# RURAL ECONOMY

**Assessing Impacts of Environmental Change on Aboriginal People: An Economic Examination of Subsistence Resource Use and Value**

Donna Dosman, Michel Haener, Wiktor Adamowicz, Juanita Marois and Peter Boxall

Project Report #02-01

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A Report on a Component of the Project:
Environmental Valuation for Use In Forest Management and Decision Making

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**Abstract**

The report describes the research design, data collection and preliminary analysis of an economic assessment of non-timber resource use by Aboriginal People in Northwest Saskatchewan. The project is designed to develop methods of valuing resource use by Aboriginal People so that these values can be incorporated into forest resource management decisions and to evaluate the impact of forest management actions on the economic well-being of Aboriginal People living in the region. Data on non-timber resource use are collected and spatially explicit economic models are developed in order to construct estimates of behavioral change and value associated with changes in the environment and landscape (through forestry, access, or other landscape changes).

## 1.0 Project Overview

Sustainable forest management is being proposed as a new method for managing forest resources. This approach differs from sustained yield management as it examines more than just timber resources in making decisions about forest harvesting and management (e.g. Mendelsohn 1995). However, the concept of sustainable forest management is still somewhat unclear in that the operational details have not generally been examined or implemented. Indeed, there is even controversy regarding the definition of the term (see Adamowicz and Veeman 1998). We view sustainable forest management as managing forest resources with due consideration of multiple values inherent in the resource and with an understanding of the social, economic and ecological implications of alternative actions. In such a case the identification of a range of non-timber values becomes a necessary element of sustainable forest management. Furthermore, the development of methods to understand the implications of alternative management strategies on non-timber values is also an important research goal.

In this research program we examine non-timber values in the NorSask forest region, identify those non-timber values that are significant and are directly and/or indirectly affected by forest management activities, and develop tools to understand the implications of forest management on these non-timber values. A considerable amount of research effort has been spent on the measurement of non-timber values (see Adamowicz 1992; Adamowicz and Boxall 1998; Loomis 1993) however, linkages between this research and forest management has at times been tenuous. Some examples of methods that can link non-timber values to forest management are the hedonic travel cost methods (Englin and Mendelsohn 1991; Englin 1990) and the random utility travel cost method (Fletcher et al. 1990; Adamowicz et al. 1997). In this report we will employ random utility models that may be linked with other forest resource planning tools to integrate non-timber valuation methods with forest planning decision tools. Information on how non-timber values will be affected by decisions regarding harvest patterns, roads, access, etc. will be the product of this research.

## 2.0 Introduction

The desire for economic growth has increased the pressure to allocate rights to resource companies for the harvest and extraction of renewable and non-renewable resources in northern Canada. A result of which is an increased number of overlapping and sometimes incompatible demands for the land base. In recognition of these potential conflicts governments are developing or are requiring the resource companies to develop integrated resource planning documents for the boreal forest that incorporate some of the economic and social aspects of non-timber resources of the boreal forest. For example, Saskatchewan Environment and Resource Management requires forestry companies to provide a 20 year plan that illustrates "… how company activities will affect other users… (SERM 2001). "

One group that is often overlooked in resource planning is the Aboriginal People who reside in the boreal forest. Their exclusion from the industrial planning and development process is a result and

extension of their history of lack of voice and power in the political process in Canada (Buckley 1993). There are two factors that highlight the importance of the inclusion of Aboriginal Peoples' use of the land base in the resource planning. First, non-timber resources continue to play an important role in Aboriginal culture, economy and diet as documented in the anthropology, geography, sociology and nutrition literatures (Tobias and Kay 1993; Usher 1976; Usher and Wenzel 1987; Beckley and Hirsch 1997; Berkes et al. 1994, 1995). The second factor is that Aboriginal People make up a large percentage of northern Canadian population and this segment of the population has a substantially higher growth rate than the rest of the Canadian population.

In many regions of the boreal forest in Canada Aboriginal people, both First Nations and Metis, are the primary users of non-timber forest products. As a result they are affected by changes to the forest landscape. Determining the influence that forest practices and policy changes have on their use of the land base is hindered by our lack of knowledge of their use of and preferences for the non-timber forest products and forest landscape attributes. For some regions, we have some information related to the quantity of products harvested but there have been no studies that attempt to identify the underlying determinants of how often aboriginal people harvest these resources, where they choose to harvest and the marginal economic values of the non-timber resources attributable to changes in the environment. The goal of this research project is to investigate some of the underlying determinants of aboriginal preferences for hunting site characteristics, the frequency of their hunting activities, and marginal values of the characteristics and activities. The purpose of this project report is to provide a detailed description of data collection tools and methods, a set of descriptive statistics data and initial modeling results.

## 3.0 Background

Research related to the importance of subsistence uses of non-timber products of the boreal forest has been conducted in anthropology, geography, nutrition and economic literature. One approach, often applied in anthropological, geography, and nutritional research, is to document the quantity and range of the resources taken from the forest and then to calculate a replacement cost for these resources. A second approach found in the anthropological literature is to examine foraging behaviour using a constrained optimization model. A third approach, stated preference methods, utilized in economic research examines hunters' preferences about their choices of hunting sites from which marginal values for changes in these attributes can be estimated. While the first two approaches focus on what Aboriginal people harvest they are unable to provide insight into what attributes of the forest landscape and the animals harvested have on harvesting behaviour and are unable to predict how behaviour may change given changes in the forest environment. The stated preference method, however, has been designed to gain a deeper understanding of how changes in the landscape attributes will alter hunting behaviour. Our study is one of the first attempts to apply this technique in a cross-cultural setting. These methods are briefly outlined in the next three sections.

### 3.1 Replacement Cost Method

Harvested non-timber goods are not traded in a market place and as a result there is no market value for them. The replacement cost method values these non-market goods, such as wild game meat, by calculating the cost of replacing these goods with similar ones available in a market. These values are typically calculated as part of a harvest survey[1] to derive an aggregate economic value for an annual Aboriginal harvest for a given area. The underlying premise of this calculation is to determine "how much it would cost [a hunter] to feed his family by buying the equivalent food at the store?"

[1] Harvest statistics are counts or estimates of the quantity of particular species of wildlife that are killed for a given area, or by a specific group over a specified period of time. Harvest statistics are then reported either as the total harvested for a given area, or for by a specified group (Usher and Wenzel 1987).

(Usher 1976).

To calculate the replacement cost a conversion factor is used to convert live weight into an edible weight. These conversion factors are based on participant observation, field measurements and detailed monitoring of harvesting activities (Tobias and Kay 1993). The price used in the replacement cost calculation is often the average price per kilogram to buy a comparable type of meat in the nearest store. For moose meat, comparable meat is a good quality beef roast (Tobias and Kay 1993). Replacement cost is calculated by multiplying the average price per kilogram by the total edible weight of the meat harvested.

### 3.1.1 Critique of Replacement Cost Method

This method determines the gross value of the loss of hunting as the minimum cost to replace the good with a substitute. In theory the net value of the lost good includes the replacement cost of the good plus compensation for lack of hunting activity minus the now avoided cost of providing the original good. In most of the harvest studies only the first step was calculated. Therefore, if society does not have the responsibility to replace pound for pound the loss of wild game meat, replacement cost will overvalue the wildlife at the margin but undervalue the total wildlife harvest.

Brown and Burch (1992) suggest that the replacement cost method is theoretically weak. They express several criticisms of the market valuation approach. First, the analyst needs an estimation of the hunter's cost to determine the net value. This process is complicated by the joint use of the equipment for different activities and over more than one period. Secondly this monetary value assumes that the hunter does not get any value from the activity of hunting.

Brown and Burch (1992) feel that there are cultural values or held values associated with hunting, such as self-reliance, closeness to nature and kinship. While some critics feel that these cannot be adequately expressed in the monetary values, Brown and Burch feel that there is no a priori reason to expect that the properly measured value of a good such as hunting will not include cultural importance.[2]

Beckley and Hirsch (1997) note that

> "there may not be substitutable commodities that could compensate for what would be lost if the opportunity to hunt and trap were not available to indigenous people whose ancestors lived in the same place, and practised the same activities before them… The native person's experience of tracking game and "living off the land" like their ancestors may not be quantifiable in the context of mainstream economic theory. The comparison of subsistence goods with store-bought replacements assumes that consumers are 'indifferent' to whether they have market goods or subsistence goods. In fact, respondent repeatedly expressed preferences for subsistence goods over store-bought substitutes."

Beckley and Hirsch (1997) state that the estimation of "…the marginal utility associated with consuming one additional unit of comparable subsistence and market goods…" may provide a better estimate of the marginal value associated with subsistence use than replacement values.

A further difficulty with the replacement cost approach is that the substitute needs to be an appropriate one. Usher (1976) points out that game meat is not easily replaced. Domesticated meat is not the same as wild game meat. Pound for pound wild game meat is more nutritious than domesticated meat and domesticated meat does not taste the same as wild game meat.

[2] Brown (1992) qualifies this statement with three conditions when this may not hold. (1) If the individual's WTP is constrained by their ability to pay and their cultural values are overwhelmed by basic needs. (2) Economic values reflect the conditions now and not in the future. So if the conditions of resource availability change then the existing economic values are not appropriate. Changes in cultural values are difficult to predict. (3) If some large non-marginal change occurs in resource availability the value can no longer be appropriate.

### 3.2 Optimal Foraging Models

Within the field of anthropology behavioural ecologists have used optimal foraging models to enhance their understanding of foraging economies (Winterhalder 2001). These models are based on constrained optimization which implicitly assumes that hunters are "proficient and skilled" and thereby efficient and rational. This method and the associated assumptions of efficiency provide an ethical commitment to their studies and reduce ethnocentrism.

