respondents of different gender and age category (20-39; 40-59 and over 60 years old) were conducted using oneway ANOVA (SPSS 16.0) analyses. Only *Wilderness & Solitude* value (male mean score = 3.38; female mean score = 3.79; $F = 3.873$, $df = 1$, $p = 0.05$) and the *Adventure* value (male mean score = 2.92; female mean score = 3.65; $F = 11.661$, $df = 1$, $p = 0.001$), were significantly different with male and female respondents. The value rating between respondents of different age category is generally significantly different (*Family Recreation*: $F = 5.438$, $df = 2$, $p = 0.005$, *Adventure*: $F = 21.944$, $df = 2$, $p < 0.001$, *Lots of things to do*: $F = 5.426$, $df = 2$, $p = 0.005$, *Wildlife*: $F = 4.003$, $df = 2$, $p = 0.019$ and *Other values*: $F = 3.502$, $df = 2$, $p = 0.031$), the two exceptions are *Wilderness & Solitude* ($F = 2.128$, $df = 2$, $p = 0.120$) and *Fishing & Hunting* ($F = 0.940$, $df = 2$, $p = 0.392$) values. Over 60 respondents' ratings are significantly lower in *Family Recreation*, *Adventure*, *Lots of things to do* and *Wildlife* than 40 to 59 years old respondents. *Wilderness & Solitude* and *Fishing & Hunting* value ratings are also lower for over 60 respondents than 40 to 59 years old respondents. The youngest group (20 to 39 years old respondents) ratings are significantly higher in *Adventure* and lower in *Other Values* than the other two age groups (see Table 4.5).

Table 4.5: Frequency means of value ratings depending on the age category.

Frequency Mean	Age: 20 to 39	Age: 40 to 59	Age: 60 and over
Family Recreation	3.35	3.45[a]	2.79[b]
Wilderness & Solitude	3.73	3.52	3.21
Adventure	3.73[a]	3.32[a]	2.22[b]
Fishing & Hunting	3.31	3.68	3.55
Lots of things to do	2.42	2.63[a]	2.00[b]
Wildlife	2.96	3.22[a]	2.67[b]
Other values	0.90[a]	1.63[b]	1.28

a, b, c – indicates differences $p < 0.05$

4.3.2 Activities in the Study Area

Respondents were asked to indicate the three main activities they participated in, and frequency and season of use at the sites they indicated on the map. The activities were classified into seven categories: 'Fishing'; 'Hiking'; 'Hunting'; 'Water Sports'; 'Camping'; 'Winter Sports'; and 'Nature & Relaxation'. Figure 4.3 shows the per cent participation for each activity category. Four broad groupings can be identified. 'Fishing' makes up almost 30 per cent of the recreational activities. 'Nature & Relaxation' type of activities (16%) are next followed by 'Hiking' (13%), 'Hunting' (12.5%), 'Camping' (11%), 'Water' (10%), and last, 'Winter Sports' (7.5%).

4.3.3 Frequency and Season of Use in Study Area

The frequency of site use per week in each season is shown in Figure 4.4. Summer was the highest season of use with people using the area 1 to 5 times per week (per cent of users = 61%). Spring and fall were next most popular with a most common use of 1 to 2 times per week (users = 34% in each season) more frequent use being still substantial (users = 27% in each season). Winter was the low season with a most common use frequency being "never" (users = 45%). However, 24 per cent of the total winter use is in the range of 1 to 2 times a week.

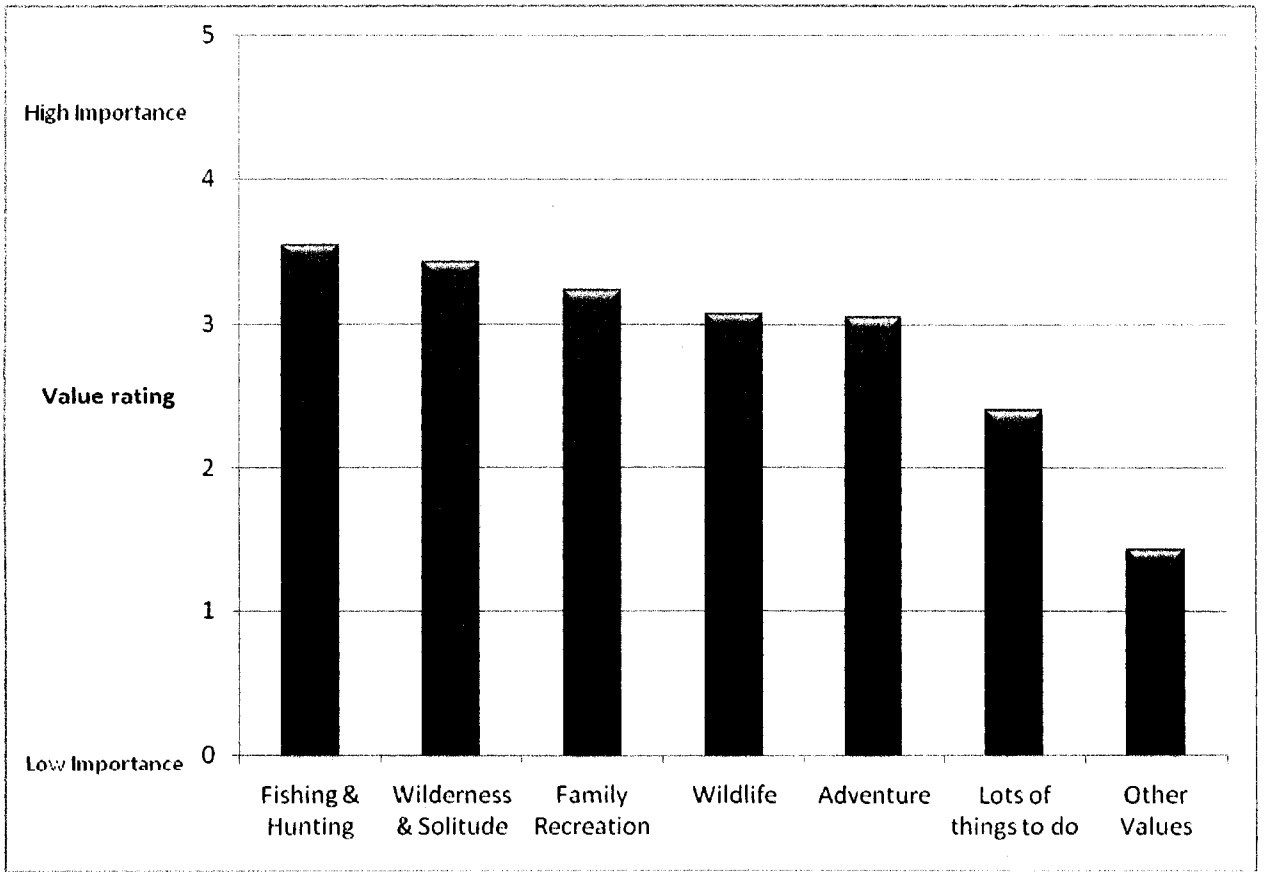

Figure 4.2: Forest Value rating of the area

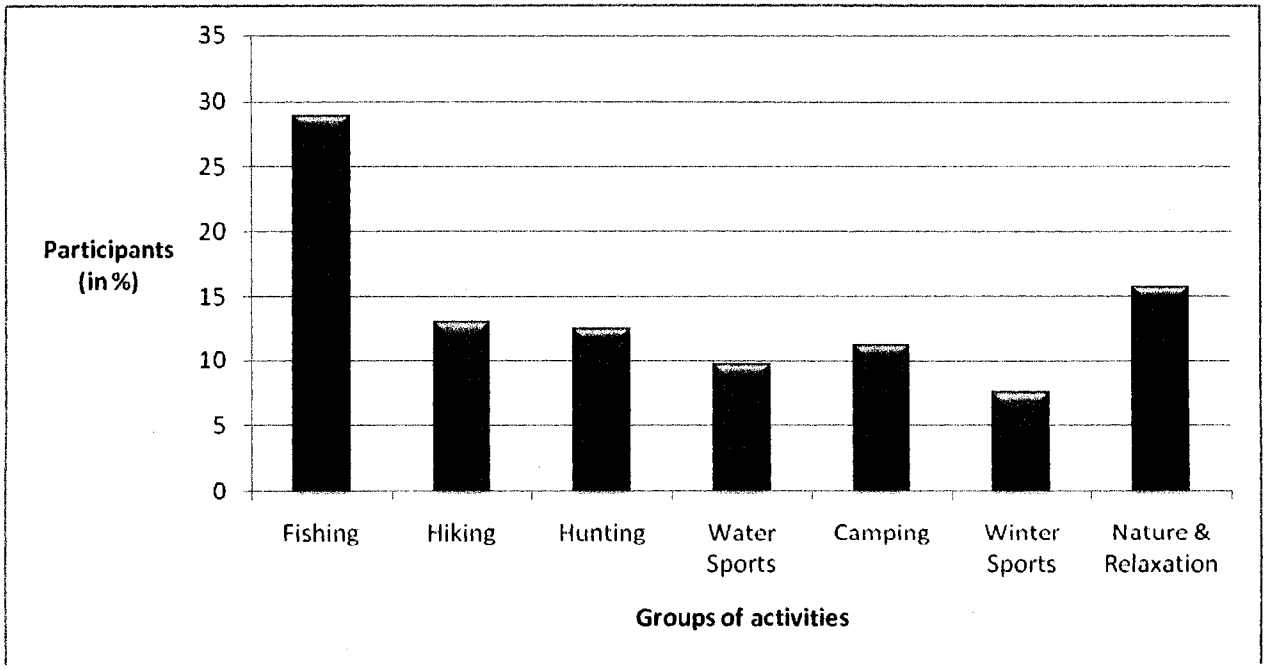

Figure 4.3: Recreational activity rating of the area

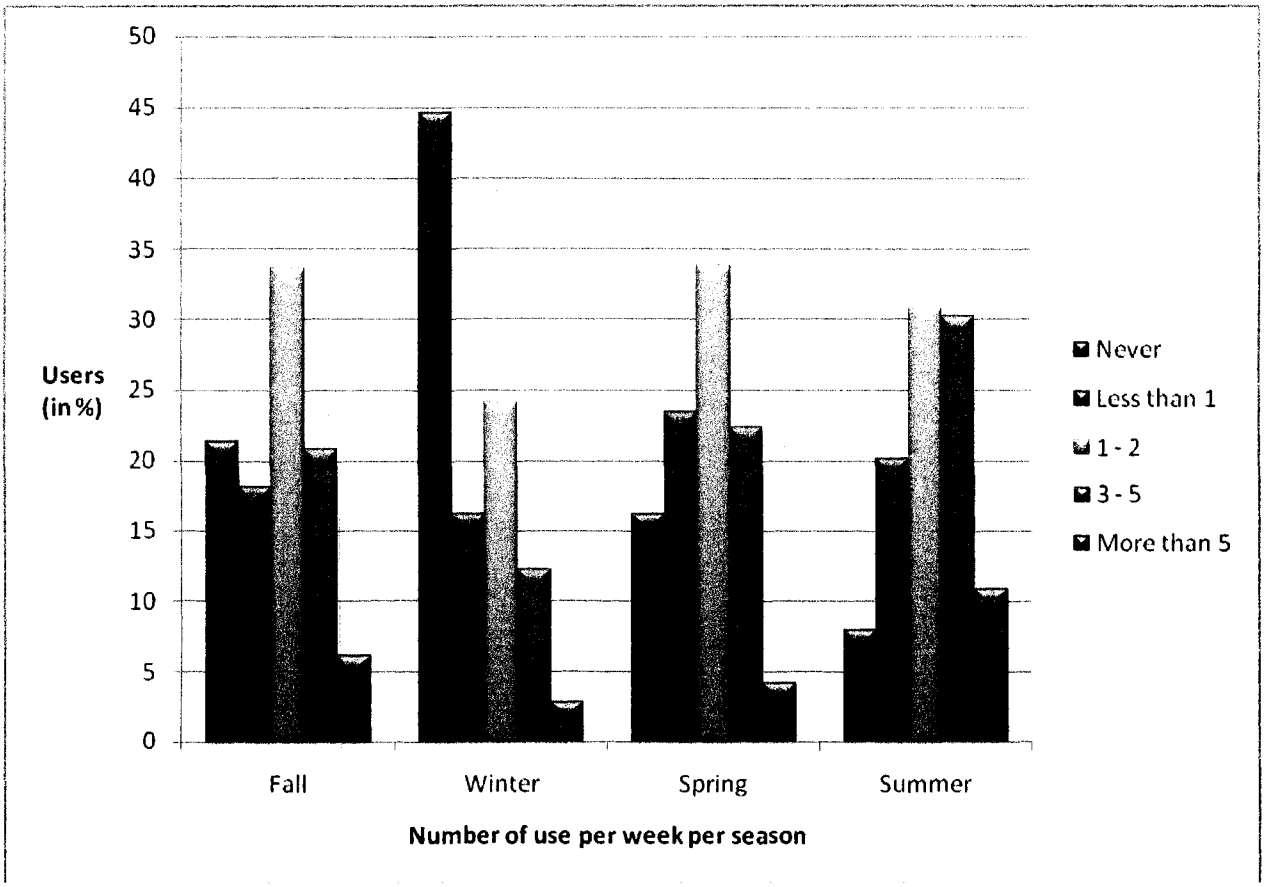

Figure 4.4: Frequency of site use per week per season of the area

Considering the first activity preference indicated by the respondents, the frequency of use per week in each season was examined for each of the seven categories of activities (Figure 4.5).

'Fishing' (Figure 4.5.a) was pursued throughout the year but most frequently in spring and summer when 1 to 2 times per week was the most common frequency of participation. The exception was winter when most people don't fish. 'Nature & relaxation' (Figure 4.5.b) exhibited a similar pattern, except that the frequency of participation in this activity was most commonly less than once a week in the spring and summer. 'Hiking' (4.5.c) was also mostly undertaken in the spring and summer and shows a similar pattern of frequency to fishing (1 to 2 times/wk). 'Hunting' (4.5.d) demonstrated a more even seasonal distribution especially in the higher frequency categories (1 to 2 and 3 to 5 times/wk). As expected, not much camping took

place in winter. 'Camping' (4.5.e) was predominantly a summer activity (3 to 5 times/week), however, fall was also popular at 1 to 2 times a week. Similarly, 'Water sports' (4.5.f) occurred most frequently (1 to 2 times/wk) in summer. 'Winter sports' (4.5.g) participation was moderately frequent in the higher frequency categories, indicating relatively high participation for the generally small number of participants who engaged in winter activities. The apparent anomaly of summer participation in winter sports shown in Figure 4.5g was explained by the inclusion of motor sports in this category that take place both in winter (e.g., snowmobiling) and in summer (e.g., off-road driving).