Behavioural ecologists acknowledge that hunters' behaviour is "multi-casual in origin" but recognize that to understand the complexity of these causal relationships that researchers first need to understand the effects of causes separately. Their research examines three broad areas: habitats and use of space; food transfers; and resource allocation models. Of particular interest to resource economists are the resource allocation models that "analyze what environmental features most directly affect the evolution of foraging behaviour (Winterhalder 2001: page 2)". A common model used is an encounter-contingent model that measures the desirability of a site by net acquisition rate of energy to select sites for foraging. These models identify and estimate a variety of costs and benefits to predict resource selectivity. Theoretically these models utilize the notion of declining marginal rate of return to predict when and where a forager will move to next. However, there have not been any quantitative studies of this type utilizing the concept of marginal analysis (Winterhalder 2001).

### 3.3 Non-Market Valuation of Non-Timber Products

Appropriate methods for exploring hunting behaviour and estimating marginal valuations can be found in resource economic research where there is a burgeoning literature on non-market valuation of non-timber products (e.g. Adamowicz et al. 1997, Boxall and Macnab 2000). Two approaches commonly taken are revealed and stated preference. The revealed preference approach documents hunting harvest levels and trip locations taken in a specified period of time. One of the advantages of this approach is that it utilizes information on actual behaviour although in some cases this information can suffer from inaccuracies due to recall errors. The stated preference approach, on the other hand, requires respondents to make hypothetical choices. The hypothetical nature of the stated preference method has been criticized in the literature. However, the stated preference approach also allows some of the shortcomings of RP data to be overcome.

For several reasons, it is important to supplement information on harvest levels and trip locations with stated preference data. First, changes taking place in the boreal landscape are beyond what has been experienced in local history. Development of road networks, forest harvesting and energy developments create conditions that cannot be captured by relying on revealed preference models. Second, while traditional areas used by Aboriginal People can be determined and analyzed, population pressures and changing preferences appear to have lessened connections to these traditional areas. Thus, the ability of revealed preference data to forecast future use patterns is weakened. Finally, collecting information on traditional activities and harvests is a significant challenge; Aboriginal People privately hold such information. It is possible that collecting choice experiment data may be less threatening and may provide sufficient information to assess the impacts of resource development on these subsistence users.

None of the existing non-market valuation research focuses on Aboriginal uses of non-timber resources, hunting behaviour or their economic values. This study attempts to fill this critical gap in our knowledge.

## 4.0 Study Area and Sample

The study area for this project is the Millar Western-NorSask Forest Management Agreement (FMA) in northwestern Saskatchewan, which extends along the Alberta-Saskatchewan border

comprising 3.3 million hectares of land (see Appendix C). Although NorSask utilizes the softwood and Millar Western utilizes the hardwood in the region, the landscape planning for the region as a whole is undertaken by Mistik Management Ltd. Mistik's mandate is "to provide the mills with a long term sustainable wood supply while taking into account the many resources and uses of the forest" (Mistik Management Information Booklet). Achieving this mandate is a challenge since demands for resources are increasing. In 2000, the government of Saskatchewan allocated additional harvesting rights in the province and increased the Annual Allowable Cut (AAC) in the NorSask region.

Demands for other resources are also increasing as the region's population increases. As with other areas in Canada, the aboriginal population is increasing at a rapid rate. In Northwestern Saskatchewan, Aboriginal People make up a substantial proportion of the population. Specifically, they comprise 26.8% of the population in census division 17 and 80.6% of the population in census division 18 and have grown by 74.2% and 43.8% respectively from 1991 to 1996 while the total population of the province had a 0.1% change in population for the same 5-year period (Statistics Canada 1998).[3] If these population trends continue the importance of the forest for traditional uses will increase. The current population of the FMLA is about 25,000 spread over about 22 communities in and around the FMLA including ancestors of Cree, Dene, Metis and Europeans.

**Table 1**: **Population change between 1991 and 1996 in northwest Saskatchewan**

| | Census Division 17 | Census Division 18 | Saskatchewan |
|---|---|---|---|
| Aboriginal population change (%) | 74.2 | 43.8 | 11.2 |
| Total population change (%) | 4.6 | 16.3 | 0.1 |

Source: Statistics Canada 1998.

Mistik has taken a unique approach to public involvement in forest management. "In consultation with Elders, Mistik has made agreements with several community-based "co-management" or advisory boards in the FMLA who wish to share in decision-making about timber, wildlife, fishing, hunting, tourism, and recreation resources in their fur conservation areas" (Mistik Management Ltd. p. 3). The co-management boards include: Waterhen, Canoe Lake, Green Lake, Beauval, Buffalo Narrows, Dillon, La Loche, and Ile a la Crosse. There are also two advisory boards for the Divide and Pierceland/Goodsoil regions. The boards meet on a regular basis (generally monthly) with Mistik managers to discuss community concerns.

For the purposes of our research project, we wanted to incorporate information from Metis and First Nations respondents from several different communities in the region. Interviews were conducted in 7 communities (Green Lake, Waterhen, Canoe Narrows, Jans Bay, Cole Bay, Beauval and Dillon) representing 5 co management areas. All respondents were community harvesters over 18 years of age. With this sample we hope to identify whether there are differences between the harvesting patterns of Metis and First Nations people and people living in the North (i.e. Dillon) and those in the South (i.e. Waterhen)[4].

## 5.0 Survey Development

In order to understand the importance of non-timber resources to Aboriginal peoples and to

[3] The Mistik FMLA includes a small portion of Census Division 17 along the northern census division boundary and the southwest portion of Census Division 18, which covers all of northern Saskatchewan north of the Meadow Lake area.
[4] Hunting rights for Metis have been and are continuing to evolve over the course of the project.

estimate the economic values attached to these resources, four distinct types of data were collected: harvest level data, discrete choice data (revealed preference data - trip logs and stated preference data - choice experiments), qualitative data, cultural and socio-demographic data. In addition to furthering our understanding of the role and importance of these resources to the aboriginal communities, the collection of the harvest data and discrete choice data allows methods of economic valuation to be compared (Haener, Dosman, Adamowicz and Boxall 2001).

### 5.1 Harvest Data

The purpose of this harvest survey is to identify the diversity and level of resources used by the harvesters in these communities. In particular the survey focuses on the level of big game hunting. Based on Usher and Wenzel (1987), the criteria on which we collected the harvest data are:

- Harvests: The harvest numbers recorded count only those animals used for human consumption.
- Categories: Big game that was hunted and furbearing animals that were trapped were the focus of this study. A list of animals harvested was developed in consultation with the native harvesters, elders, outfitters, and forest managers. Key informant interviews with elders and focus groups comprising native harvesters who are employed in the forestry industry, were conducted to ensure that the species listed, timelines and harvest questions on this survey were accurate and answerable. During the interview process, harvesters were asked about whether there were other animals they harvested that had been omitted from the list. We also asked whether they harvested a number other non-timber products, but due to the length of the survey we did not collect harvest levels for fish and other plant products.
- Time: Five years of annual harvest data were collected using a recall approach. A key informant – an elder- felt that most hunters would be able to remember harvest levels for at least five years and many individuals, he felt, would remember further back. We found though that this time period seemed more appropriate for the big game hunting than for the trapping. Hunters were better able to remember specific numbers of animals harvested than were the trappers. The exception to this would be those trappers who continued this activity to earn money rather than as a hobby or cultural activity.

  The hunting season was defined from the beginning of the fall 1998 to the end of the summer of 1999.
- Hunting Area: To determine how their hunting areas relate to the NorSask FMLA each harvester was asked to identify their own general hunting area on a map. It was evident from the maps that the general hunting areas for the majority of the harvesters fell well within the boundaries of the FMLA.

The harvest data will indicate the level of utilization of wild game meat, which is critical to the calculation of the replacement cost method of valuation.

### 5.2 Discrete Choice Data

As noted earlier, two types of discrete choice data were collected for this study. The revealed preference data were collected in the form of a hunting trip log and associated map. The stated preference data were collected in a choice experiment format.

#### 5.2.1 Revealed Preference Method

Hunting trip information for the past hunting season was collected in two complementary formats. The first was a traditional trip log, which records the location and frequency of each trip. It also included information on the approximate distance traveled, the modes of transportation, with

whom the trip was taken, the duration of the trip, the season of the trip and the number of moose harvested by the harvester and the group. The second format was a map of the NorSask FMLA on which the harvester drew his general hunting area and the location of the trips recorded on the trip log.[5] This provided a spatial record of the trips taken. The general hunting area is defined as the entire area in which they would consider going to hunt moose and each trip was recorded taken that season were also recorded on the map.

The general hunting areas were fairly consistent for harvesters from the same community. As a result a general hunting area was derived for each community using a compilation of all the maps of the harvesters of the community in question. The Dillon region was the only exception as a few of the harvesters' general hunting areas were substantially different from the majority of the group. These outlier maps were excluded from the compilation when the general hunting area for Dillon was derived. The general hunting area for each community defines the choice set for harvesters from the said community. This spatial hunting information in conjunction with site characteristic information provided by Mistik Management will allow spatial simulation models to be constructed.

During key informant interviews both the trip log and mapping procedure were reviewed to ensure that it would appropriate to seek this type of information. Several pre-tests were conducted to determine the best approach and line of questions to obtain this information. It took several interviews and discussions with the community contact before an approach was developed that ensured that complete information was collected.

This process continued into the implementation of the actual interviews, and changed in the various communities. The methods used to obtain complete information responded to the level of confidence and disclosure of the respondents. Both the map and the trip log were used simultaneously. Many informants preferred to talk in stories. The use of a map as a visual tool worked to make the respondents feel more at ease with the process. They would point out the sites and begin to remember the rest of the trip details that were needed to complete the trip log: "Ya, I was with my wife. It's in the fall time we do hunting eh. Every time you go you're on a hunting trip. You know to the cabin" (Respondent 104). Many unmarked maps were also left with respondents in exchange for the information provided about their hunting sites.

### 5.2.2 Stated Preference Method

We extend existing studies on Aboriginal harvests by incorporating stated preference methods into our survey. We used a choice experiment approach to investigate how Aboriginal people in the region select where they hunt and how their behavior might change in response to landscape changes. Through focus groups and discussions with Aboriginal harvesters and forest managers in the region we determined that moose are the most significant non-timber resource in the aboriginal culture and as such were chosen as the good to be used in our choice experiment.

The design of the choice experiment began with a list of hunting site characteristics used in earlier choice experiments designed to capture preferences of southern hunters for hunting sites in central and northern Saskatchewan (Tanguay et al 1995; Morton, 1993). This list of potential hunting site characteristics was presented to a focus group; the appropriateness of each attribute was discussed and culturally appropriate levels were determined. This set of attributes was further vetted through an elder harvester who after some discussion approved the list. From these approved attributes a choice experiment was designed.

The attributes themselves did not differ radically from earlier designs, however, the levels of the attributes did (see Table 2). In particular, the levels for the distance and the mode of transportation attributes differed from earlier surveys reflecting the fact that Aboriginal hunters live in their hunting

[5] The map provided was approximately 6x3 feet in size so that detailed information could be recorded.

regions and that past cultural practices influence the mode of transportation for some hunters.

The prototype choice experiment was initially text based, similar to choice experiments used in mail surveys of licensed hunters in the south. One elder informant, who was conversant in English but had difficulty reading, found that reading the survey and discerning the specifics of the choice experiments difficult. It was decided that an illustrative approach would be more appropriate in this setting (see Appendix B). Photographs were used for attributes for which a picture would easily illustrate its meaning, such as time since harvest and access to the hunting site. Though better, these photographs created some confusion, as some respondents could not distinguish between the access and time since harvest pictures making statements such as

*"I would hunt in this one, but not that one"*

while referring to the same site (i.e. boat access to a recently harvested site).

A common criticism of the stated preference method is that the setting is hypothetical actual behaviour is not observed. The hypothetical nature of the questions posed further difficult for some of the Aboriginal harvesters. Some respondents had difficulty understanding what was being asked of them, and the relevance of these questions to their lives. The confusion was evident in some of the responses, but more common with the older respondents. Their lives have not been made up of hypothetical choices and this concept was difficult for them to grasp.

**Table 2: Definition of hunting site attributes for the choice experiment**

| Attributes | Levels |
|---|---|
| How far hunting site is from home. | 10 km |
| | 50 km |
| | 100 km |
| | 200 km |
| How many people you see at the hunting site. | Nobody else, except other in my hunting party |
| | Other people |
| How many signs of moose you will see each day. | Signs of less than 1 moose per day |
| | Signs of 1 to 2 moose per day |
| | Signs of 3 moose per day |
| | Signs of more than 4 moose per day |
| How hunters travel to the site. | On foot without trails or cutlines. |
| | By quads on old logging roads. |
| | By 4-wheel drive on new logging roads. |
| | By boat through interconnected lakes. |
| How long it has been since the site was harvested. | Site just harvested. |
| | Site logged 3 to 5 years. |
| | Site logged 10 to 15 years. |
| | No evidence of logging. |

Certain choice sets that comprised a hunting site were not logical and they did not understand why such an option would be given.

*"I thought the pictures weren't accurate and didn't make much sense to me" (respondent C38).*

An explanation about the "silliness" of the computer programs and an assurance of their knowledge was often required for them to make the choice.

### 5.3 Socio Demographic and Cultural Data

The socio-demographic data collected included age, community born, sex, education, marital status, number of children, employment status, partner's employment status, and aboriginal status. During the development of the survey tool we were informed that it would be culturally inappropriate for us to ask what the respondent's annual income was. We thought annual income could be imputed from the respondent's employment status and industry in which he worked. However, what became evident through discussions is that, for many of the respondents, employment is a patchwork of jobs that may last for a few days to several weeks or months in many different industries ranging from forest fire fighting to road construction to forestry work. A much more detailed employment record for the year would be needed to be able to impute income.

The cultural data were collected to provide insight into what role harvesting plays in each respondent's life. Capturing the importance of hunting and other boreal forest non-timber resources in terms of the continuation of cultural and the role the associated activities play in their lives was a difficult task. Questions focused on how long they had been hunting and trapping, whether they pass their traditions along by teaching others their harvesting skills and whether the meat harvested was shared amongst family and friends. Unfortunately these questions only provide proxies for the importance of the traditional lifestyle to the respondent.

### 5.4 Special Sites Map

The last set of data collected was sites of special importance to the aboriginal harvesters including calving areas for moose and caribou, nesting areas for eagles, burial sites, salt licks, cabins and sites of historical significance such as trails and portages. These data were collected while the trip logs and trip mappings were being completed. The harvester was asked to locate the sites on the map; all the sites compiled on one map.

These data were collected at the request of Mistik management. The data were not used for modeling purposes but were provided to Mistik Management to be used when drafting their harvest plans. In addition, community level special sites maps were created and given back to each community during presentations in June 2001.

## 6.0 Data Collection Process

The process by which the data were collected differed from previous harvesting research, which primarily relied on mail surveys. During the pre-tests it became evident the data collection could not be done by a mail survey so instead data were collected in less formal in-person interviews. While the design of the survey was to be a straightforward question and answer session, the interview style that evolved was more of a conversation allowing "story telling" and elicitation of information from a conversation. The interviews ranged in time from approximately 40 minutes up two hours and averaged just over one hour.

Trust was an important factor in the entire process. Community members were apprehensive about discussing hunting and trapping activities with a stranger, especially a non-Aboriginal person. In response, we employed one primary interviewer who became known in the communities and developed a relationship with the local people. Interviews were arranged with the assistance of a community resident who socially and culturally had access to the hunters. The interviewer lived in the communities for approximately one year, which facilitated the development of trust between the interviewer and community members. The fact that the interviewer lived in the community was a fundamental component of the research process.

Reciprocity also played a vital role in securing relationships with the respondents. Reciprocity for participation in the study was offered at several levels. First, the research group made a

commitment to report back the findings to each of the communities.[6] Each harvester was asked during the mapping exercise to identify special sites such as nesting areas, calving areas, burial sites, cabins or historical sites. A map of special sites was created for each community and presented to community leaders. These gifts assisted the researchers in securing support from influential groups in the community. Second, an incentive of a draw in each community for a gift certificate at a local hunting store was offered to all respondents. Individual respondents responded favourably to the incentive and in several cases the respondent was much more forthcoming with information when the draw was described to him. Third, in interviews with First Nations elders an offering of tobacco was made at the beginning of the interview. This offering is a sign of respect and formalizes the relationship between the interviewer and the elder.

In each community initial contact was made through the co-management boards[7] with the exception of Dillon and Waterhen. In the first communities to be contacted Mistik Management provided the initial introduction to the co-management boards. In most cases the board had representation from the municipality or the tribal council so that the initial presentation to the board effectively contacted both groups. However, in the case of Canoe Narrows the tribal council required a further process of approval of the survey by the band council. At each board meeting copies of the survey were provided to each board member for their review and approval. In addition, we offered to include any questions that they wish to have added. We returned periodically to the boards to touch base and answer any of their questions.

The decision to complete interviews in the Dillon and Waterhen First Nations was made later in the fieldwork process. As a result, initial contact with these two communities was pursued differently. In Dillon, the interviewer approached the co management coordinator directly, on the recommendation of individuals from Mistik Management. This process worked well. The coordinator also assisted in the identification of a community contact. Though the Chief and Council were not approached about the project, the chief was one of the first people interviewed and gave his support in this manner. There is no co management board in Waterhen First Nation, thus initial contact was made directly with the Chief. He reviewed the survey, participated in an interview, discussed it with Council and gave approval. He was also instrumental in the identification of the community contact.

In each community the approval process was slightly different but without it data would not have been collected. To ensure accessibility to the harvesters, often the first interviews in each community were with high profile community members such as the chief, mayor, or chair of the co management board. By way of example their participation sent out a strong message that working with this research group was acceptable.

The fieldwork portion of this project started in the fall 1999 and was completed over a number of months: October 1999 to September 2000. During this period 124 interviews were completed in 7 different communities. Initial contact with the co management boards began in the January 1999 in Beauval and Green Lake. By the summer of 1999, a significant amount of contact with Canoe Lake, Green Lake and Beauval had been made to prepare for the interviews, but none had been completed. Though a community contact had been identified for Green Lake, a number of unsuccessful attempts to set up appointments with this person made it evident that a new contact was needed. In early October, interviews were started in the community of Canoe Lake (Canoe Narrows, Cole Bay and Jan's Bay). Being the first community, this area posed many challenges and work there continued slowly until the end of the month. The next community in which the interviews were begun was Green Lake. For the month of November, people were interviewed in both areas. Interviews continued at the end of January in Beauval. Here a very resourceful community contact was hired and the interviews in this

[6] These presentations were carried out in June 2001 in all but one community, Dillon.
[7] Definition of co management board and their role in this FMLA.

community were completed quickly - only 2 weeks. In April a second attempt was made to complete interviews in the Canoe Lake region, which lasted two more weeks and was more successful than the first due to the hiring of a more interested community contact. Contact in Dillon was initiated in spring 2000 and a community contact hired during this period. Interviews in Dillon were conducted over a period of one week in each of the following months: May, June and July. Community members tend to travel a lot during the summer and interviews were a challenge to organize. During the first week of August the Dillon interviews were completed, and contact was initiated with Waterhen First Nation. A community contact was hired and interviews completed in August and early September. This concluded the fieldwork process.

The recruitment of interviewees differed slightly from community to community but in all instances the community contact was the cornerstone to the process. Finding a reliable and successful community contact often took considerable time. The community contact had to be someone whom the community respects and has access to the hunters. In five of the seven communities more than one community contact was required as the initial contact person was not committed to the project, did not have access to the harvesters, or was not reliable.