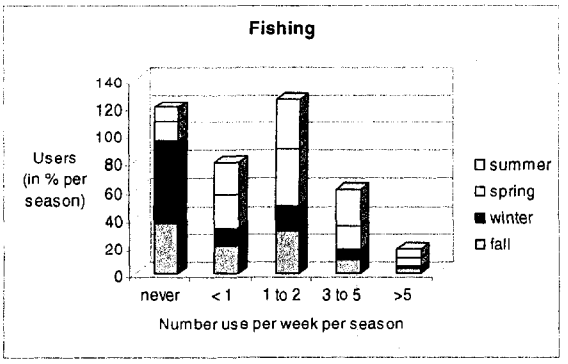

Figure 4.5.a: Fishing frequency of use (/wk/season)

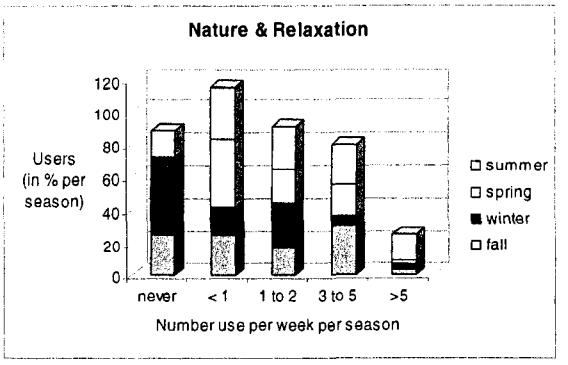

Figure 4.5.b: Nature & Relaxation frequency of use (/wk/season)

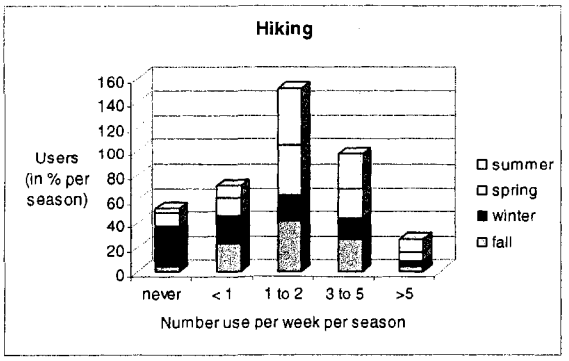

Figure 4.5.c: Hiking frequency of use (/wk/season)

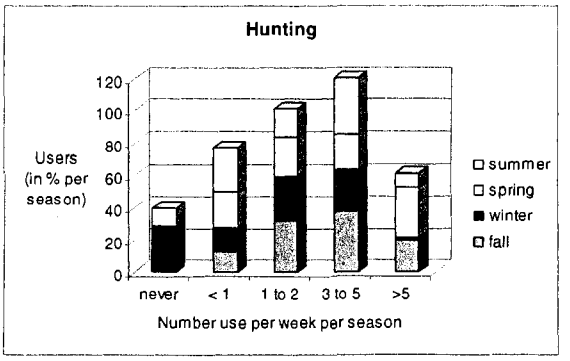

Figure 4.5.d: Hunting frequency of use (/wk/season)

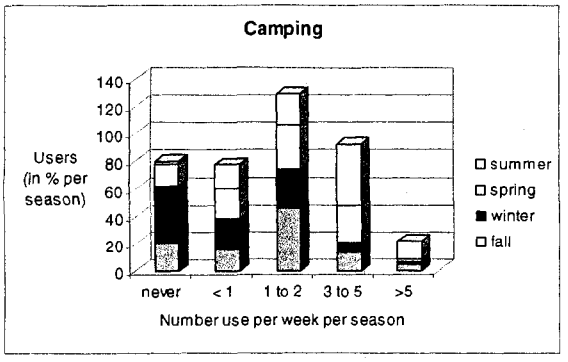

Figure 4.5.e: Camping frequency of use (/wk/season)

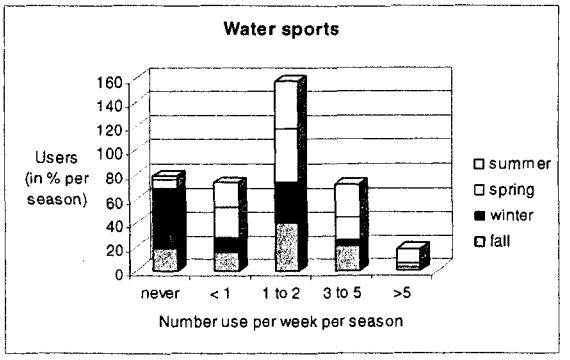

Figure 4.5.f: Water sports frequency of use (/wk/season)

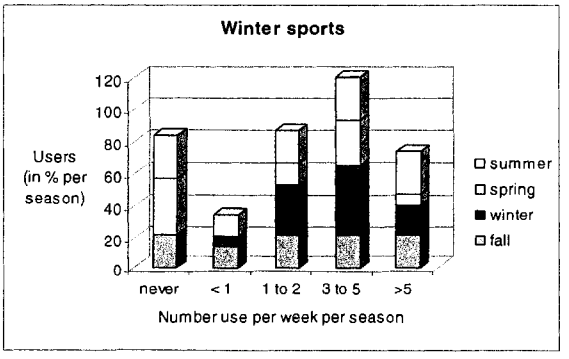

Figure 4.5.g: Winter sports frequency of use (/wk/season)

Figure 4.5: Frequency of use per activity (Activity 1), per week and per season.

In summary, *Fishing & Hunting* values were the most important and the *Lots of thing to do* value was least important. *Other values* were rated as unimportant. Consistent with these results, 'Fishing' was the predominant recreational activity. Summer was the high season of use while people used the area least ("mostly never") in winter.

4.4 High Use Areas (HUAs) and their distribution

This next section focuses on identifying the areas of concentrated recreational use (HUAs) and describing their distribution.

Mapping the HUAs

Trial and error suggested that an appropriate criterion to define a high use area[1] was an area used by at least eight respondents. A total of 201 responses to the surveys were received from an area population of 9,205 residents (i.e., a ratio of one response to 45 residents). This high use minimum criterion of at least eight respondents thus translates to a potential use of at least 366 persons.

Nine areas were defined on this basis (see Figure 4.6). Four areas (HUAs 4A, 4B, 4C & 1C) were along the shore of Lake Superior, incorporating adjacent shorelines, the water body and islands. Another area (HUA 1A) included Lake Nipigon and some of its islands. The remaining four areas (HUAs 1B, 2A, 2B & 3) were centred on sectors of the Trans-Canada Highway (17 & 11) connecting the main towns in the area and roads providing access to the forests and the nearby rivers. One of these latter areas (HUA 1B), was located west of Red Rock along a provincial park, a second (HUA 2A) encompassed the main forest access roads north of Nipigon,

[1] To create these maps, no sites were excluded from the analyses. A sensitivity analysis of this assumption showed that the overall pattern changed slightly when excluding the bigger sites (Refer Appendix 6). However the criterion of at least eight respondents to define a high use area was not satisfactory for the sensitivity analysis and had to be reduced to at least five respondents (i.e. a potential use by at least 229 persons).

a third was to the north of Red Rock and Nipigon following the Nipigon River and the Highway 11 (HUA 2B), and the final one encircled the main forest access roads north of Schreiber and Terrace Bay (HUA 3). As observed on the recreational use patterns map there was a very low concentration of sites around Marathon, this was confirmed by the presence of only one small high use area (HUA 1C).

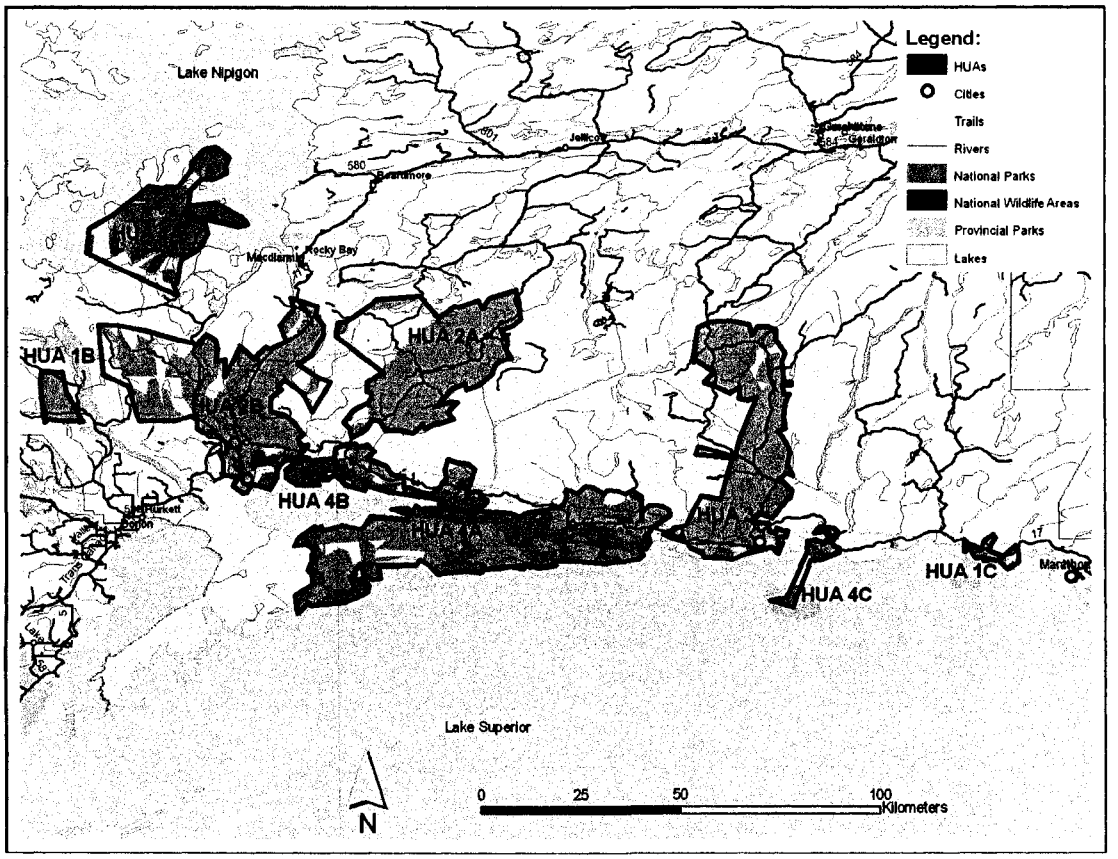

Figure 4.6: Map of the High use areas (HUAs)

4.5 Classification of the HUAs in terms of Values and Recreation Use Characteristics

A K-Means Cluster Analysis (SPSS 16-0) was used to classify each of the 409 individual sites identified by respondents on the seven value categories. Four distinct clusters resulted from this analysis (Table 4.6). Cluster one comprised 159 sites and was characterised by a relatively high valuation of *Fishing & Hunting* (Z-score = 0.61) and a relatively lower valuation on *Other Values* (Z-score = -0.42). Cluster two encompassed 70 sites and was differentiated by a low

valuation on *Wilderness & Solitude* (Z-score = -1.37), on *Wildlife* (Z-score = -1.22), on *Adventure* (Z-score = -1.13) and on *Lots of things to do* (Z-score = -1.03). The third cluster included 95 sites and was characterised by a relatively high valuation of *Family Recreation* (Z-score = 0.71) and a low valuation on *Fishing & Hunting* (Z-score = -1.08). Lastly, the fourth cluster comprised 84 sites and was described by a high valuation of *Lots of things to do* (Z-score = 1.15) and *Other Values* (Z-score = 1.13).

Table 4.6: Final Cluster Centers

	Cluster			
	1 N = 159	2 N = 70	3 N = 95	4 N = 84
Family Recreation Value	-.388*	-.806	**.707**	.607
Wilderness and Solitude Value	.313	**-1.372**	-.207	.785
Adventure Value	.017	**-1.131**	-.054	.970
Fishing and Hunting Value	**.605**	-.434	**-1.076**	.432
Lots of things to do Value	-.240	**-1.029**	.143	**1.149**
Wildlife Value	.298	**-1.218**	-.357	.855
Other Values	**-.424**	-.602	.156	**1.129**

** Z-scores*

The Discriminant Analysis procedure (SPSS 16-0) was then used to more clearly define the cluster characteristics. In this analysis, the discriminant variable is the cluster (1 to 4) and the predictor variables are the seven value categories. Three significant discriminant functions resulted from the analysis (Table 4.7). A correct classification of 96 per cent indicated that the four clusters identified were well discriminated from the predictor variables.

Table 4.7: Discriminant Functions

Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1	.063	1110.044	21	.000
2	.320	457.736	12	.000
3	.865	58.002	5	.000

The characteristics of each of the three functions in terms of the predictor variables were loaded from the structure matrix and are shown in Table 4.8. Function 1 is characterised by high valuations on *Lots of things to do* (Z-score = 0.45), *Wildlife* (Z-score = 0.44) and *Adventure* (Z-score = 0.42). Function 2 demonstrates a high valuation on *Fishing & Hunting* (Z-score = 0.65) and low valuation of *Family Recreation* (Z-score = -0.43). Finally Function 3 is characterised by high valuation of *Other values* (Z-score = 0.69) and low valuation on *Wilderness & Solitude* (Z-score = -0.57).

Table 4.8: Structure Matrix of Value Loadings

	Function		
	1	2	3
Lots of things to do Value	**.450***	-.232	.256
Wildlife Value	**.444***	.211	-.234
Adventure Value	**.417***	-.030	-.053
Fishing and Hunting Value	.224	**.648***	.339
Family Recreation Value	.243	**-.430***	-.317
Other Value	.331	-.296	**.693***
Wilderness and Solitude Value	.469	.171	**-.568***

** Z-scores*

Examination of the group centroids (Table 4.9) demonstrates that cluster 1 sites were characterised by a high valuation on *Fishing & Hunting,* the cluster being strongly and positively defined by function 2, the '*Fishing & Hunting* **Not** *Family Recreation*' function (Z-score = 1.39). Cluster 2 sites were characterised by a relatively high valuation (Z-score = 0.53) on '*Other*

values' (function 3) and a strong negative score on '*Lots of things to do, Wildlife, and Adventure*' (*Lots of things to do, W & A,* function 1). Cluster 3 had a negative valuation (Z-score = -1.98) on '*Fishing & Hunting* **Not** *Family Recreation*' (function 2) which translated into a high value placed on *Family Recreation.* Cluster 4 sites were characterised by a high valuation on function 1, the *Lots of things to do, W & A* function (Z-score = 3.07). The characteristics of the various clusters in terms of the values is summarised schematically in Table 4.10.

Table 4.9: Functions at Group Centroids

	Discriminant Function		
Cluster Number	**Function1** *(Lots of things to do, Wildlife and Adventure)*	**Function2** *(Fishing & Hunting* **Not** *Family Recreation)*	**Function3** *(Other values* **Not** *Wilderness & Solitude)*
1	.123	**1.387**	-.256
2	**-3.469**	-.011	**.533**
3	-.361	**-1.978**	-.382
4	**3.066**	-.379	.471

Table 4.10: Relationships between the functions and the clusters

Cluster	**Function 1** *(Lots of things to do, Wildlife and Adventure)*	**Function 2** *(Fishing & hunting* **Not** *Family recreation)*	**Function 3** *(Other values* **Not** *Wilderness & Solitude)*
1		*Fishing & hunting**	
2	**Not** *Lots of things to do, Wildlife and Adventure*		*Other values**
3		*Family Recreation**	
4	*Lots of things to do, W & A**		

** Cluster names*

4.5.1 Characterisation of the Clusters

In this section, the characteristics of the various clusters are developed in terms of the recreation use parameters (i.e., recreation activities, and frequency and season of use).

Activities

The first analysis on the clusters examined the activities that respondents participated in when visiting their sites. Respondents were asked to nominate three activities by importance for each place they marked on the map. As explained above, these activities were classified into seven main categories: 'Fishing'; 'Hiking'; 'Hunting'; 'Water Sports'; 'Camping'; 'Winter Sports' and 'Nature & Relaxation'. An analysis of preferences across clusters for the first choice of activities was used to characterise the clusters and is presented in Figure 4.7.

The analysis of preferences across clusters for first choice of activity indicated significant differences between the four clusters (Chi-square= 124.6; df = 18; $p < 0.001$). In three of the four clusters, 'Fishing' was the dominant first choice of activity (Clusters 1, 2 and 4). The *Family Recreation* Cluster (3) sites differed in that 'Hiking', 'Camping', and 'Nature & Relaxation' were the main activities. Cluster 4 (*Lots of thing to do, W & A*) sites, after 'Fishing', demonstrated a rather uniform preference for a broad range of activities. 'Hunting' was also prominent after 'Fishing' in Cluster 1 (*Fishing & Hunting*) sites.

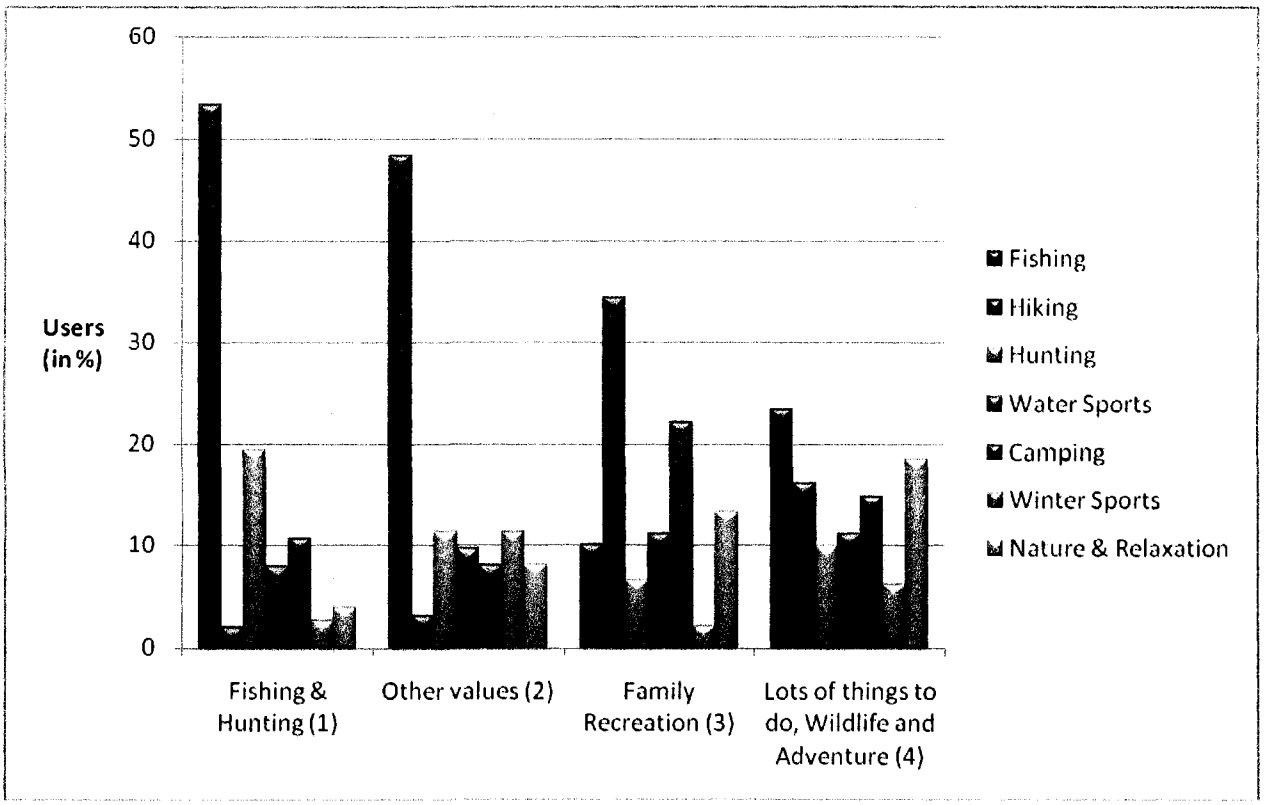

Figure 4.7: First choice of Activities by Cluster

As expected, in the *Fishing & Hunting* cluster sites, 'Fishing' and 'Hunting' were dominant. In the *Other values* cluster sites, 'Fishing' was the main activity. In the *Family Recreation* Cluster sites, 'Hiking' 'Camping' and 'Nature & Relaxation' were dominant. Lastly in the *Lots of things to do, W & A* cluster sites, 'Fishing', 'Nature & Relaxation', 'Hiking' and 'Camping' are the main activities.

Frequency of use

Frequency of use was categorised on a five-point scale: "never" (= 0), "less than 1" (= 1), "1 to 2" (= 2), "3 to 5" (= 3) or "more than 5" (= 4) times a week. Cluster 4 (*lots of things to do, W & A*) sites showed the highest level of use overall (Mean score = 2.15) and the *Fishing & Hunting* sites the least (Mean score = 1.47) (see Figure 4.8). The other two cluster sites (*Other values* and *Family Recreation*) were used about the same on average (Mean score = 1.66).

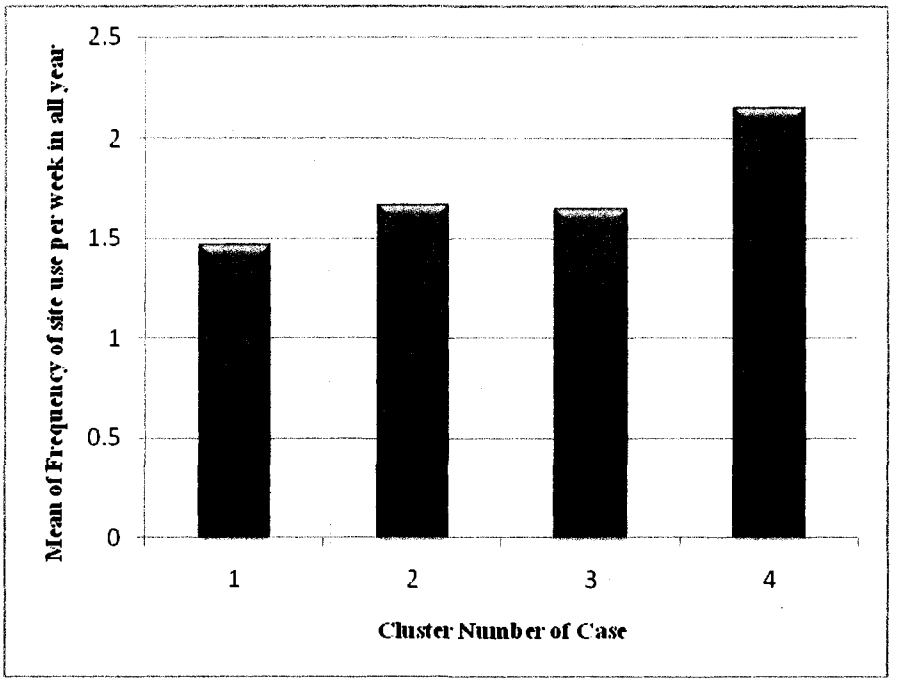

Figure 4.8: Means Plot of the Frequency of site use per week all year round

The frequency of use in the different clusters was analysed with a oneway ANOVA (SPSS 16.0). In the Fall ($F = 4.09$, $df = 3$, $p = .007$), Winter ($F = 4.09$, $df = 3$, $p < 0.001$), Spring ($F = 9.08$, $df = 3$, $p < 0.001$) and Summer ($F = 8.56$, $df = 3$, $p < 0.001$), the frequencies of use between the four cluster sites were significantly different. Table 4.11 presents the results from a post-hoc analysis of these differences (Scheffé Test). In each season, the mean frequency of use per week of clusters 1 and 4 sites differed significantly (Fall: $p = 0.012$, Winter: $p < 0.001$, Spring: $p < 0.001$, and Summer: $p < 0.001$). In winter and spring, the mean frequency of use of cluster 3 sites dropped significantly (Winter: $p = 0.003$, and Spring: $p = 0.010$).

Table 4.11: Frequency means of site use per week during the four seasons.

Frequency Mean	Cluster 1 (*Fishing & Hunting*)	Cluster 2 (*Other values*)	Cluster 3 (*Family recreation*)	Cluster 4 (*Lots of things to do, W & A*)
Fall	1.57 [d]	1.58	1.68	2.11 [a]
Winter	0.89 [d]	1.29	0.95 [d]	1.63 [a, c]
Spring	1.49 [d]	1.77	1.69 [d]	2.25 [a, c]
Summer	1.9 [d]	2.02	2.26	2.62 [a]
Total	1.47	1.67	1.65	2.15

a (cluster1), b (cluster2), c (cluster3), d (cluster4) – indicates differences $p < 0.05$

The general pattern was an increase in mean frequency of use through clusters 1 to 4 with the exception of winter and spring when Cluster 3 (*Family recreation*) dropped significantly (Figure 4.9). Cluster 4 (*Lots of things to do, W & A*) sites were used most frequently per week during all seasons with a lower mean (mean score = 1.63) in winter and a higher mean in summer (mean score = 2.62). In contrast, cluster 1 had less frequent use per week during the year with a lower mean (mean score = 0.89) in winter and a higher mean (mean score = 1.9) in summer. Between these were cluster 2 (*Other values*) and 3 (*Family Recreation*) with similar means of use on an annual basis (i.e., approximately 1.66).

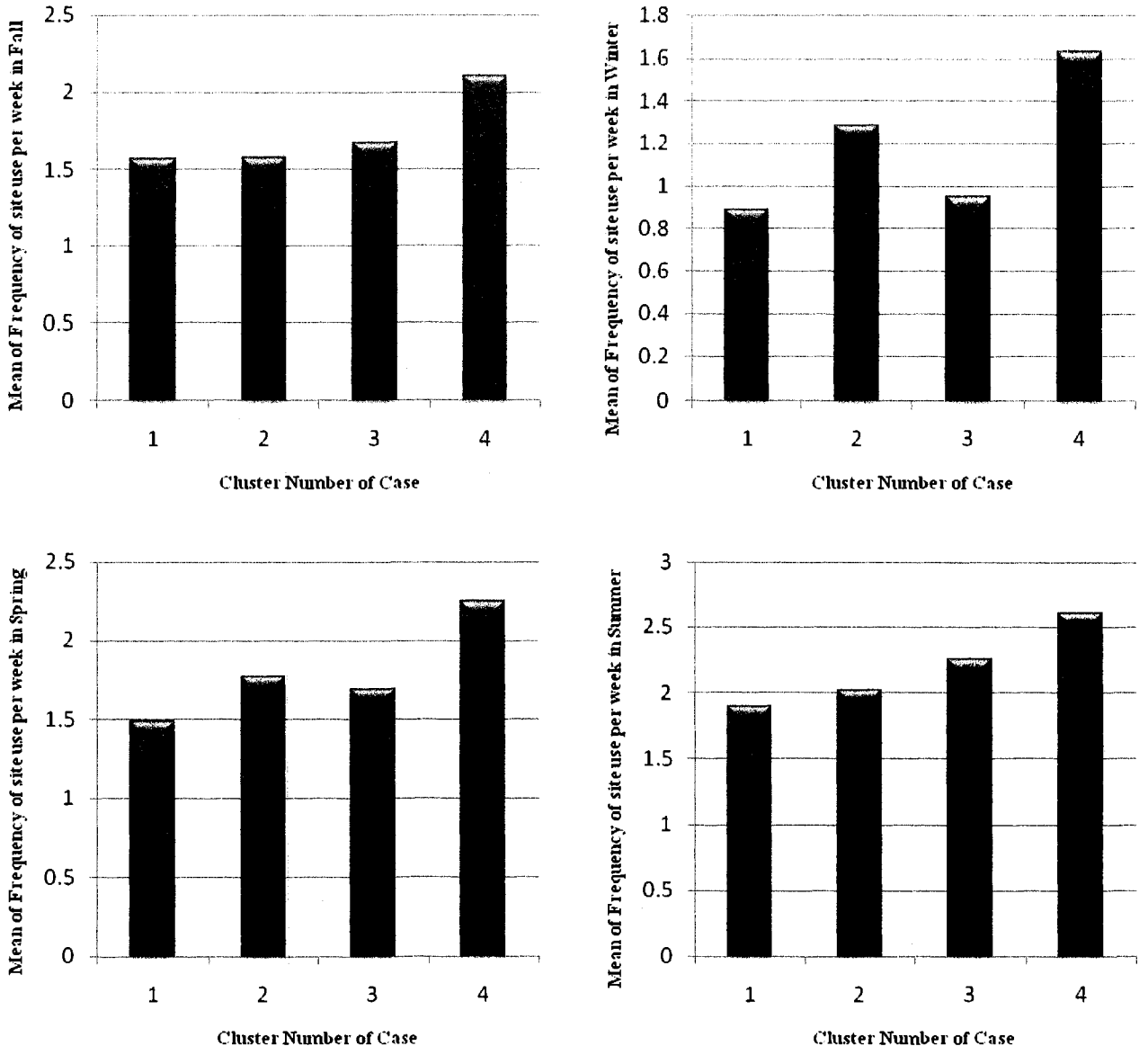

Figure 4.9: Means Plots of the Frequency of site use per week during the 4 seasons.

4.5.2 *Summary of the Clusters characteristics*

Table 4.12 summarises in terms of values, activities and frequency of use, the diverse characteristics of the clusters defined through the analyses. Using this summary it will then be possible to characterise the different High Use Areas.

Table 4.12: Summary of the Clusters characteristics.

Clusters	Forest Values	Most Frequent Activities	Mean Frequency of use per week and season (mean scores)
1	Fishing & Hunting	Fishing Hunting	**Year: Medium (mean score = 1.47)** Summer: Medium-High (1.9) Fall (1.57) and Spring (1.49): Medium Winter: Low (0.89)
2	Other values	Fishing	**Year: Medium (mean score = 1.67)** Summer: Medium-High (2.02) Fall (1.77) and Spring (1.58): Medium Winter: Low-Medium (1.29)
3	Family Recreation	Hiking Camping Nature & Relaxation	**Year: Medium (mean score = 1.65)** Summer: High (2.26) Fall (1.69) and Spring (1.68): Medium Winter: Low (0.95)
4	Lots of things to do Wildlife Adventure	Fishing Nature & Relaxation Hiking Camping	**Year: High (mean score = 2.15)** Summer (2.62), Spring (2.25) and Fall (2.11): High Winter: Medium (1.63)

4.6 Definition of the High Use Areas by clusters

In this section, each of the HUAs are discussed in terms of the proportion of the various clusters that each contains. The chart associated with each HUA shows the percentage of each of the clusters comprising the HUAs (see Figure 4.10).