When the initial contact did not work out we would return to the co management board, contacts in Mistik management, the town manager or band office for further suggestions. This process of identifying a reliable and committed contact often took a substantial length of time. Once a reliable community contact was identified the first interviews were often with high profile community members such as the chief, mayor, or chair of the co management board and then harvesters who were known to the community contact. In Green Lake and Beauval access to respondents became somewhat easier as the community became more aware of the research project. In other communities where residents are more cautious of outsiders access to respondents was more difficult and substantially more time was spent waiting for interviews. During interviews respondents were asked if they could suggest others who would be willing to be interviewed. Although, it is difficult to determine an actual response rate, the fieldworker estimated that it ranged from about 85% in Beauval and Waterhen, to 75% in Green Lake, 65% in Dillon and about 55% in the Canoe Narrows, Cole and Jans Bay area. In section 6.0, we use trapping activity to help us determine the total number of harvesters in each community and the percent that were captured in our survey.

**6.1 Challenges in Data Collection**

Conducting cross-cultural research is full of challenges. The first challenge is developing trust. The members of the communities were apprehensive about discussing their hunting and trapping activities with a stranger, especially a non-Aboriginal person. As a result, our interviewer had to overcome this before people agreed to talk to her. Developing reliable contacts in the communities and gaining their trust was a time intensive process. Data were collected in 7 communities and as a result 7 community contacts needed to be found. In each community the researcher had to initiate new contacts and relationships. Each community presented different problems with respect to community contacts and the identification of harvesters.

A second problem encountered had to do with different concepts of time between the researchers and residents in the native communities. The community contacts and interviewees tend to have a number of different “jobs” or responsibilities that take precedence over interviews. Interviews had to be completed on their schedule, not on our project timeline. In addition, the population in which we were interested (hunters and trappers) was often “in the bush” and not always available.

A third problem arose due the relationship between the researchers and Mistik management. Certain individuals assumed that because Mistik financially supported the research, they also controlled it. For that reason, they were apprehensive about agreeing to the interviews and providing certain information. This apprehension was especially apparent with those people who were in some

way affiliated with forestry, and felt they had a lot to lose if they said something negative about Mistik.

Another challenge that was alluded to earlier was that Metis hunting rights are evolving. The awareness of this evolution is indicated in comments such as "Different, yep. Gotta buy a license now. Well now we don't have to with our Metis rights" (Respondent B76). We also found that different harvesters interpret the rules differently, as these rules seem to change with circumstances: "They are holding everybody, but the Treaties in the fall. Treaties can get it anytime for yourself. I never get a license because I'm married to a Treaty. She has to go with me" (Respondent B62). The uncertainty of the laws and the different levels of interpretation may have led to inaccurate harvest information being given by Metis respondents. They were concerned that the interview data may be given to SERM, and used to charge certain individuals. This concern was evident with comments such as "You are an undercover aren't you?" (Respondent W106).

### 6.2 Capacity Building

An important objective of this project is to involve the Aboriginal peoples of the NorSask forest in the research process. An important aspect of this goal is to incorporate any of the concerns and issues of these communities into the research tools. The communities were involved initially in the creation of the survey tools through focus groups and key informant interviews. In addition, one or two individuals in each community were hired as community coordinators to assist with the interview process.

Comments made by the community coordinators have indicated that the interview process has been one from which they have learned. During the interviews, there have been various times when the coordinators have given explanation of concepts to the interviewees, and in certain cases, have conducted the entire interview themselves. This process has provided various benefits for them including research skills and an opportunity to practice their traditional languages, either Cree or Dene.

An additional objective of this project is to elicit community input into the forestry management process. Though the final results of this study will provide the bulk of this information, the process itself has also affected this objective. The community coordinators learned from the interviews. The interviews provided a structured opportunity for the coordinators to hear concerns and comments from community members. Listening to these concerns has increased their own knowledge of the issues facing their communities. Many of the interviewees' comments related to current issues with which the co-management boards struggle. The information provided in these interviews has become a part of the community input as certain coordinators indicated they would take this information back to their discussions at the board meetings (though they have been reminded that the specific responses are confidential).

## 7.0 Results

### 7.1 Descriptive Statistics

A total of 124 in-person interviews were conducted in seven communities located in the NorSask FMLA (see Table 3). Although the intent was to collect approximately equal proportions of Metis and First Nations harvesters, slightly more Metis (59%) were interviewed than the First Nations (41%). In addition, an attempt was made to capture harvesters from both northern (37%) and southern (63%) communities, to facilitate investigating the influence of better access to larger commercial centers on harvesting behaviour.

To determine how representative our sample is the number of trappers and harvesters is needed. The number of trappers is based on SERM trapping records (see Table 4). The number of harvesters is calculated by multiplying the average number of trappers for 1996-1998 for each region by a magnitude of 3-4 times (according to SERM representative: McKay 2001). While the number of

trappers declined in 1998 for these regions, the number of hunters is not declining as quickly. The number of trappers is declining as there are young men acquiring hunting skills who are not taking up trapping at the same time.

**Table 3: Number of respondents**

| Community | Metis or First Nations | North/South | Access | Number of interviews |
|---|---|---|---|---|
| Green Lake | Metis | South | Paved highway | 30 |
| Beauval | Metis | South/north | Paved highway | 29 |
| Canoe Narrows | First Nations | North | Gravel road | 12 |
| Cole Bay | Metis | North | Gravel road | 9 |
| Jans Bay | Metis | North | Gravel road | 5 |
| Waterhen | First Nations | South | Gravel road | 20 |
| Dillon | First Nations/Metis | North | Gravel road | 19 |
| Total | | | | 124 |

**Table 4: Number of trappers and harvesters**

| | Number of trappers[a] | | | | Approximate Number of harvesters |
|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | |
| Green Lake | 16 | 13 | 20 | 13 | 48-64 |
| Beauval | 26 | 27 | 25 | 12 | 78-104 |
| Waterhen | 8 | 9 | 14 | 5 | 60-80 |
| Canoe Narrows region | 34 | 36 | 29 | 24 | 96-128 |
| Dillon | 8 | 11 | 12 | 4 | 33-44 |

[a] Based on SERM records.

### 7.2 Participation Rates and Harvest Levels

The descriptive statistics on harvest activities and levels reported in this section are derived from the harvest survey. The harvests statistics indicate that the pattern of harvesting differs significantly between communities. However, for confidentiality reasons only the aggregate harvest numbers will be presented.

Table 5 reports the proportion of respondents who harvest a variety of big game species and trap fur-bearing animals. We attempted to recruit those who considered themselves moose hunters, however, these results indicate that a few of the respondents were not moose hunters. Deer and moose were the most common big game animals harvested, while elk and caribou were least commonly harvested. The proportion of harvesters, who also trap, ranges in this sample from about 45% to 100%. It is felt that in the community with the lowest proportion of trappers (i.e. 47.4%) many of the trappers were not available to be interviewed as they were working away from the community and as a result this figure is an under representation.

Moose and deer are harvested in all 7 communities; however, there are differences in harvest trends between the communities. Moose harvest levels ranged from 0.37 to 3.17 animals per season.

Deer harvest levels are about 2 times higher than moose harvest levels. Communities with the highest levels of moose and deer harvests are 5 to 6 times larger than the communities where the harvests are the lowest. Caribou and elk are less consistently harvested in this region and in several communities have not been harvested in the past five years at all. Bear, on the other hand, is not commonly harvested *by* all hunters but at least one bear was taken in each community in each of the past five *years.* Comments by the harvesters would tend to suggest that these harvests occur more for safety or nuisance concerns than subsistence*: "I shot a bear from the deck of my cabin. Not this one, at the cabin. Because it was a real pest, not because I wanted to shoot it for the fur. It kept coming to the cabin. Coming around." (Respondent B73).*

**Table 5: Percent of respondents to harvest by species**

| | Moose | Deer | Caribou | Elk | Trapping |
|---|---|---|---|---|---|
| Average proportion of respondents (%) | 96 | 92.7 | 25 | 41.1 | 71 |
| Community with minimum proportion (%) | 90 | 83.3 | 3.3 | 10.3 | 47.4 |
| Community with maximum proportion (%) | 100 | 100 | 42.1 | 85 | 100 |

Overall, the harvest trends for all species have not changed substantially over the past 5 years. However the maximum and minimum harvest levels indicate that hunting patterns do differ between communities (see table 6).

**Table 6: Average number of animals harvested per harvester (n=124) and highest and lowest community averages**

| | | 1999 | 1998 | 1997 | 1996 | 1995 |
|---|---|---|---|---|---|---|
| Moose | Average | 1.1 | 1.3 | 1.4 | 1.31 | 1.31 |
| | Highest | 2.42 | 3.0 | 3.17 | 2.74 | 2.67 |
| | Lowest | 0.37 | 0.57 | 0.70 | 0.73 | 0.63 |
| Deer | Average | 2.23 | 2.27 | 2.16 | 2.04 | 1.99 |
| | Highest | 6.33 | 6.22 | 6.33 | 6.11 | 6.11 |
| | Lowest | 1.41 | 1.37 | 1.37 | 1.07 | 1.00 |
| Caribou | Average | 0.024 | 0.008 | 0 | 0.008 | 0.073 |
| | Highest | 0.22 | 0.2 | 0 | 0.2 | 0.31 |
| | Lowest | 0 | 0 | 0 | 0 | 0 |
| Elk | Average | 0.024 | 0.024 | 0.024 | 0.024 | 0.032 |
| | Highest | 0.33 | 0.33 | 0.083 | 0.083 | 0.15 |
| | Lowest | 0 | 0 | 0 | 0 | 0 |
| Bear | Average | 0.15 | 0.15 | 0.13 | 0.11 | 0.081 |
| | Highest | 0.42 | 0.42 | 0.31 | 0.2 | 0.21 |
| | Lowest | 0 | 0.05 | 0 | 0.033 | 0 |

Trapping levels tend to fluctuate slightly more than hunting levels (Table 7). This is in part due to the price fluctuation of the pelts from year to year (see Table 8). There were a few entries for marten

pelts in the SERM records, however, none of our respondents indicated that they trapped marten.