As expected, given the predominance of 'Fishing' and 'Hunting' activities, the *Fishing & Hunting* cluster sites were a prominent component of all the HUAs. Similarities between the cluster compositions of each of the nine HUAs allowed their classification into four main groups. Group 1 (HUAs 1A, 1B and 1C) was differentiated by the dominance (i.e., more than 50%) of cluster 3 (*Family recreation*) sites and the absence of cluster 4 (*Lots of things to do, W & A*) sites. This latter cluster dominates Group 2 (HUAs 2A and 2B) and the third group (HUA 3) was largely influenced by Clusters 1 (*Fishing & Hunting*) and 2 (*Other values*) sites. The last group

(HUAs 4A, 4B and 4C) was characterised by a predominance of cluster 1 (*Fishing & Hunting*) sites.

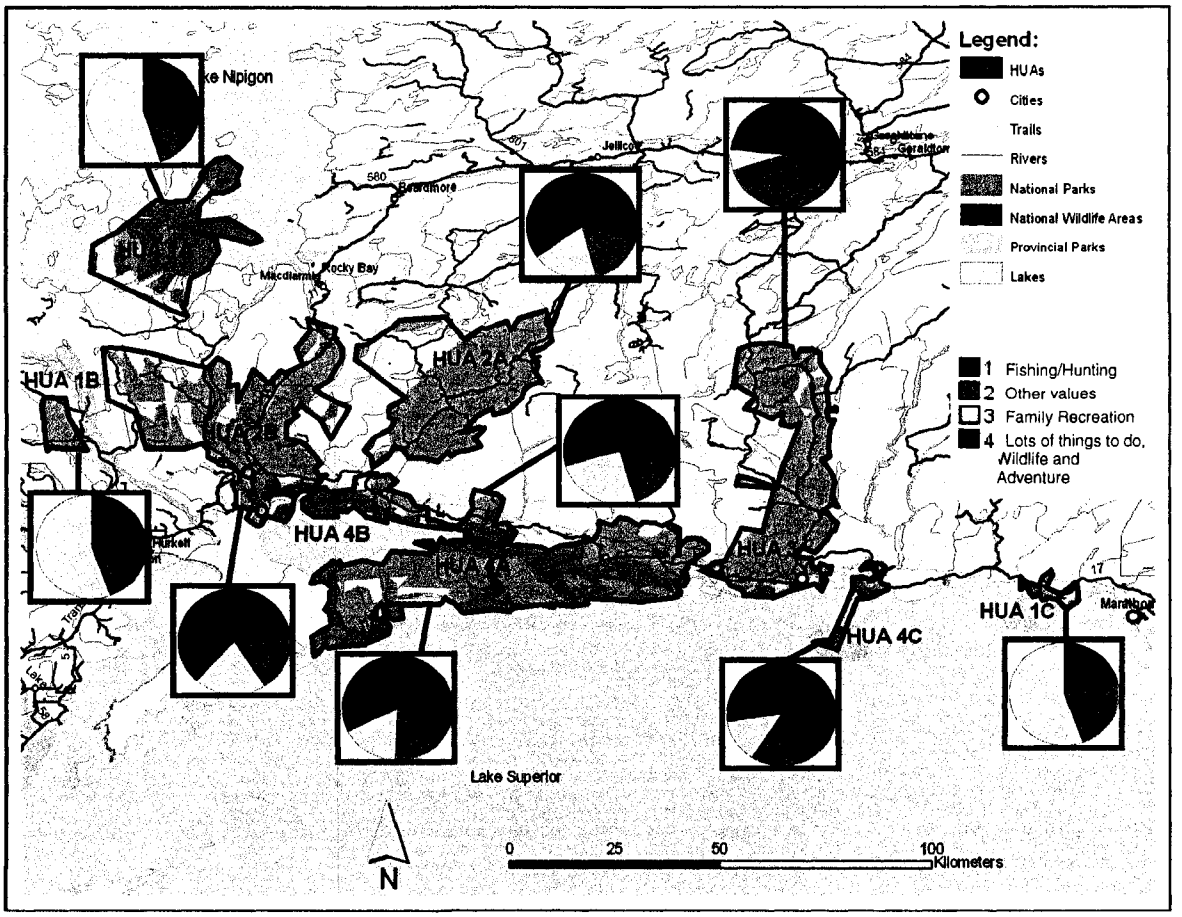

Figure 4.10: Map summary of the High Use Areas (HUAs) (see Table 5.1 for description)

Cluster 3 (*Family Recreation*) sites dominated group 1 HUAs (HUAs 1A, 1B and 1C) by more than half (55% - 56%) while cluster 4 (*Lots of things to do, W & A*) was totally absent. The *Fishing & Hunting* cluster (cluster 1) also stood out (i.e., between 22% and 35%). Cluster 2 (*Other values*) sites were in a minority (approximately 10%) with the exception of HUA 1C where they were as important as the *Fishing & Hunting* cluster (22%) sites. The main activities of the HUAs are 'Hiking', 'Nature & Relaxation', 'Fishing' and 'Hunting'. The frequency of site use was moderate during all seasons with a higher mean in Summer and a lower mean in Winter.

HUA 1B is the exception with a higher mean in Fall (2.11) and lower means in Summer and Winter (1.78)

Cluster 4 (*Lots of things to do, W & A*) sites make about 35 per cent of group 2 HUAs (HUAs 2A and 2B). The three other clusters are equally important with a slight prominence of cluster 1 (*Fishing & Hunting*) sites. The main activities in these HUAs were 'Fishing', and 'Nature & Relaxation'. 'Hunting' and 'Hiking' are also prominent activities. HUAs 2A and B were moderately to highly frequented during all year with a higher mean in summer and a lower mean in winter.

Group 3 comprises just one HUA (HUA 3) and is dominated by cluster 1 (*Fishing & Hunting*) and cluster 2 (*Other values*) sites representing around 35 per cent each. Cluster 4 (*Lots of things to do, W & A*) is also major (23.5%) and cluster 3 (*Family Recreation*) is minor (less than 10%). The main activities characterising this HUA are 'Fishing' and 'Hunting'. 'Nature & Relaxation' and 'Camping' are also important. HUA 3 frequency of site use was medium-high during all seasons with a higher mean (2.23) in summer and a lower mean (1.83) in winter.

Group 4 (HUAs 4A, 4B and 4C) is characterised by the dominance (i.e., 30% to 46%) of Cluster 1 (*Fishing & Hunting*) sites. Cluster 4 (*Lots of things to do, W & A*) makes up about a third and clusters 2 (*Other values*) and 3 (*Family Recreation*) are less than 15 per cent each except in HUA 4B where the *Family recreation* Cluster is as important as cluster 4 (i.e., approximately 25%). The main activities characterising this group are 'Fishing' and 'Hunting'. 'Nature & Relaxation' activities are also significant. The frequency of site use was moderate during the all year with a higher mean in summer and a lower mean in winter.

The cluster characteristics enable description of the HUAs by forest values, activities, frequency of use overall and by season. The discussion chapter will distinguish them on the basis of their location, distribution, and bio-physical characteristics.

Chapter 5: Discussion

5.0 Introduction

Values have been the subject of theoretical consideration in many disciplines and areas of study including "education, political science, economics, anthropology, and theology, as well as psychology and sociology" (Rokeach, 1968, p.158). It has been argued that many natural resource conflicts are more about values than they are about facts (Yankelovich, 1991). This suggests that natural resource planning is mainly "an intrinsically political process involving community deliberation and struggle" (Lachapelle, McCool, & Patterson, 2003: p.475) over different value positions about specific places. Although the theoretical importance of values in natural resource planning has been recognised for some time, it is only recently that researchers have begun to struggle with ways of incorporating them into resource planning (e.g., Satterfield, 2001; Brown & Reed, 1999; McFarlane & Boxall, 2000).

A number of issues have faced social scientists in incorporating values into planning including: a) how to elicit contextual values from users of forest areas; b) at what scale (e.g., forest or site) are the values to be represented; c) how to spatially represent values; and d) how to best incorporate values into natural resource planning? Building on earlier work in the boreal forests of north-western Ontario (McIntyre, et al., 2004), this thesis set out to address these questions.

Although multiple use is a clear mandate of the Ontario Crown Forest Sustainability Act (Ontario's Forests, 2008) 1994 that stated that Crown Forests are to be managed "to meet social, economic and environmental needs of present and future generations", incorporating values (i.e, including measuring values and also the management responses to values) other than harvesting, including recreation, proactively in forest planning has been contentious. This thesis argues that

mapping the spatial pattern of places used by recreationists and specifying the values associated with these places is an essential part of incorporating proactively recreation use as perceived by users in the forest planning process.

This study focused on mapping the recreational use patterns in the boreal forests and associated values of residents from five communities in north-western Ontario: Red Rock, Nipigon, Schreiber, Terrace Bay and Marathon. The process of values mapping involved residents marking the places used for recreation on a map of the area (either paper or web-based). Each of the places marked were then rated on an assigned set of values, activities were specified, and season and frequency of use indicated.

Using Arc GIS mapping and the density distributions of places specified, High Use Areas (HUAs) were delineated. These HUAs were subsequently characterised on the basis of recreational values, activities, and seasons and frequency of use. The recognition and characterisation of these HUAs facilitates their incorporation into forest planning at an early stage in the process as special management zones similar to heritage, conservation and wildlife areas.

In this chapter, the general characteristics of residents' recreational use of the boreal forests adjacent to their communities are first discussed. The locations and features of HUAs are developed and broad management suggestions proposed. Then, the rationale and approach to the study are detailed. Finally, some general conclusions, the validity and reliability of the research and its limitations close the chapter.

5.1 Recreational use patterns, values and use characteristics attached to the boreal forest

Recreational Use Patterns

The recreational use patterns in the study area indicate that the recreational range of residents within the boreal forest is defined by major northerly trending forest roads and subsidiaries radiating from these to a distance about 150 km north of Hwy 17 between Red Rock and Terrace Bay and to the south by L. Superior and its islands. Hwy 11 is also a major access route to L. Nipigon and to the forests in the western portion of the study area. Around Marathon, residents do not travel far north due to the scarcity of roads but rather spread to the west, east and south. Boat access is of secondary importance and is generally restricted to the more sheltered waters along the north shore of L. Superior and the southern part of L. Nipigon. These use patterns, largely defined by highways, primary forest access roads and entrance points (e.g. to Lake Superior, Lake Nipigon and Nipigon River), emphasise the importance of accessibility and highlight the centrality of forest production activity in providing roads and access points for recreation in this area (Hunt, et al., 2000).

Forest Values

Place-based approaches to natural resource planning have gained in popularity in recent years (Brown, 2005; Galliano & Loeffler, 1999; Mitchell, Force, Carroll, & McLaughlin, 1993; Williams & Patterson, 1996; Williams & Stewart, 1998). In part, this has resulted from the increased adoption of community-based collaborative partnerships in forest management (Oglethorpe, 2002) that has emphasised the contextual nature of the planning of natural resource use. This latter realisation has instigated a move away from traditional 'one-suit-fits-all' planning models such as the ROS (McIntyre et al., 2004). Place-based planning is necessarily context focused and collaboration that recognises the strong bonds that people develop with the places

they use for recreation. This planning also acknowledges the need to involve users in influencing the future direction of change in such places.

Brown (2005) has suggested that sense of place constructs may be operationalised by determining the nature and range of place values assigned to special places in the forests. He argued that the values people assign to such special places are linked to the psychological dimensions that make up sense of place, including place dependence (utilitarian values), and place attachment and identity (symbolic values). While this theoretical position underpins the approach taken in this study, interviews with potential respondents indicated that the use of the term 'special place' evoked resistance to participation. For this reason, residents were asked to identify places on the map they *used* for recreation and subsequently to assign values to those places.

A set of specific forest values derived from previous research in the adjacent Dog River-Matawin (DRM) Forest (McIntyre et al., 2004) were used in this study. Residents were requested to rate each of the values on a five-point scale of importance for the specific places they had marked on the map.

Overall, *Fishing & Hunting* values were rated as most important, followed by *Wilderness & Solitude*, *Family Recreation*, *Wildlife* and *Adventure* values. The value categories *Lots of things to do* and *Other Values* (learning, economic, sacred, feeling at home and management) were rated as least important.

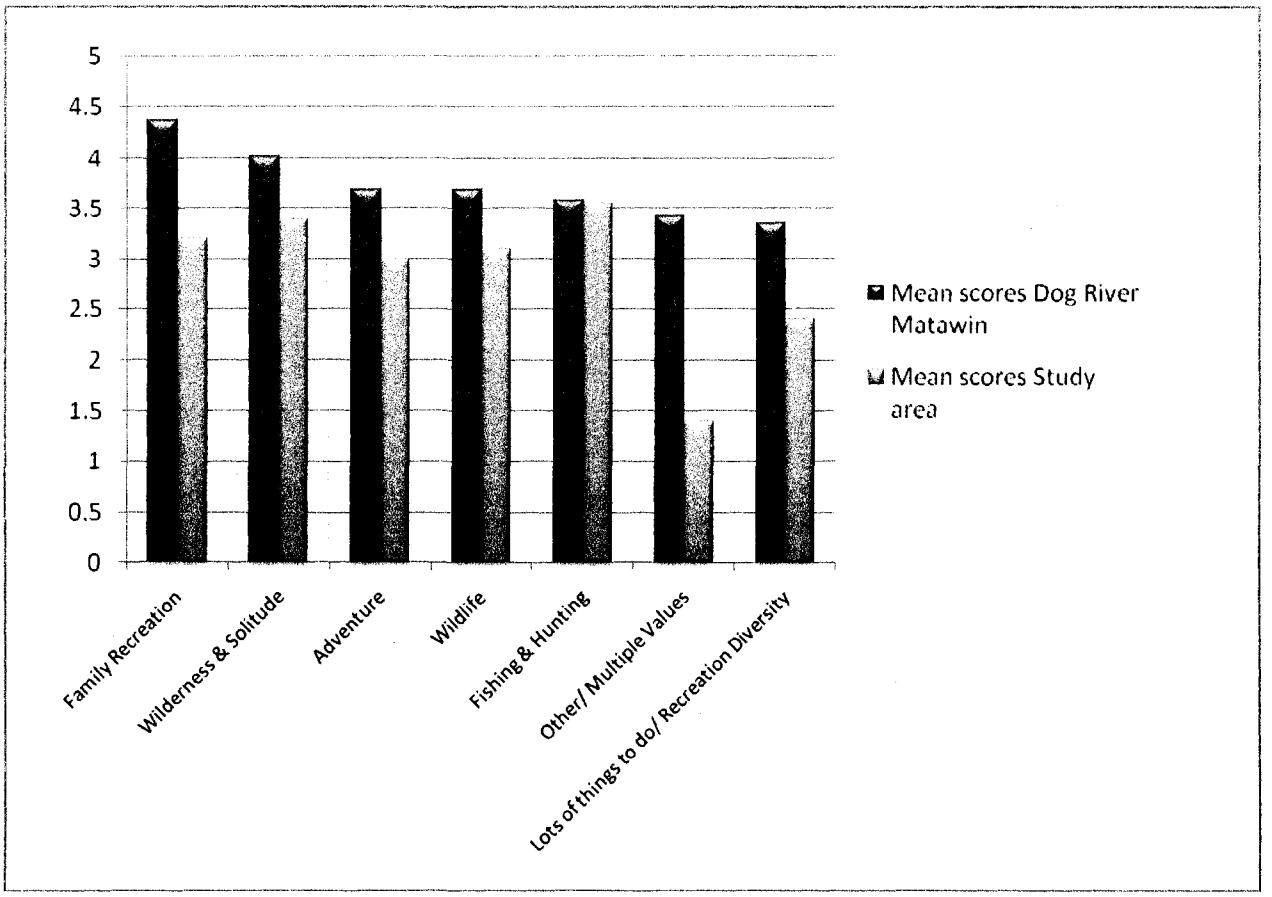

Figure 5.1: Value ratings in the Dog River Matawin and the study area

This same set of values was used in the previous project in the DRM forest area (McIntyre, et al., 2004). Comparison of the importance ratings of the values in these two areas (Figure 5.1) revealed two major differences between the DRM and the study area. In the first place, the *Fishing & Hunting* values (Mean score = 3.55) were rated highest in the study area, whereas *Family Recreation* was the most important value in the DRM (Mean score = 4.38). Secondly, the value categories *Lots of things to do/Recreation Diversity* (Mean score DRM = 3.36; Mean score Study area = 2.4) and *Other/Multiple values* (Mean score DRM = 3.43; Mean score Study area = 1.4) were clearly rated as more important in the DRM than in the study area. A number of possibilities present themselves as potential explanations of these observations. The Dog-River Matawin forest area attracts mainly residents from Thunder Bay, which is a regional centre with

a population of over 100,000 people. This contrasts with the much smaller (9,200 residents) rural population of the study area. The observed differences in valuing of these forest areas may well represent a combination of the preferences of rural as compared to urban residents for consumptive types of recreation (McFarlane & Boxall, 2000) and the broader range of recreation preferences of a significantly larger population. Also, the DRM study included non-residents from other parts of Canada who have been shown to demonstrate both a preference for a broader range of recreational activities and also place a greater importance on non-recreational forest values (McIntyre, et al., 2004). Contrarily to the DMR study, in the study area, the abundance and proximity of lakes and rivers and especially of two large lakes, Lake Superior and Lake Nipigon, makes fishing opportunities readily accessible which could contribute to its popularity and thus the differences in the ratings of forest values.

Activities

The relative emphasis of activities at the various sites was consistent with the value ratings. 'Fishing' (including ice fishing) was identified as the most important activity making up almost 30 per cent of the recreational activities; almost twice as important as the second-rated activity 'Nature/Relaxation' (16%). For many people in the area, recreation apparently means 'fishing'! 'Nature & Relaxation' including activities such as wildlife viewing, berry picking, sightseeing, photography, and picknicking was the second most mentioned activity category. (i.e., activities closely related to *Family Recreation* and *Wildlife* values). 'Winter sports' (7.5%) were rated as last. The low rating of 'Winter sports' was surprising given the length of winter in the region and the numerous snowmobile trails. A possible explanation is that the last winters have been characterised by lower than average snowfalls (Ontario's Forests, 2006) that have seriously curtailed winter activities in the northwest.

According to Hunt and McFarlane (2002), the top five activities for residents of northern Ontario were 'hiking', 'fishing', followed by 'wildlife viewing', 'motor-boating and jet-skiing' and finally 'hunting'. The top three activities indicated in the present study are similar to these findings, although the order is different as 'Fishing' was more prominent. This prominence reflects the high valuation of consumptive type recreation noted above. In contrast to the findings of Hunt and McFarlane, 'water sports' were not listed in the top five activities in the study area, despite the fact that many of the HUAs were water based. As the category 'Water sports' included 'motor boating' in the Hunt and MacFarlane study, it is likely that this was subsumed under 'Fishing' in this study as the latter is often associated with fishing and, respondents possibly did not make a distinction between these two activities.

Frequency of use per week and per season

Summer was the peak season of use in the region with people using the forest on average of 'one to five times per week'. In fall and spring, people used the area mostly 'once or twice a week' and in winter 'mostly never'. Considering the top five activities ('fishing', 'nature & relaxation', 'hiking', 'hunting', and 'camping'), preferences, regulations climate and weather conditions affected the seasonal frequency of use for these activities.

Combining 'fishing' and 'ice-fishing' it is possible to fish at any time of the year. Existing regulations for the various species (walleye season: third Saturday in May and ends April 15th; the brook trout season: January 1st and ends on Labour day (September 3rd) and lake trout season: January 1st and ends September 30th) (Fish & Wildlife Branch, 2008; personal communication with Len Hunt, June 2nd, 2008) indicates that for the non-species specialist, fishing opportunities are available throughout the year. However, at those localities where 'fishing' was indicated as the primary activity, spring and summer were the most popular

seasons for fishing. Hunt (2006) detailed fishing preferences during spring and summer. Victoria Day weekend (which corresponds to the opening season of walleye and the Labour Day weekend (i.e., the end of brook trout season) are particularly important for recreational fishers (Hunt, 2006). Walleye is highly preferred over other species from April through September. When the season is closed (i.e., between April 15th and the third Saturday in May), the targeted species is rainbow trout (*Oncorhynchus mykiss)*, period when they go up the rivers and thus easy to catch. Brook trouts are also appreciated thorough spring and summer.

'Hiking', 'camping' and 'nature & relaxation' activities showed similar patterns of seasonal participation in that, summer was the popular season with fall and spring being somewhat less and winter least popular. This similarity is not surprising because these broad activity categories are often combined. Specific activities showed some seasonal variation. For example, wildlife viewing can occur at any time, but the hibernation of some species reduces the possibility of viewing them during winter and young vegetation growing along roads attracts wildlife, which is thus more easily seen in such localities in spring. Activities such as berry picking are limited to summer and spring. Hunting seasons are limited by government regulations which restrict large game hunting (black bear, deer (*Odocoileus virginianus*) and moose) to the fall with season regulations depending on the species and weapons (i.e., bow and arrow vs. gun). In the study area, the season starts with black bears August 15th and ends for all species between October 31st and December 15th, the opening of gun moose season starting the second Saturday in October being an important date for northern Ontarians who particularly appreciate moose hunting (Fish & Wildlife Branch, 2008; personal communication with Len Hunt, June 2nd, 2008). Small game hunting happens all year round with variation in seasons depending on species (Fish & Wildlife Branch, 2008). Game and migratory birds hunting occurs between

September 15th and December 31st while rabbit (*Sylvilagus floridanus*) and hare (*Lepus europaeus* or *Lepus americanus*) season starts September 1st and ends June 15th (Fish & Wildlife Branch, 2008). Wolf (*Canis lupus*) and coyote (*Canis latrans*) hunting happens between September 15th and March 31st (Fish & Wildlife Branch, 2008). Furbearing mammals' regulations are more complex, some species as skunks (*Mephitis mephitis*) can be hunted all year round while others can mostly be hunted in fall and winter (Fish & Wildlife Branch, 2008). Consistent with these regulations, the frequency of use is significantly more important in the fall, "never" being completely absent as frequency of use during this season. Moreover if fewer people indicated 'hunting' as a first activity than 'fishing', the frequency of site use on a weekly basis is higher (3 to 5 times of week opposed to 1 to 2 for 'fishing').

5.2 Recreational use concentration: the High Use Areas (HUAs), the values that residents attach to them and their recreational characteristics

Nine HUAs were identified in the study area. As these represent the areas most frequently used for recreation, it is important to consider them as distinct planning units in the forest planning process. The HUAs were categorised into four groups based on the forest values, attached to them by participants. Subsequently, each of the HUAs were characterised by their distribution, activities and frequencies of use (see Table5.1).

Family Recreation HUAs

The first group includes HUAs 1A, 1B and 1C (Figure 5.2), which are mainly valued as *Family Recreation* areas and are unique among the HUAs in that the *Lots of things to do*, *Wildlife* and *Adventure* values were not rated as key values.

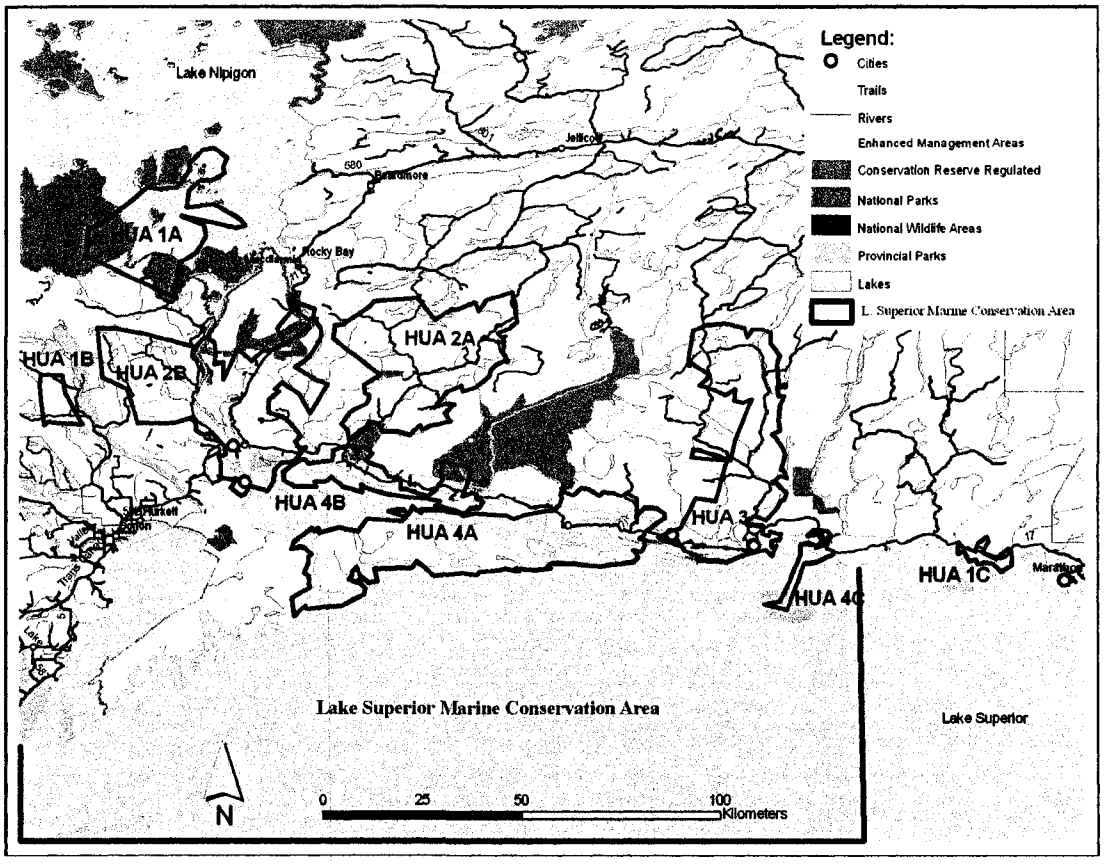

Figure 5.2: Map of the Protected Areas and of the HUAs.

Two of these HUAs are small in size: HUA 1B: around 50 km^2 and HUA 1C: around 15 km^2. HUA 1A is the exception at approximately 350 km^2. These HUAs are located at the periphery of the study area. With the exception of HUA 1C located close to Marathon, HUAs 1A and 1B are found at further distances from the surveyed communities (i.e., Red Rock, Nipigon, Schreiber, Terrace Bay and Marathon). HUA 1A encompasses the southern part of Lake Nipigon much of which lies within Conservation regulated areas (Figure 5.2). HUAs 1B and 1C are located in the vicinity of campgrounds in Provincial Parks (i.e., Black Sturgeon River and Neys Park) (see Figure 5.2), HUA 1C being embraced by Highway 17 and Neys Park. HUA 1B is situated in the Shilabeer and Nonwatin Lakes area.

'Hiking' and 'nature & relaxation' activity categories are dominant in these HUAs (Table 5.1), but, fishing and hunting are also valued activities. The absence of the *Lots of things to do*, *Wildlife* and *Adventure* values and the relative remoteness from the targeted communities suggest that people, and more precisely families, travel to these areas to use the trails, campgrounds and amenities of the Provincial Parks for 'hiking' and 'nature & relaxation'. Although recreationists may use vehicles to access the HUAs, the small size of HUA 1B and 1C are consistent with the non-motorised nature of participation. Fishing and hunting are also significant in these HUAs which are all located close to water bodies (Lake Nipigon, Nipigon River, Lake Shilabeer, Lake Nonwatin and Lake Superior).

Summer is the main season of use (Table 5.1), which is consistent with family recreation and the close distance to Provincial Parks. The distance from main residential centres suggest that people are attracted to the camping opportunities provided by the Provincial Parks.

Table 5.1: Summary of the HUAs 1 characteristics.

HUAs	Forest Values (Cluster frequency in %)	Most Frequent Activities	Frequency of use per week and season (mean scores)
1A	Family Recreation (55%) Fishing & Hunting (35%)	Hiking Nature & Relaxation Fishing Hunting	**Year: Medium (1.55)** Summer: Medium-High (2.00) Spring (1.84) and Fall (1.42): Medium Winter: Low (0.95)
1B	Family Recreation (55.5%) Fishing & Hunting (33.5%)	Hiking Nature & Relaxation Fishing Hunting	**Year: Medium-High (1.89)** Fall: High (2.11) Spring: Medium-High (1.89) Summer and Winter: Medium (1.78)
1C	Family Recreation (56%) Fishing & Hunting (22%) Other values (22%)	Hiking Nature & Relaxation Fishing Hunting	**Year: Medium (1.51)** Summer: High (2.24) Spring (1.75) and Fall (1.40): Medium Winter: Low (0.64)

Lots of things to do, Wildlife & Adventure HUAs

The second group comprises HUAs 2A and 2B (Figure 5.2), which are characterised by the dominance of the value categories *Lots of things to do*, *Wildlife* and *Adventure*. *Fishing & Hunting*, *Family Recreation* and *Other* values are also important (Table 5.2).

These HUAs are large size (HUA 2A: around 550 km^2 and HUA 2B: around 750 km^2), centred on roads and rivers and are located to the north of the townships of Red Rock and Nipigon. HUA 2B follows the Nipigon River and the Highway 11, it includes four major lakes Helen Lake, Jessie Lake, Frazer Lake and Elizabeth Lake. HUA 2A encompasses the main forest access roads north of Nipigon that allow getting to Georgia, Barbara, Cosgrave and Kabamichigama Lakes. HUA 2A and 2B both include Conservation Reserves and in HUA 2A Ruby Lake Provincial Park, providing campgrounds, hiking trails and a variety of recreational opportunities (see Figure 5.2).