**Table 7: Average number of animals trapped per trapper (n=88) and highest and lowest community averages**

| | | 1999 | 1998 | 1997 | 1996 | 1995 |
|---|---|---|---|---|---|---|
| Beaver | Average | 8.18 | 9.7 | 7.66 | 4.65 | 7.52 |
| | Highest | 24.89 | 33.56 | 19.13 | 8.86 | 13.6 |
| | Lowest | 0.43 | 0.93 | 2.5 | 0.25 | 0.25 |
| Coyote | Average | 0.75 | 0.51 | 0.73 | 0.28 | 0.56 |
| | Highest | 3.0 | 2.5 | 3.0 | 0.71 | 1.29 |
| | Lowest | 0 | 0 | 0 | 0 | 0 |
| Fisher | Average | 1.99 | 2.69 | 1.86 | 1.43 | 2.22 |
| | Highest | 6.78 | 6.0 | 4.75 | 4.78 | 4.44 |
| | Lowest | 0 | 0.67 | 0 | 0 | 0 |
| Fox | Average | 1.34 | 1.1 | 0.91 | 0.66 | 0.78 |
| | Highest | 5.24 | 3.56 | 3.11 | 3.11 | 3.44 |
| | Lowest | 0.11 | 0 | 0 | 0 | 0 |
| Lynx | Average | 0.65 | 0.52 | 0.52 | 0.25 | 0.23 |
| | Highest | 2.44 | 1.63 | 1.63 | 1.0 | 0.78 |
| | Lowest | 0 | 0 | 0 | 0 | 0 |
| Mink | Average | 1.41 | 1.97 | 1.47 | 1.00 | 1.61 |
| | Maximum | 4.67 | 4.0 | 3.78 | 3.22 | 3.78 |
| | Minimum | 0 | 0 | 0.43 | 0 | 0 |
| Muskrat | Average | 19.45 | 50.27 | 29.84 | 19.88 | 24.35 |
| | Highest | 33.33 | 198.89 | 98.89 | 110 | 98.89 |
| | Lowest | 0.43 | 0.67 | 0 | 0.89 | 0 |
| Otter | Average | 1.32 | 1.47 | 1.1 | 0.89 | 1.27 |
| | Highest | 3.67 | 3.75 | 3.25 | 3.43 | 3.57 |
| | Lowest | 0.21 | 0.67 | 0 | 0 | 0 |
| Weasel | Average | 2.5 | 2.83 | 2.32 | 1.92 | 2.33 |
| | Highest | 4.67 | 7.89 | 8.0 | 6.78 | 7.11 |
| | Lowest | 0 | 0 | 0.27 | 0 | 0 |
| Wolves | Average | 0.22 | 0.26 | 0.17 | 0.16 | 0.43 |
| | Highest | 1.11 | 0.55 | 0.44 | 0.71 | 1.33 |
| | Lowest | 0 | 0 | 0 | 0 | 0 |

Note: All means were calculated using only those who indicated they were trappers.

| Table 8: Price per pelt in northwest Saskatchewan ($) | | | | |
|---|---|---|---|---|
| | **1998-99** | **1997-98** | **1996-97** | **1997-98** |
| Beaver | 21.82 | 26.23 | 30.39 | 26.23 |
| Bear | n.a. | 55.00 | 57.00 | 55.00 |
| Coyote | 14.75 | 12.28 | 29.84 | 12.28 |
| Fisher | 32.80 | 35.40 | 49.90 | 35.40 |
| Fox | 4.76 | 18.24 | 21.93 | 18.24 |
| Lynx | 58.99 | 87.09 | 115.91 | 87.09 |
| Mink | 14.32 | 17.46 | 25.11 | 17.46 |
| Muskrat | 1.29 | 2.95 | 4.12 | 2.95 |
| Otter | 55.37 | 73.10 | 60.12 | 73.10 |
| Weasel | 1.03 | 2.01 | 3.84 | 2.01 |
| Wolves | 83.63 | 114.17 | 26.97 | 114.17 |

Note: $s are in current year.

Hunting behaviour varies from community to community. To illustrate the range of behavior, the averages for all respondents and the maximum and minimums community values are presented in Table 9. Hunters in some communities choose to go hunting frequently for short durations and distances, while in other communities the preference is to travel longer distances less frequently. In addition some communities' harvest levels are substantially higher; success rates vary from 25% per day to a low of 3.6% per day.

| **Table 9: Descriptive statistics for actual moose hunting trips taken in 1999 hunting season** | | | |
|---|---|---|---|
| | Overall Average | Highest community average | Lowest community average |
| Frequency of trip | 7.87 | 19.89 | 3.5 |
| Individual harvest/trip | 1.09 | 2.75 | 0.43 |
| Party harvest/trip | 1.65 | 5.22 | 0.59 |
| Individual success rate/harvest day | 0.14 | 0.25 | 0.036 |
| Average duration | 2.52 | 5.17 | 2.2 |
| Distance drive | 44.26 | 150.99 | 14.4 |
| Distance canoe | 4.16 | 7.32 | 1.25 |
| Distance walk | 1.34 | 2.8 | 0.12 |
| Distance ATV | 4.27 | 14.09 | 1.5 |
| Distance snow | 1.44 | 5.99 | 0 |

The fieldworker would move between the harvest survey and the trip log comparing harvest numbers trying to ensure that the numbers corresponded. There is some concern about over reporting in some instances because of a need to "boast". Others may have underreported because they took more than their allowable limit and in some instances the animals were double counted because culturally when you hunt with a group you and an animal is killed the animal belongs to the group. Some of hunters were hunting together during the season reported. Overall, however, it is felt that these biases are minimal.

### 7.3 Replacement Cost Estimates

In order to compare our RP and SP results with traditional replacement cost methods, we also calculated replacement costs using the data collected from the harvesters (see Haener et al. 2002). Replacement cost estimates for our sample of hunters suggests that a 25% loss in harvest would be valued at approximately $800 per hunter per season (based on estimated values of beef).

**Table 10: Replacement cost for moose harvest per harvester per season ($)**

| | Based on Trip Log | | Based on Harvest Survey | |
|---|---|---|---|---|
| | All | Trips only | Moose hunters only | Full Sample |
| Total value | 3220.13 | 3958.7 | 3367.85 | 3249.675 |
| **loss- 10%** | **322.01** | **395.87** | **336.78** | **324.97** |
| **loss- 25%** | **805.03** | **989.67** | **841.96** | **812.42** |

**Table 11: Replacement cost for moose harvest per harvester per season by status ($)**

| | Status | | | | | |
|---|---|---|---|---|---|---|
| | First Nation (n=62) | | Metis (n=56) | | Other (n=6) | |
| | Harvest survey | Trip log | Harvest survey | Trip log | Harvest survey | Trip log |
| total value | 4520 | 2983.8 | 1625 | 3480.11 | 5406.3 | 2954 |
| **loss- 10%** | 452 | 298.38 | 162 | 348.011 | 540.63 | 295 |
| **loss- 25%** | 1130 | 745.95 | 406 | 870.027 | 1351.6 | 739 |

### 7.4 Other Non-Timber Forest Products

There are many more non-timber products harvested from the boreal forest. In this study we did not collect precise harvest levels for each of these goods, however, we did capture which other non-timber products these harvesters used in their household or to provide household income (see Table 12). The non-timber products range from plant materials collected for their own use like berries, medicinals and firewood to the collection of cones, mushrooms, and wild

**Table 12: Use of other non-timber products by harvesters**

| | Average for all communities (%) | Highest community participation rate (%) | Lowest community participation rate (%) |
|---|---|---|---|
| Firewood | 75.0 | 100 | 63.3 |
| Medicinals | 54.0 | 75.0 | 33.3 |
| Berries | 87.1 | 100 | 76.7 |
| Mushroom | 28.2 | 73.7 | 0 |
| Cones | 0.8 | 3.4 | 0 |
| Outfitter | 6.5 | 20 | 0 |
| Rice | 29.0 | 83.3 | 6.7 |
| Small game | 73.4 | 95.0 | 30.0 |
| Commercial fishing | 21.0 | 55.6 | 10.0 |
| Personal fishing | 65.3 | 100 | 33.3 |

rice, which are sold to forest companies and southern markets respectively. Berries continue to be an important supplemental foodstuff for households in all communities while small game, firewood and fishing are important resources to the majority of the households in 5 of the 6 communities. The

variability in the utilization rates is in part to due to the location of the communities to good transportation routes and southern communities and in part due to the lack of the resource such as mushrooms in the more southern communities.

### 7.5 Cultural importance of harvest of non-timber products

The harvest statistics provide a strong indication that these resource play an important role in these households. In addition, the forest is an important component to the spiritual and in particular, the cultural aspects of their lives (see Table 13). In addition few respondents identified the forest as a location of recreational activities.

**Table 13: Role of forest to respondents**

| | Average (%) | Highest community average (%) | Lowest community average (%) |
|---|---|---|---|
| Food | 89.5 | 100.0 | 72.4 |
| Spiritual | 55.6 | 83.3 | 10.0 |
| Cultural | 85.5 | 100.0 | 70.0 |
| Recreation | 19.4 | 50.0 | 11.1 |

In an attempt to further capture the cultural role of hunting and its significance in their lives, we focused on two areas: how the meat was distributed amongst the community and whether their hunting and trapping skills are being passed on. The majority of the hunters responded that they shared the meat that they harvested (see Table 14). In the communities where harvest levels are higher all the harvesters shared their meat. Communities where the harvest levels are the lowest also share their meat less.