The main activities characterising them are 'fishing' and 'nature & relaxation' (Table 5.2). The diversity of values (*Lots of things to do*) indicates a wide range of recreational opportunities are accessible in these HUAs. They are easily accessible and offer a variety of landscapes and amenities including rivers, lakes, cliffs, forests, walking trails and roads, which provide a wide diversity of wildlife encounters, nature contact and opportunities for adventurous activities. The frequency of use is consistent with the wide range of values attached to these HUAs and their proximity to the communities. They are used mainly during spring, summer and fall, while in winter the frequency of use is significant but about half that in summer.

Table 5.2: Summary of the HUAs 2 characteristics.

HUAs	Forest Values (Cluster frequency in %)	Most Frequent Activities	Frequency of use per week and season
2A	Lots of things to do Wildlife Adventure (35%) Fishing & Hunting (29.5%)	Fishing Nature & Relaxation Hunting Hiking	**Year: Medium (1.89)** Summer: High (2.31) Fall: Medium-High (2.03) Spring (1.71) and Winter (1.49): Medium
2B	Lots of things to do Wildlife Adventure (38.5%)	Fishing Nature & Relaxation Hunting Hiking	**Year: Medium-High (1.99)** Summer (2.36) and Fall (2.19): High Spring: Medium-High (1.95) Winter: Medium (1.47)

Fishing & Hunting and Other Values HUAs

This group comprises only one HUA (HUA3) of large size (approximately 640 km^2) located to the north of Terrace Bay and Schreiber (Figure 5.2), which is mostly valued for *Fishing & Hunting* and *Other* values. HUA 3 stretches northwards along a line of main forest access roads. These main arteries provide access to a wide array of minor forest roads, and a multitude of lakes and rivers including Lake Superior.

The main activities in this HUA are 'Fishing' and 'Hunting' but 'Nature & Relaxation' and 'Camping' are also prominent (Table 5.3). HUA 3 is accessible from Terrace Bay and Schreiber, along forest roads providing access to Long Lake and Lake Superior.

A unique feature of this HUA is that *Other* values (learning, economic, sacred, feeling at home and management) are important. Part of the explanation may be related to the nature of the participants in 'hunting and fishing' who are dominantly male (FEDNOR, 2002; 76% of the respondents are male) and possibly employed in the forest industry and/or recognise the contribution of the forestry industry to the community (economic, access). Some may also own 'camps' in the area and most also have a long association over many years with the forests (62% of the respondents live in the area for 30 years or more) which has created a sense of belonging

and attachment to the forests and a desire to retain their value for future generations (bequest values). Overall, these characteristics potentially create an appreciation for the *Other Values* of the forest.

The frequency of site use in HUA 3 is high in summer, medium in fall and spring and medium/low in winter. While spring and summer are the peak fishing seasons (personal communication with Len Hunt, June 2nd, 2008) and fall the peak hunting season (Fish & Wildlife Branch, 2008), the area is more frequently used in summer. Summer holidays and activities such as 'nature and relaxation' or 'camping' would be likely reasons for the high summer use.

Table 5.3: Summary of the HUA 3 characteristics.

HUAs	Forest Values (Cluster frequency in %)	Most Frequent Activities	Frequency of use per week and season
3	Fishing & Hunting (36%) Other Values (34%) Lots of things to do Wildlife Adventure (23.5%)	Fishing Hunting Nature & Relaxation Camping	**Year: Medium-High (2.02)** Summer: High (2.23) Spring (2.06) and Fall (1.97): Medium-High Winter: Medium (1.83)

Fishing and Hunting HUAs

The last group is comprised of three HUAs (4A, 4B and 4C; Figure 5.2) of different sizes along the northern shores of Lake Superior. These sites are valued mainly for '*Fishing & Hunting*'. *Lots of things to do*, and *Wildlife* and *Adventure* values are also important (Table 5.4).

HUA 4A is the largest at 915 km^2 and HUA 4B; (180 km^2) and 4C ((45 km^2) are smaller. HUAs 4A and 4B are located along the coast between Nipigon and Schreiber and HUA 4C is situated to the east of Terrace Bay. The three HUAs along the shores of Lake Superior comprise shorelines, the water body and islands. The shorelines lie within an Enhanced Management Area and the entire water body is part of the Lake Superior National Marine Conservation Area (see

Figure 5.2). HUA 4A also includes actual and proposed Conservation Reserves and HUA 4C includes a portion of Slate Islands Provincial Park. These HUAs coincide with access points to Lake Superior (see Figure5.2).

'Fishing' and 'hunting' are the dominant activities but 'nature & relaxation' activities are also important (Table 5.4). These HUAs, include Lake Superior and its shoreline, hence the dominance of fishing as a value and activity is understandable. Hunting is possible on islands (with the exception of Slate Islands) and on the coast (Ontario's Crown Land Use Policy Atlas, 2008). Access to Lake Superior, its islands and beaches provides opportunities for 'nature & relaxation' activities. HUA 4C encompasses the mouth of a river linking Santoy Lake to Lake Superior, it also includes access points to Slate Islands, providing recreational opportunities such as Caribou (*Rangifer tarandus*) viewing and recreational facilities such as campgrounds and cabins (e.g. Slate Island cabin).

The frequency of site use is highest in summer, moderate in fall and spring, and low in winter. The lake being frozen during winter recreational activity is less frequent (i.e., ice fishing or snowmobiling). The frequency of use in spring and fall depends on weather conditions such as ice formation and melting, snow condition and wind/wave intensities that could restrict its use for specific activities (e.g. fishing, boating or surfing).

Table 5.4: Summary of the HUAs 4 characteristics.

HUAs	Forest Values (Cluster frequency in %)	Most Frequent Activities	Frequency of use per week and season
4A	Fishing & Hunting (38.5%) Lots of things to do Wildlife Adventure (32.5%)	Fishing Hunting Nature & Relaxation	**Year: Medium (1.75)** Summer: High (2.19) Spring (1.80) and Fall (1.70): Medium Winter: Low-Medium (1.33)
4B	Fishing & Hunting (29.5%) Lots of things to do Wildlife Adventure (29.5%) Family Recreation (25%)	Fishing Hunting Nature & Relaxation	**Year: Medium-High (2.01)** Summer: High (2.35) Spring (2.05) and Fall (2.03): Medium-High Winter: Medium (1.63)
4C	Fishing & Hunting (45.5%) Lots of things to do Wildlife Adventure (27.5%)	Fishing Hunting Nature & Relaxation	**Year: Medium (1.76)** Summer: High (2.24) Spring: Medium-High (1.89) Fall (1.74): Medium Winter: Low-Medium (1.17)

Overall, the recognition and descriptions of the various types of HUAs provides insights into the range of values attached to these concentrated use areas, their distribution, and the diversity and seasonal patterns of recreational activity of residents. Further, these data provide a useful basis for proactively managing recreation in the larger regional context and more specifically within those areas where forest companies are active. Conflicts may be avoided by incorporating these data early and thus facilitating the inclusion of a broader range of user values in the planning process. In this way the full benefits envisaged in the Ontario Crown Forest Sustainability Act 1994 may be more fully realised.

5.3 Forest Management Implications

It is evident from the distribution of the various HUAs that many of these coincide with areas that already receive special management provision (e.g., provincial parks, enhanced management and conservation areas). The HUAs 1A, 1B and 1C encompass such areas that facilitate 'hiking' and 'nature & relaxation' activities and are valued for *Family Recreation* opportunities. HUAs 4A, 4B and 4C which are particularly valued for *Fishing and Hunting*

opportunities lie along the shores of Lake Superior and include provincial parks, enhanced management areas and conservation reserves.

Recreation activities and facilities are regulated differently in the various special management areas (Ontario's Crown Land Use Policy Atlas, 2008). Within provincial parks, timber harvesting is usually totally forbidden (Algonquin Park being an exception) and while this enhances the opportunities for certain types of recreation which are less compatible with harvesting (e.g., nature and relaxation), it makes access into the parks more difficult, thus, concentrated use in such areas is confined to the campgrounds and adjacent walking trails. Conservation Reserves also do not allow timber harvesting but regulations affecting recreational uses are more flexible than in provincial parks (Ontario's Crown Land Use Policy Atlas, 2008). In Conservation Reserves (CRs), all terrain vehicle and snowmobile use is restricted to on-trail use but completely forbidden in Provincial Parks (PP). Development and maintenance of existing roads differ depending on the PP or the CR, however, development and maintenance of new roads is prohibited in PPs. Campgrounds are authorised in some PPs while completely absent from CRs. Hunting, horseback riding (on trail), mountain bike use and rock climbing are permitted in CRs while forbidden in PPs (with some exceptions concerning rock climbing) (Ontario's Crown Land Use Policy Atlas, 2008).

Timber harvesting is, however, permitted in the Enhanced Management areas but such areas also make special provision for recreation and tourism activities such as angling, hunting, motorised and pedestrian trail use, and canoeing. Some recreation enhanced management areas have been identified to protect remote recreation values and in such areas all activities need to be carried out so as to maintain or enhance the remote recreation qualities (Ontario's Crown Land Use Policy Atlas, 2008). The recent declaration of the Lake Superior National Marine

Conservation Area (Parks Canada, 2008) that encompasses the waters adjacent to HUAs 4A, B and C, while providing enhanced protection for current recreational activities will also likely have a significant effect in increasing tourist use of the area.

Some HUAs lie almost entirely within commercial forest leases (2A, 2B and 3) and are thus potentially affected by commercial forestry activities. This has implications for both the types of recreational activities best suited to these areas and also how they might be managed.

The wide variety of terrain accessed by the harvesting road network in HUAs 2A, 2B and 3 facilitates a broad range of activities and a high valuation on *Lots of things to do, Wildlife and Adventure* (Table 5.2). The dominant activity 'fishing' is well suited to forestry activities because the latter often provides access to lakes and rivers which would otherwise be relatively inaccessible (Hunt, et al., 2000).

Because of long distances and difficult terrain, road access is an important determinant of recreational use. This is clearly evident in these particular HUAs that are centered on major logging access roads and subsidiary roads that emanate from them. A controversial issue is the continued maintenance of such roads when forest activity is terminated. Which roads should be maintained, who pays and how best to manage access (Ministry of Natural Resources, Task Team, 2003). The data in this thesis reinforces the importance of maintaining road access and can provide guidance on priorities with regard to continued maintenance and accessibility.

The data emphasise the importance of regulated areas in the provision of valued recreational opportunities for urban residents along the northern shore of Lake Superior. Equally they highlight the importance of forest production activities in enhancing access to areas that would otherwise be inaccessible to local recreationists. This synergy between forestry and recreation in the boreal forest, although acknowledged generally, is not always recognised as a key component

of the forest planning process in northern Ontario. The methods used and the results of this thesis provide a basis for the inclusion of representative recreation considerations at an early stage in regional and local planning initiatives in the northwest and more generally in boreal forest areas in Canada and elsewhere.

5.4 Methods and Approaches

The use of a web-based survey approach that is a relatively novel technique within the field of values mapping provided an opportunity to evaluate the efficiency and effectiveness of this technique. Further, as a paper-based version of the survey was also implemented at the same time and in the same context, it was possible to compare the relative merits of these different data collection methods.

Using the WWW to distribute the survey resulted in some access limitations that were addressed in several ways. Free access to computers and internet was provided in public libraries and community centres in the different communities surveyed. Open-house information sessions were organised and training and assistance in using the web-survey were provided. A tutorial was incorporated into the survey to explain the use of the different mapping tools. A pre-test of the web-tool was conducted to improve the technology and accessibility prior to full implementation of the survey. Because of problems with loading speeds and response capability revealed in initial trials, a paper version of the survey was designed to facilitate access to the survey and increase response rates.

The web-based survey and paper survey response rates were respectively of 31 and 21 per cent. This latter response rate is typical for unsolicited mail-out surveys. For his different surveys, Brown (2005) had response rates ranging from a "high of 32% to a low of 18% (p.24). Dey (1997) has noted a response rate decline in US mail-out surveys from approximately 60 per

cent to 21 per cent since the 1960s. Reasons suggested for this decline "ranges from the proliferation of junk mail to the rapid growth and ease of large scale" questionnaires (Sax, Gilmartin, & Bryant, 2003, p.423). Sax, et al. (2003) also observed that providing the option to complete a web-survey while sending a paper survey offers highest response rates, which is consistent with our results.

Carver, et al. (2000; 2001) suggested that web-surveys providing spatial and non-spatial information enabled respondents to experiment with the data, made the process concrete, interactive and fun, and, therefore, more popular than paper surveys. These conclusions are generally confirmed by the results of this study, in that the response rate from the web survey was higher than from the paper version. However, the latter approach provided more localities than the web survey. This suggests that, although there was higher interest by respondents in completing the web-survey, as reflected in the higher response rate, the difficulties in entering data constrained somewhat their ability to respond. Feedback from individuals suggest that difficulties were most probably linked to difficulties in using the unfamiliar GIS mapping tools and frustration with the speed of loading of the maps over slow internet connections.

Respondents also demonstrated a preference for marking areas (polygons) rather than specific localities on both the paper version and web-survey. This observation reinforces other research findings that people are more likely to mark areas rather than localities on values maps if the opportunity is provided (Gunderson, & Watson, 2007). These data indicate that other approaches using predefined dots to represent areas for each value listed (e.g., Brown, 2005) may collect different data such as access points and other restricted sites (e.g., camping areas) rather than the more extensive valued recreation areas. Given the observations in this study, this lack of flexibility may well affect the validity and reliability of the values data collected.

Previous research in the use of web-based surveys indicates that older people may be unfamiliar with computers and may, as a result, be excluded from participation (Carver, et al., 2000). The data in this thesis did not support this conclusion, in that, persons over 65 responding to the survey were almost equally distributed between the paper (51%) and the web versions (49%).

The web-survey apparently provided a more attractive alternative for respondents. It provided useful data and previously reported access issues for older people did not seem to be a problem. It was particularly valuable for researchers in that locality data were immediately accessible in GIS format and involved no transfer or interpretation. The main difficulties arose with the mapping tools and the speed of loading and these impacted the quantity of data collected in comparison to the paper survey which was apparently easier to use.

Other studies using web-based GIS technology to map values have been developed. Brown (2005) limited the drawing tool to pre-designated value points, while Watson (personal communication, June 2008) has used a spray can tool (tool allowing the participants to mark an area with a density more or less strong) and 'Tagger' software (http://www.ccg.leeds.ac.uk/software/tagger/) for delineating valued areas. The present study suggests that respondents prefer to use polygons rather than points but feedback comments indicated that this tool was difficult to use. A combined study using the three methods (i.e., Brown's, Watson's and the method of the present study) in the same area would be beneficial in revealing the relative benefits of the different approaches.

In conclusion, paper surveys are probably more useful in areas of slow internet access. Alternatively, in such areas, limits are necessary on map complexity and scale variability (e.g., limited set of map pictures) to facilitate more rapid loading. In addition, simpler more intuitive

tools (Bonaguro, 2002) for re-scaling and delineating areas on the maps (MapQuest tools or Tagger; http://www.ccg.leeds.ac.uk/software/tagger/) would enhance respondent's ability to delineate localities on maps. Despite these problems, web-based GIS mapping has the potential to revolutionise the collection of spatial social science data due to its acceptability by respondents, its relatively low cost in relation to alternatives and 24/7 access.