**Table 14: Percent of harvesters that share their meat**

| | Average of all respondents (%) | Highest community average (%) | Lowest community average (%) |
|---|---|---|---|
| Give moose | 89.5 | 100 | 83.3 |
| Give deer | 87.1 | 100 | 68.5 |
| Receive meat | 79.0 | 89.5 | 66.7 |

The majority of the transfers of resources occur between family members, in particular, between children and parents, and between siblings. Kinship tends to determine the flow of meat and Tobias and Kay (1993) found that it "serves to level the economic differences and imbalances among households." There seems still to be a role specialization here as most of the hunters are men and a higher proportion of the meat is shared with their mothers, sisters and grandparents while few of these hunters receive meat from these same individuals (see Tables 15 and 16). Another group that shares meat are friends who hunt together. The party considers a kill by one of the members a success for the entire hunting party: *"We split the moose when you catch one and share all the meat. Sometimes they say if you don't get a moose, don't bother coming home. My buddy, his wife told him that. When I shot my moose and give him some, he knelt down and said 'Thank you God, now I can go home tonight" (Respondent C79).*

| Table 15: With whom respondents share meat | | | |
|---|---|---|---|
| | Average of all respondents | Highest community average | Lowest community average |
| Father | 41.9 | 66.7 | 10 |
| Mother | 47.6 | 77.8 | 15 |
| Grandparents | 17.7 | 60 | 0 |
| Aunt | 21.8 | 55.6 | 5 |
| Child | 41.9 | 63.2 | 15 |
| Brother | 52.4 | 100 | 35 |
| Sister | 46.0 | 100 | 15 |
| Uncle | 16.9 | 44.4 | 5.0 |
| Niece | 18.5 | 60 | 6.9 |
| Grandchildren | 4.0 | 40 | 0 |
| Family | 4.8 | 16.7 | 0 |
| Friend | 41.9 | 63.2 | 30.0 |
| Elders | 20.2 | 33.3 | 0 |
| In-laws | 13.7 | 25.0 | 25.0 |

Note: these proportions will not add up to 100 as the respondents could choose more than one recipient.

| Table 16: From whom respondents receive meat | | | |
|---|---|---|---|
| | Average of all respondents | Highest community average | Lowest community average |
| Parent | 6.43 | 20.0 | 0 |
| Brother | 24.99 | 50.0 | 0 |
| Uncle | 8.05 | 20.0 | 0 |
| Family | 8.85 | 60.0 | 0 |
| Friend | 43.52 | 68.4 | 24.9 |
| Son | 8.08 | 40.0 | 0 |
| Aunt | 1.61 | 6.9 | 0 |
| Sister | 4.02 | 11.1 | 0 |
| Daughter | 0.80 | 3.3 | 0 |
| other | 11.29 | 25.0 | 0 |

Note: these proportions will not add up to 100 as the respondents could choose more than one recipient.

The passing on of traditions and skills is an important way that cultures are continued. Many of these harvesters learned their hunting and trapping skills from their fathers and grandfathers (see Table 17). These skills are also being passed on to younger generations as well. In particular the proportions of respondents who indicate they also teach these skills is about 80% in all but two communities. One factor that may contribute to these lower levels is the accessibility to the town of Meadow Lake; in more isolated communities a higher proportion of the harvesters are involved in teaching younger members hunting skills. Compared to hunting, fewer respondents are teaching trapping skills. The lower rate of transference may be a result of the fact that trapping is not a commercially viable activity due the low prices for fur. These lower prices have resulted in fewer animals being trapped and less importance placed on this skill set.

| Table 17: Who first taught the respondents to hunt and trap and do they teach others | | | |
|---|---|---|---|
| | Average of all respondents | Highest community average | Lowest community average |
| **Hunt** | | | |
| Father | 70.15 | 78.9 | 60.0 |
| Brother | 5.64 | 40.0 | 0 |
| Uncle | 7.25 | 40.0 | 0 |
| Grandfather | 19.3 | 50.0 | 0 |
| Other | 22.6 | 26.3* | 16.7* |
| Teach Others (%) | 79.04 | 100 | **69** |
| **Trap** | | | |
| Father | 64.5 | 100.0 | 55.2 |
| Brother | 10.5 | 20.0 | 0 |
| Uncle | 8.05 | 25.0 | 0 |
| Grandfather | 19.4 | 50.0 | 0 |
| Other | 22.6 | 40.0* | 0 |
| Teach Others (%) | 59.7 | 100.0 | **43.3** |

Note: other includes family, friends, mother and grandmother. * indicates mother or grandmother taught the skill.

### 7.6 Socio Demographic Statistics

Table 18 provides the descriptive statistics for the socio-demographic variables collected. Income levels were not collected directly as it was felt to be a culturally inappropriate question. Instead information was collected on employment levels (full-time, part-time, seasonal) and the industry the respondent was employed in. However, it became apparent that more detailed information is needed to determine income levels. In particular many individuals hold several different jobs over the course of a year due seasonal nature of many of the jobs in the region. In order to understand the role of employment in hunting behaviour more detailed information is needed about the range of jobs an individual holds, the duration of these jobs, average number of hours, the type of position and the seasonal patterns of the jobs.

**Table 18: Socio-demographic statistics**

| | Average | Maximum | Minimum |
|---|---|---|---|
| Age | 48.0 | 86 | 21 |
| Years hunting | 33.8 | 70 | 2 |
| Years trapping | 28.8 | 70 | 1 |
| Household size | 3.5 | 11 | 1 |
| Years of schooling | 11.5 | 16 | 0 |
| Marital status | Percent (%) | | |
| Married/common law | 68.5 | | |
| Single/divorced/widowed | 31.5 | | |
| Employment | | | |
| Part time | 10.5 | | |
| Full time | 61.3 | | |
| Unemployed[a] | 6.5 | | |
| Student | 1.6 | | |
| Retired | 16.9 | | |
| Status | | | |
| First Nations | 50.0 | | |
| Metis | 45.2 | | |
| Other | 4.8 | | |

[a] Unemployment levels reported in table 18 are substantially lower than Statistics Canada's unemployment rate. The difference is due the fact that we record employment levels over the past year while the unemployment rate often quoted is based on whether the respondent was employed on the day the survey was conducted.

## 8.0 Choice experiment estimation and results

In addition to collecting information about actual harvesting activities, we collected information on hypothetical choices that the harvesters would make if environmental conditions were as presented using constructed descriptions of hunting sites. These methods are referred to as choice experiments and allow the researcher to examine responses to environmental conditions that are outside of the current range of data and they allow the researcher to identify influences on site choice independent from other often-confounded influences (see Haener et al 2002 for additional discussion on the choice experiment). The structure and purpose of the choice experiment were explained to each respondent during the course of the interview. We attempted to have respondents from each community complete an equal number of each version of the choice experiments. While this goal was not achieved entirely, overall equal proportions of each version were completed (see Table 19).

| Table 19: Percent of respondents completing versions of choice experiment | | | | |
|---|---|---|---|---|
| | Version 1 | Version 2 | Version 3 | Version 4 |
| Green Lake (n=30) | 23.3 | 23.3 | 26.7 | 26.7 |
| Canoe Narrows (n=12) | 25.0 | 33.3 | 16.7 | 25 |
| Cole Bay (n=9) | 22.2 | 22.2 | 33.3 | 22.2 |
| Jans Bay (n=5) | 20 | 0 | 40 | 40 |
| Beauval (n=29) | 27.6 | 24.1 | 24.1 | 24.1 |
| Dillon (n=19) | 26.3 | 31.6 | 21.1 | 21.1 |
| Waterhen (n=20) | 25 | 25 | 25 | 25 |
| Total (n=124) | 25 | 25 | 25 | 25 |

### 8.1 Methods and Estimation

Responses to choice experiments generate discrete choice data that can be analyzed using methods based on random utility theory (Louviere, Hensher and Swait 2001). The utility that an individual derives from an alternative is considered to be associated the attributes of the alternative. The utility function ($U$) can be represented as $U=V+\varepsilon$ where $V$ signifies a deterministic component and $\varepsilon$ an unobservable or stochastic component.

$V$ can be characterized according to arguments as: $V_i = \beta_k X_i$ where $X$ is a vector of $k$ attributes associated with alternative $i$ and $\beta$ is a parameter vector. If the distribution of the stochastic components is characterized as IID Gumbel, the conditional choice probability of selecting alternative $i$ is:

$$(3) \qquad prob(i) = \exp(\mu\beta_k X_i) \Big/ \sum_{j \in C} \exp(\mu\beta_k X_j)$$