Validity and Reliability

Using a quantitative approach provided a large amount of data for the analysis which allowed for reliable results to be included in forest planning. Nevertheless, residents not included in the sample could have answered differently to the survey than the respondents. The lack of representativeness of the sample could be problematic for generalisation of the results beyond the study area. The significant differences in the gender patterns between the sample and the census data may well be representative of the dominance of males in outdoor recreation participation in this area. However, the significant under-representation of the 20-39 age group is less likely to be representative., The ratings of the values was not significantly different between male and female respondents, with the exception of the *Wilderness & Solitude* and *Adventure* values, which could result in an under representation of sites with those values. This is likely exacerbated by the fact that the sample is significantly under represented in the age group 20 to 39 which also differs significantly from the other age groups in the rating of the *Adventure* value.

The list of values used within the survey had already been used within the Dog River Matawin project an area very similar to the study area. As mentioned previously this list of values was built using a qualitative study and is thus grounded in the same context as the study

area in this project, the values list derived from the Dog River Matawin project was therefore, likely to be valid.

Pre-tests were conducted between June and September 2007 with key informants and all participants were asked to complete a feed-back questionnaire evaluating the web-tool. Adaptations and improvements of the web-survey for future participants were thus permitted and a paper version of the survey created to allow a broader participation as Internet access is limited in the area.

Google Earth was used more closely examine the various HUAs in order to better understand their physical characteristics. Visits to communities (October – November 2008) will allow key informants to validate the accuracy of the information and thus permitting further 'ground-truthing' of the use characteristics data.

Limitations

Despite the measures taken at the outset of the survey to overcome issues of access to and familiarity with the WWW technology, it was expected that problems would continue to exist for some individuals. However, the main constraint was the slow internet access in the communities which inhibited use of the web-tool. The implementation of a paper version of the survey permitted the reduction of these difficulties and provided more flexibility for participants. Requests from people who preferred to answer the paper survey helped the tracking of the paper survey sample, however, because of confidentiality it was impossible to know which respondents decided to fill out the web rather than the paper survey.

Another limitation was the differences in responses between the web and paper surveys (Cole, 2005), and more specifically differences due to the divergences in the mapping process between the two surveys. Unlike users of the web-tool, who could zoom in to find a specific spot

and thus be precise when delineating the area, the paper survey participants were limited to a general map of the entire study area. This difference in scale and flexibility may have impacted the precision of marked sites. Moreover, there is a possibility that participants tend to draw bigger sites when using a smaller scale map. Further research comparing the two methods could verify these suppositions.

Exact response rate calculations were difficult as participants were able to fill out either mode of survey, and while the number of respondents who chose the paper survey rather than the web-survey was known, it was impossible to calculate how many respondents chose the web-survey over the paper survey. Moreover to enhance the response rate, the data from the 25 persons contacted during the pilot phase of the project were included. It is difficult also to estimate how many persons responded who were contacted through advertisement and open-houses.

High Use Areas (HUA) were produced selecting the divisions marked by at least eight respondents. This figure provided the best trade off between precision and providing appropriate aggregation patterns.. For a more local and specific planning situation, it might be necessary to increase this criterion and so increase the precision. A sensitivity analysis excluding the bigger sites marked by respondents was conducted (see Appendix 6) and it was found that an appropriate criterion for these sites was to select divisions marked by at least five respondents.

Chapter 6: Conclusion

This thesis has detailed the process of mapping forest values for recreation in the Boreal Forest around five communities of northwestern Ontario: Marathon, Terrace Bay, Schreiber, Nipigon and Red Rock. While forest values are well documented in the literature, "few studies have explored ways in which valued places can be located and incorporated realistically into the forest planning process" (McIntyre, et al., 2004). The spatial representation of the values assigned to special places in a working forest, allows the integration of recreational values and use characteristics into forest planning at the local and regional levels.

One insight of this study is the recreational patterns which show that parks and protected areas are spared much use because of the presence of road access from forestry operations. This suggests that forest operations were to cease (or be scaled back), parks and protected areas would likely receive a large increase in use. This increased use could have both negative (e.g. increased recreation impacts) and positive (enhanced revenue generation) effects inside but also outside parks and protected areas. Contrarily to the Dog-River Matawin forest area, where *Family Recreation* was the main value, *Fishing & Hunting* values were prominent in the region. This difference might be related to the sample population being residential (DMR included tourists) and rural (DMR attracted urban population of Thunder Bay).

The approach detailed allows the identification of high use areas (HUAs) with their associated values and use characteristics. Many of those identified are centred on areas that are designated as special management areas and, hence, already recognise the importance of recreational use. Other HUAs have been delineated in parts of the forest where productive forest practices and recreation co-exist, the recognition of which sensitises managers to the need to implement specific management practices to minimise conflicts and enhance the productive

integration of forestry and recreation. Equally the importance of forest production activities in enhancing access to areas that would otherwise be inaccessible to local recreationists is to be taken into consideration.

The adopted web-based GIS approach attempted to provide maximum flexibility in map scale and drawing tools. While this was appreciated by many respondents, it also created difficulties with loading on slow internet connections and made delineation of valued areas more difficult. As a consequence, a paper version of the survey was developed. Comparison of the two methods revealed that each had its advantages and drawbacks. Overall, the results suggest that both flexibility in scale and a variety (point, line, polygon) in drawing tools are advantages but that some compromises in flexibility may be necessary in the former to enhance speed of loading and that more intuitive versions of the drawing tools need to be developed.

Although the values and use characteristics are likely to be site specific, there is sufficient similarity between the results of this study and previous studies in the boreal forest (Hunt, et al., 2000; McIntyre, et al., 2004) to suggest that while the relative importance of the value categories may differ, the general values scale and broad use characteristics identified will be useful in planning other culturally similar boreal forest areas. More importantly, the approach involving web-based GIS mapping combined with statistical analysis involving clustering of sites based on respondent rated forest values is more generally applicable to a broad variety of natural resource recreational use contexts. From a theoretical point of view this study addresses a key issue in place theory in that it proposes a practical approach to both operationalising recreationists' place meanings and integrating them into land use planning processes.

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Appendix 1: Introductory information and Consent form

Introductory information:
Mapping Recreation and Tourism Values in the Boreal Forest
Thank you for your interest in this survey which is part of a research project conducted by the Centre for Tourism, Parks and Outdoor Recreation Research, Lakehead University. You have been identified to take part in this survey because you live in one of the communities of Red Rock, Nipigon, Schreiber, Terrace Bay, or Marathon. The survey seeks to collect information about recreation and tourism activities in the boreal forests surrounding these communities. Very little is known about the locations and characteristics of the places that people use for recreation in these forests and so it is difficult to include them in forest planning models. The aim of this study is to map the places that people use for recreation so that they can be included in decisions about forest uses. This information will be a valuable input into forest planning processes and could potentially have an impact on forest management decisions in your area
The information you provide will allow the creation of maps highlighting the main places that you and other residents of the region use. You will be asked to indicate the places that you use for recreation on a map and to answer some questions about each of the places you indicated. A user-name, which you provide, will allow you to visit the web-site as often as you want, to see your data and add new data to your map. In this way, you won't have to fill out all the information in the one session.
In order to protect your privacy, all responses to this survey will be anonymous. The information you provide and the places you mark on your map will be available only to you and to the research team. Published maps and other information will only show the combined data from many people. These aggregate data and summary reports will be available to you by e-mail at various stages in the project. Because of these precautions, there are no risks to your taking this survey. Your participation in this study is voluntary, and you may decline to participate without penalty. You are free to skip any question that makes you uncomfortable and you may withdraw from the study at any time.
The data you provide will be stored in a secure place at Lakehead University for 7 years. Access to these data will be limited to myself (Perrine Lesueur) and my supervisor Dr. Norman McIntyre. Any identifying information (email) will be stored separately from these data. This information will be used only for the purposes stated and will be destroyed at the end of the project.
For more information about the survey please contact the researcher Perrine Lesueur at (807) 343-8882 or plesueur@lakeheadu.ca.
Thank you,
Perrine Lesueur

Contacts:

Perrine Lesueur Masters candidate Lakehead University School of Outdoor Recreation, Parks and Tourism 955 Oliver Road Thunder Bay, ON P7B 5E1 Ph: (807) 343-8882 Email: plesueur@lakeheadu.ca	Dr. Norman McIntyre Professor/Supervisor Lakehead University School of Outdoor Recreation, Parks and Tourism 955 Oliver Road Thunder Bay, ON P7B 5E1 Ph: (807) 343-8963 Email: nmcintyr@lakeheadu.ca

Consent form:

I have read and understood the previous information:

- I am volunteering and can withdraw from the study at any time
- I understand that the information provided will be securely stored at Lakehead University for seven years
- I will remain anonymous in any public communication of the research findings and my information will stay confidential.

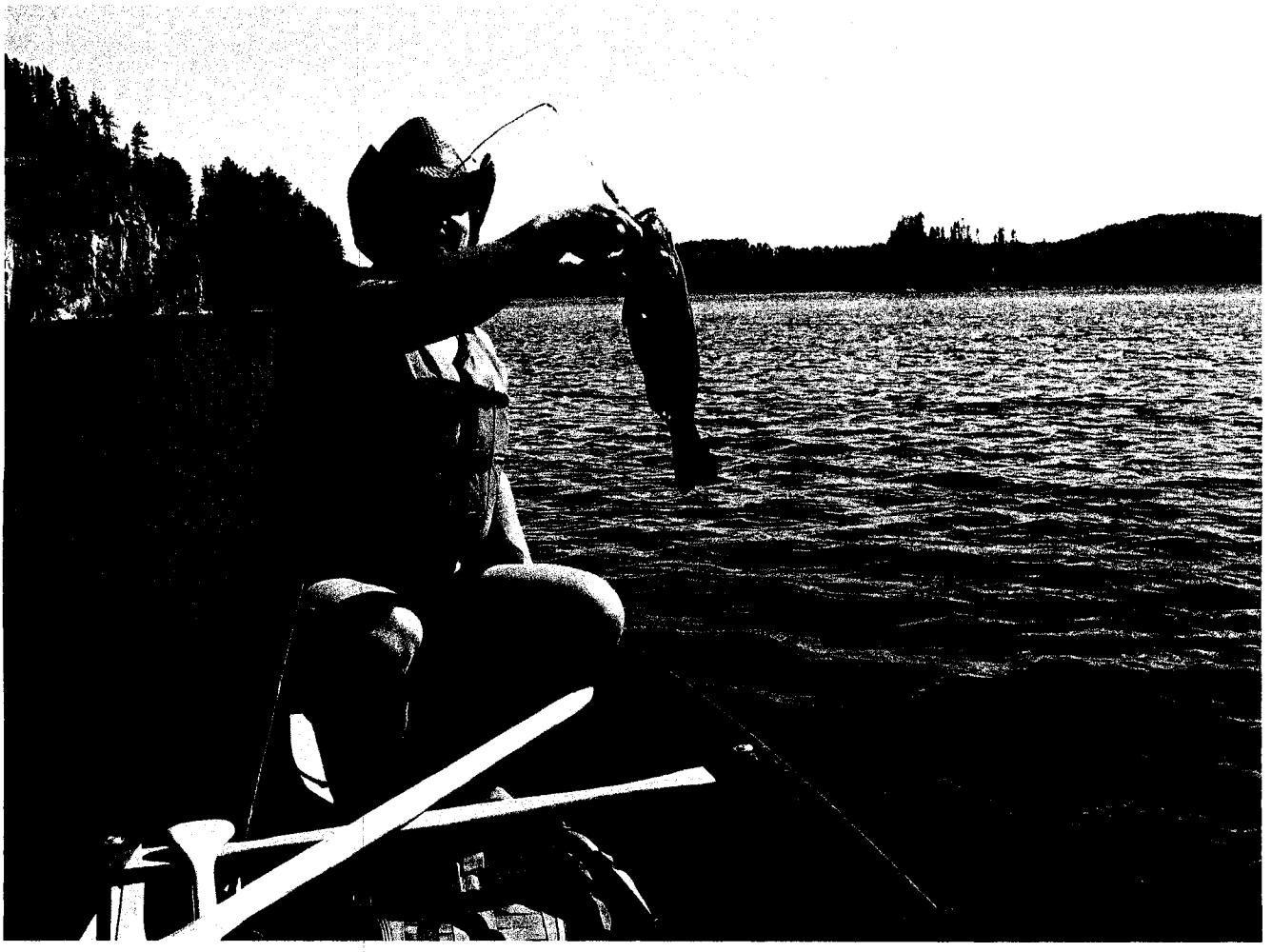
and I agree to participate:

O Yes

O No

Appendix 2: Mapping survey

Mapping Recreation Values of the Lake Superior North Coast (Red Rock – Marathon)



This survey seeks to collect information about recreation uses of the forests and waters surrounding the communities of the Northshore (Red Rock - Wawa).

Mapping the places that you and other people use for recreation will help to include them in decisions about land use planning.

SOME QUESTIONS ABOUT YOURSELF AND YOUR RECREATION ACTIVITIES IN THE FORESTS AND WATERS OF THE LAKE SUPERIOR NORTH SHORE BETWEEN RED-ROCK & MARATHON

To ensure that the people we are surveying represent the general population, please answer the following questions about yourself. All answers are confidential.