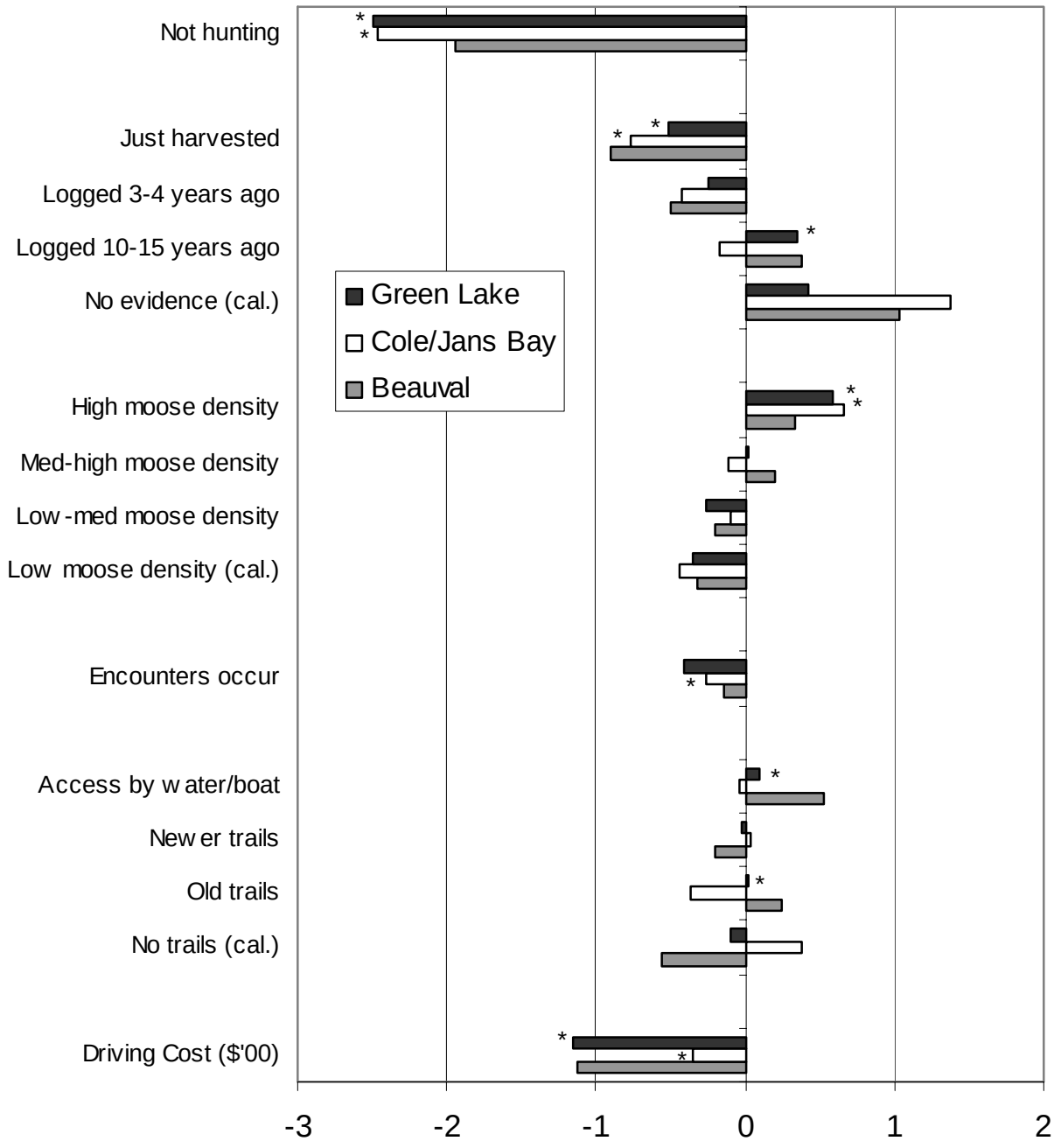
where $\mu$ is a scale parameter and C is the choice set. When a single set of data is used to estimate a model, $\mu$ is confounded with the parameter vector and cannot be identified. The model specification in (3) is referred to as the multinomial logit model (MNL).

In our case, the $X$ matrix is composed of the attributes used in the CE design (Table 2). All variables with the exception of distance were effects coded. Distance was converted to driving cost using operating costs for a full size vehicle ($0.589/km as reported by the Canadian Automobile Association).

### 8.2 Results

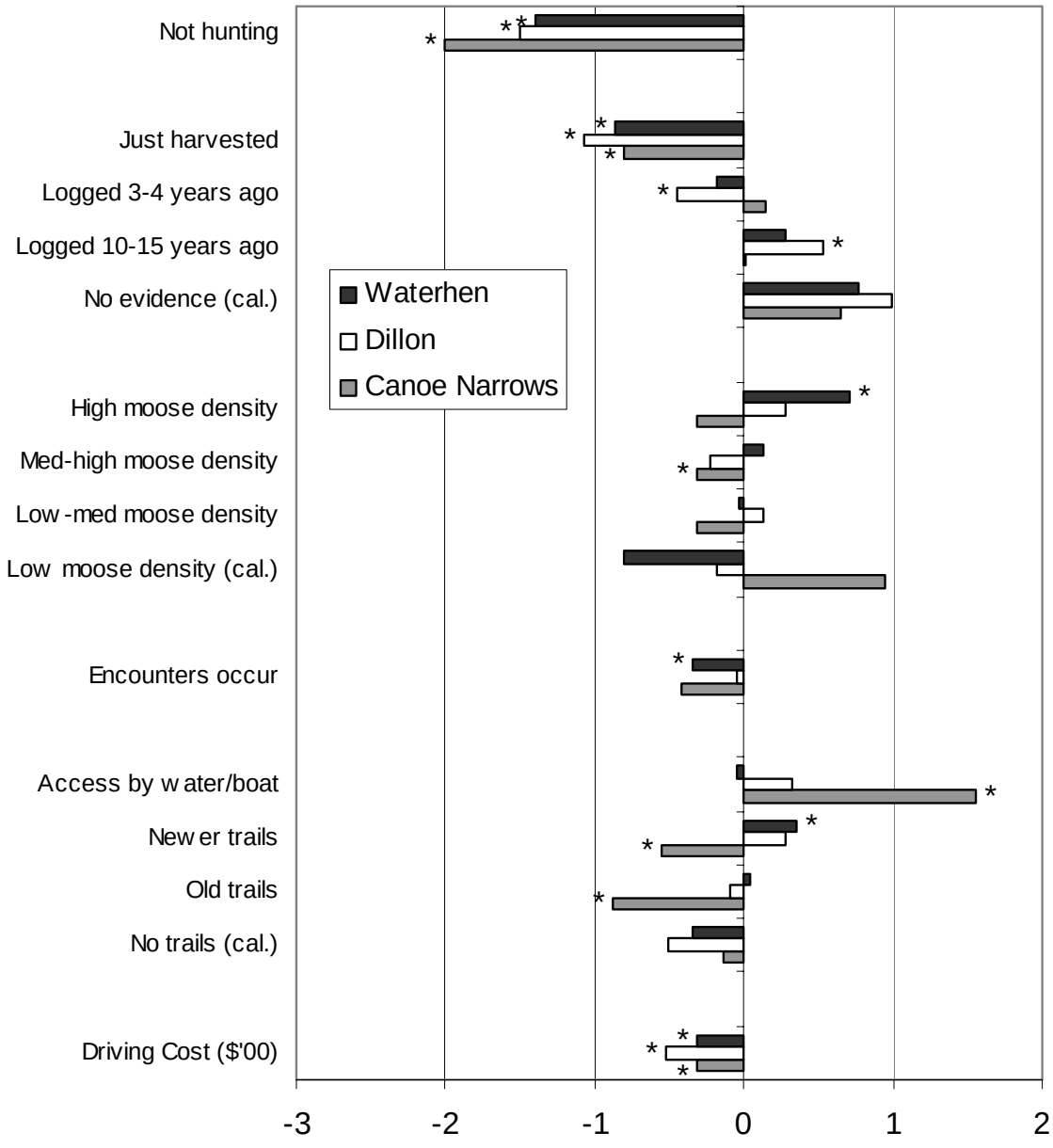
We estimated MNL models using the choice experiment responses of hunters in each community. For illustrative purposes we group the preference models for communities which are predominately Metis (Beauval, Cole Bay/Jans Bay, and Green Lake) and First Nations (Canoe Narrows, Dillon and Waterhen) in Figures 1 and 2. From the figures we can see that there are similarities between the communities but also some significant differences. As we would expect, for all communities increased travel costs and not hunting provide disutility. For all communities, a site is preferred more the longer it has been since it was harvested. Fewer encounters with other hunters are also universally preferred. Preferences for access and moose density are more variable.

**Figure 1: Preferences of Metis Communities**




* Indicates significance at the 95% confidence level; (cal.) indicates calculated value.

**Figure 2: Preferences of First Nations communities**




* Indicates significance at the 95% confidence level; (cal.) indicates calculated value.

Using more advanced modeling techniques, the possible sources of the observed heterogeneity in preferences were investigated and the results are reported in Haener et al. 2001. In general, Haener et al. find that age (young, middle-age, or elder) and aboriginal status (Metis or First Nations) seem to influence hunting preferences. Some of the more specific findings are that increases in travel costs and loss of hunting sites would most significantly affect elders. Younger hunters are more concerned with high moose populations and are not as sensitive to differences in travel costs.

**9.0 Future Directions**

The next phase of the project will involve the development of models of hunting behavior based on the trip log data collected during interviews with hunters. As noted in Section 4.2.1, each respondent marked their general hunting area and their trip locations from 1999/2000 hunting season on a paper map of the NorSask region. The information on each map was transferred into digital form using ArcView. ArcView coverages for the region (lakes, rivers, FMLA boundary, FCA boundaries, Operating Area boundaries, roads and trails) were provided by Mistik Management and were used as the geographic reference for developing general hunting area and hunting location coverages from the maps. Although individual level data were digitized, for purposes of displaying the results in ArcView, the data were aggregated by community to ensure confidentiality.

Aggregating the general hunting areas by community helped us to determine the geographical extent of hunting behavior for each community. General hunting areas for several communities overlapped but for the most part they followed the boundaries of the FCAs.

For the purposes of modeling hunting behavior, the operating area was selected as the unit of analysis. The operating area, as the name suggests, is the smallest unit of operation planning used by Mistik Management. Hunters in our sample, took trips to most of the 450 operating areas in the FMLA, as well as some outside the FMLA. Table 20 lists the number of operating areas (within and outside the FMLA) visited by respondents from each community surveyed.

**Table 20: Operating areas visited by each community**

| Community | Operating Areas Visited | Operating Areas Visited within FMLA | Operating Areas Visited outside FMLA |
|---|---|---|---|
| Waterhen | 55 | 40 | 15 |
| Beauval | 59 | 56 | 3 |
| Canoe Narrows | 207 | 173 | 34 |
| Green Lake | 30 | 30 | 0 |
| Dillon | 127 | 104 | 23 |
| Cole Bay/Jans Bay | 155 | 131 | 24 |

From the GIS coverages, we were able to create the following variables by operating area: lake area (ha), length of rivers (km), length of road (km) by each road class (1-8), size (ha), In addition, for the operating areas in the FMLA, Mistik was able to provide data related to the following landscape characteristics: crown closure class (A-D), percent conifer, age class, disturbance (fire, insect or pest, wind) presence or absence, biodiversity emphasis, non-forest area (i.e. muskeg), and uncut area.