1. **Please indicate your gender:** □ Female □ Male

2. **Please indicate your age:** _____ years old

3. **What is your Postal Code?** _____

4. **How many years have you lived in the area?** _____ years

5. **In what seasons and how often in each season do you use these forests and waters for recreation?**

	never	<1 time/week	1-2 times/week	3-5 times/week	5> times/week
Fall	O	O	O	O	O
Winter	O	O	O	O	O
Spring	O	O	O	O	O
Summer	O	O	O	O	O

6. **What three recreation activities do you participate in most often in the forests and waters between Red Rock and Wawa?**

Number 1: _____

Number 2: _____

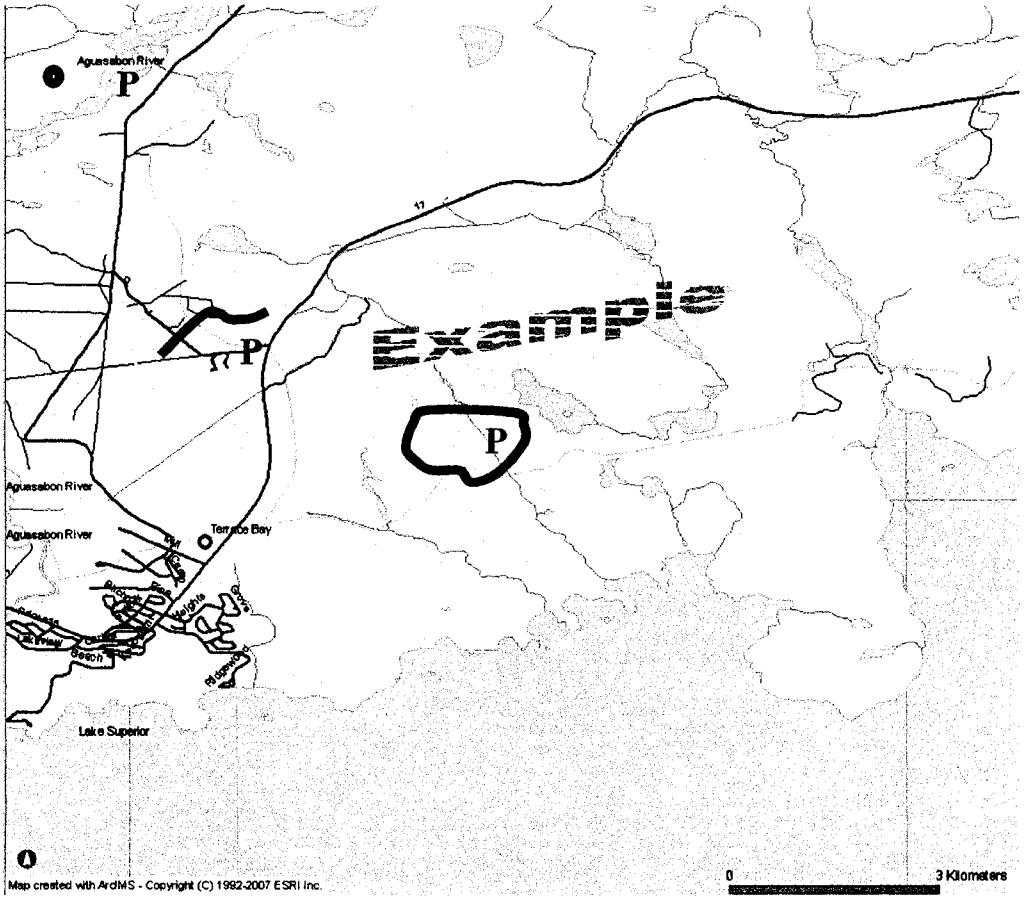
Number 3: _____

This survey collects information on the ways in which you value natural areas in the forests and waters around your community.

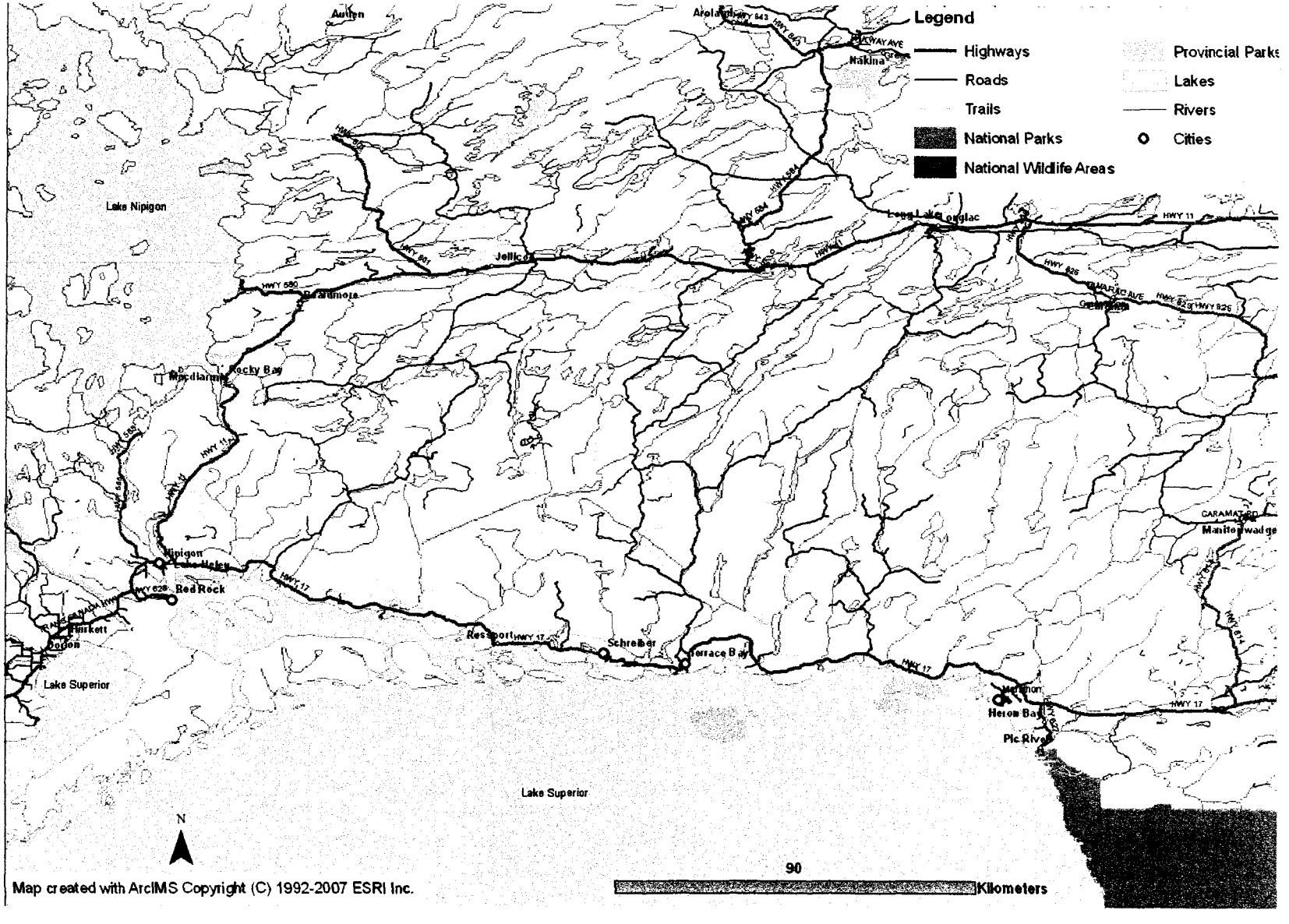
You are now asked to mark up to 6 specific locations or areas on the attached map (p.4) that you value. For each of these 6 special places/locations you will be indicated, you will have to enter information.

Please take a felt color marker to draw your special places on the attached map. You can choose to mark a specific spot using a dot, a trail (for example a road, a river) using a line or an area by circling it.

You can indicate up to 6 places, please specify for each of them a reference code: P1, P2, P3, P4, P5 or P6, they will allow you later on to enter information for each specific location.



Example: Please refer to page 5 to enter the information relating to the places: P1 to P6


Legend
Highways
Roads
Trails
National Parks
National Wildlife Areas
Provincial Parks
Lakes
Rivers
Cities
Lake Nipigon
Lake Superior
Lake Superior
Nipigon
Red Rock
Rocky Bay
Jellicoe
Longlac
Geraldton
Nakina
Schreiber
Terrace Bay
Heron Bay
Pic River
Manitouwadge
Marathon
Hurkett
Dorion
N
90
Kilometers
Map created with ArcIMS Copyright (C) 1992-2007 ESRI Inc.

7. How important are the listed recreation values in making the places you have marked on the map valuable to you?

Please rate each of the values listed on the scale of 1 to 5 by entering the appropriate number in the following table.

Please use a scale of 1 to 5 where 5 means that you think that particular forest value is of *high importance.*

	P1	P2	P3	P4	P5	P6
A place for families	1	5	2	2	2	5

	P1	P2	P3	P4	P5	P6
A place for families						
Wilderness / Solitude						
Adventure						
Fishing / Hunting						
Lots of things to do						
Wildlife						
Other values						

8. In what seasons and how many "times per week" in each season do you use the forest for recreation?

For each season, please rate in the following table each of your places using the following scale:

Never, Less than 1, 1 – 2, 3 – 5, More than 5

	P1	P2	P3	P4	P5	P6
Fall	More than 5	1-2	Never	Never	3-5	1-2

	P1	P2	P3	P4	P5	P6
Fall						
Winter						
Spring						
Summer						

9. What three activities do you participate in most often in each of your places?

	P1	P2	P3	P4	P5	P6
Activity 1	Canoeing	Skiing	Pick-nicking	Hunting	Fishing	Fishing

	P1	P2	P3	P4	P5	P6
Activity 1						
Activity 2						
Activity 3						

10. Please feel free to add any additional comments about your places in the space provided below:

Thank you for your participation.

If you would like to be further involved in the project and/or would like to receive a copy of the maps and summary report please add your e-mail or mailing information in the space below. This information will be stored in a secure place, it will be used only for this project, it will not be communicated to any others and will be destroyed at the end of the project in March 2009.

_____

_____

_____

If you have any additional questions or concerns please send an email to plesueur@lakeheadu.ca or phone (807) 472-2784.

Appendix 3: Feedback survey

Recreation On-Line Mapping Tool – Feedback

Please fill out the feedback survey below.

---

1. On what computer do you mostly access the internet? ---------- Please Select ----------

2. On average how much time do you spend on the internet per week? ---------- Please Select ----------

3. Have you ever used an internet mapping tool such as MapQuest or Google Earth? ---------- Please Select ----------

4. Why do you mostly use the Internet for? (Please rate the following uses in the table below)

	Not at all	Infrequently	2-3 times/week	Everyday	Many times/day
Leisure (surfing the web)	☐	☐	☐	☐	☐
Communications (email, MSN Messenger, SKYPE)	☐	☐	☐	☐	☐
Computer games	☐	☐	☐	☐	☐
Work	☐	☐	☐	☐	☐
Shopping	☐	☐	☐	☐	☐
News	☐	☐	☐	☐	☐
Other (Please specify)	☐	☐	☐	☐	☐

1. How did the web-site load and respond to input on your computer?

Very Slowly ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 Very Quickly

2. What type of internet connection did you use to complete the survey?

☐ High Speed (dsl/cable) ☐ Dial-Up ☐ Wireless ☐ Don't Know

3. Please rate the following aspects of the web-site on an ease of use scale of 1(not at all easy) to 5 (very easy)

	Poor 1	2	3	4	Excellent 5
a. The Web-site Overall	☐	☐	☐	☐	☐
b. The Tutorial	☐	☐	☐	☐	☐
c. The Map (Level of Detail)	☐	☐	☐	☐	☐
d. The Map Tools (Zoom, Pan)	☐	☐	☐	☐	☐
e. The Drawing Tools	☐	☐	☐	☐	☐

If you rated any of the above items as 2 or lower, please use the space below to elaborate on what you found difficult and any suggestions you can offer for improving the website / tool. We would also appreciate any other comments you may have on any other aspect of the web site or internet mapping tool.

Submit Reset Cancel

Appendix 4: Supervisor and committee members approval

May 18th, 2007

Madam, Sir,

This proposal has been peer-reviewed and approved by the thesis committee.

Dr. Norman McIntyre.
Professor,
Outdoor Recreation Parks & Tourism

Appendix 5: Kimberley Whitmore's letter of understanding of ethic procedures

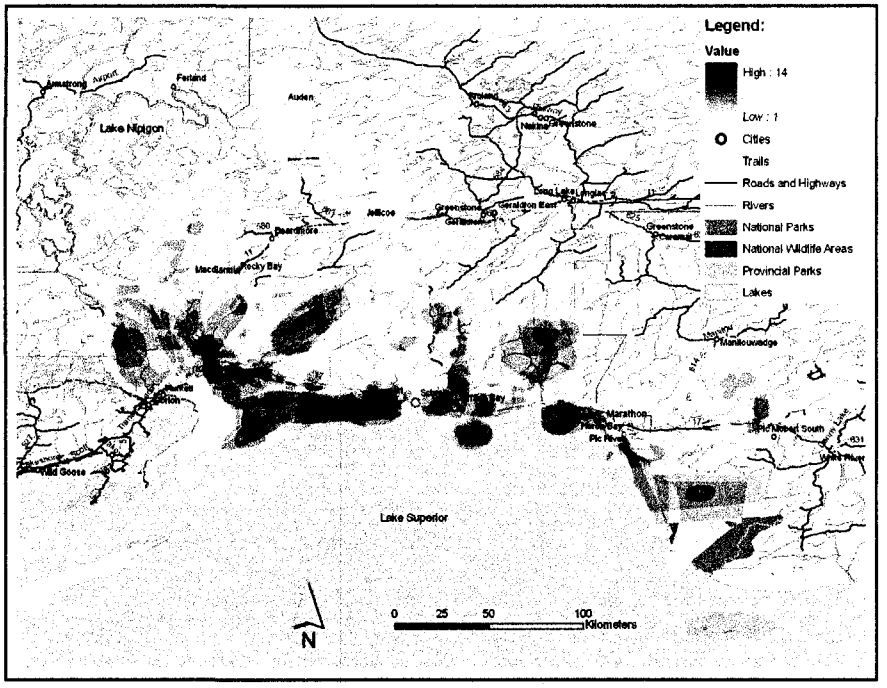
May 16th, 2007.

Madam, Sir,

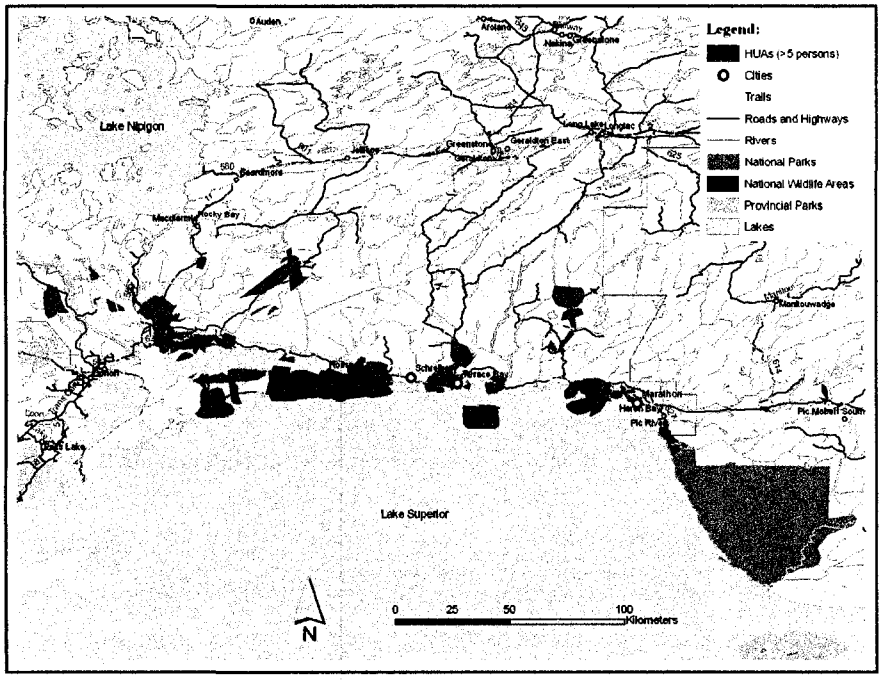
I have read and understood the ethic procedures and how they apply to the project conducted by Perrine Lesueur and Norman McIntyre and to my involvement in the data collection process. I agree to be bound by the ethical procedures governing this project.

Kimberley Whitmore.

Appendix 6: Sensitivity analysis



Sensitivity analysis: Map of the Recreational Use Patterns



Sensitivity analysis: Map of the High Use Areas (criterion of at least fiver respondents)