In RP models of hunting site choice, travel cost is used as proxy for price. In this case, we assume that travel cost is a function of travel distance and the cost of traveling.[8] Towards this end, we determined the shortest road distance between each community and of operating area centroids within their general hunting area. In several parts of the FMLA the road network is sparse, therefore travel

[8] We do not include the value of time in the calculation of travel cost due our lack of knowledge regarding the value of time in the aboriginal culture. This is an area that we are continuing to investigate.

distances include the distance by road and the remaining 'non-road' distance required to reach the operating area. The 'non-road' distance also serves as an indicator of the remoteness of the operating area.

The next step in the analysis is to combine hunting trip locations and visitation frequency with the operating area characteristics to develop models that explain hunting location choice. Once the RP models have been developed, joint models that combine the SP and RP data can be developed and used to test the consistency of the two types of data.

Once the most suitable hunting site choice model has been identified, it will be used to predict the response of hunting behavior to landscape changes. We intend to build this predictive tool into ArcView so that it can be easily integrated into Mistik's existing GIS tools. The overall goal is to have Mistik utilize the predictive model along with its other ecological modeling tools. In doing so they will be integrating a social science component into their adaptive management framework, something that is rarely done.

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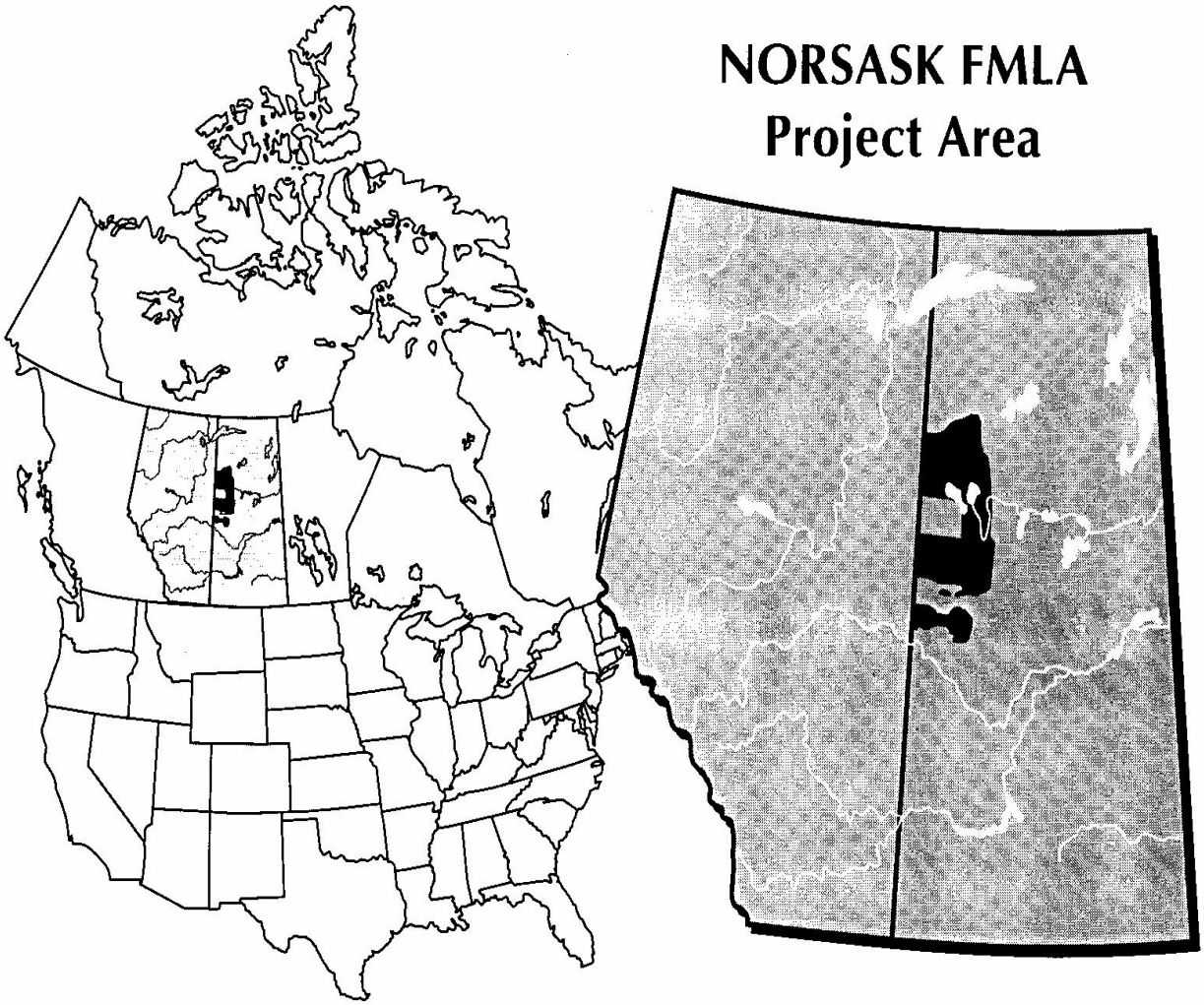
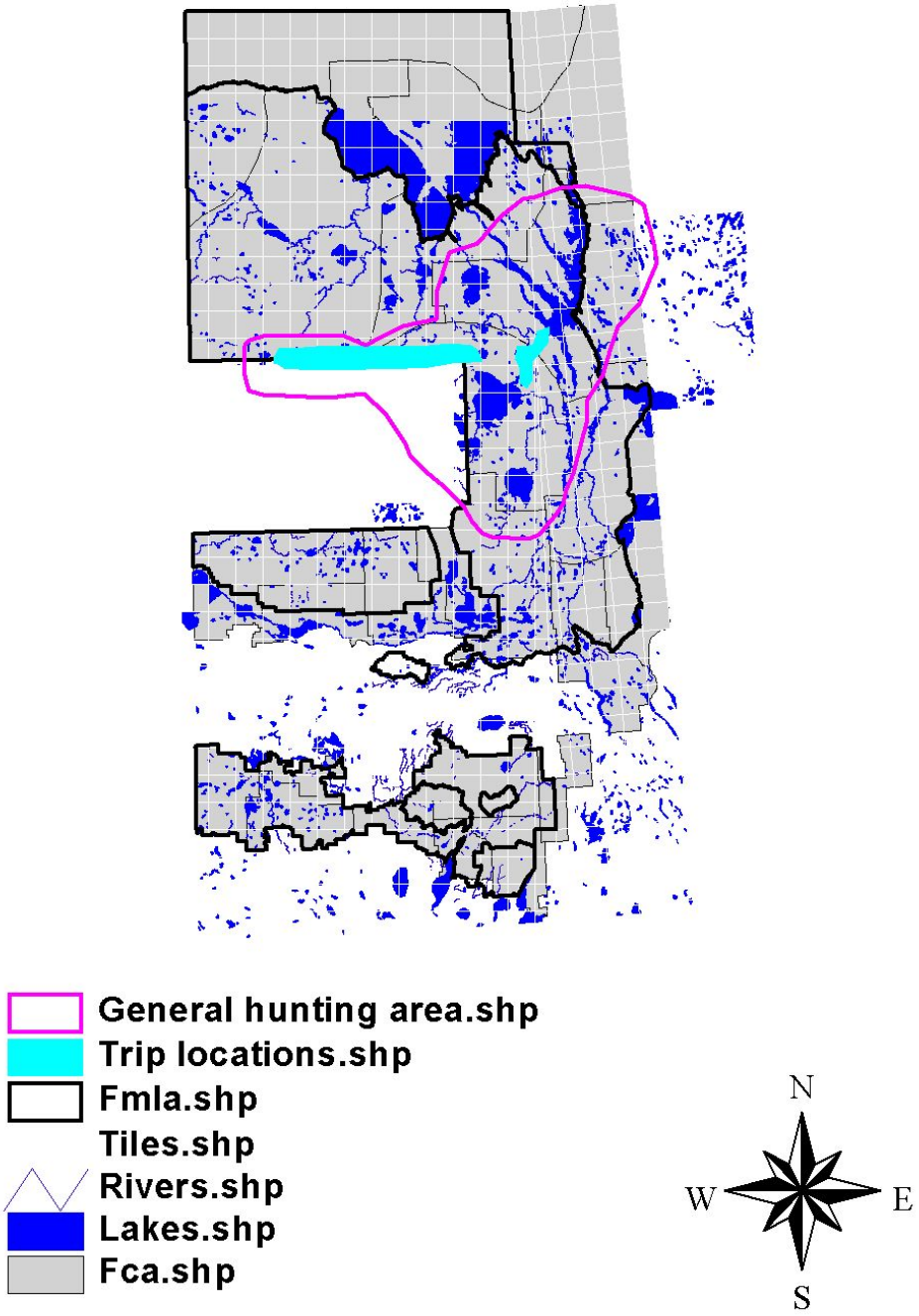
**Appendix A**

**Map of Study Area**



**Appendix B**

**Mock of Spatial Trip Log**




Tiles are 10 km by 10 km.

## Appendix C

### Choice Experiment Question

| Features | Hunting site 1 |
|---|---|
| How far the hunting site is from your home. | 50 km |
| How hunters can get to the hunting site. |  <br>Old Logging trails used by quads in summer and snowmobiles in winter |
| How long has it been since the site was harvested. |  <br>Just Harvested |
| How many people you will see at the site. | Other hunting parties |
| How many signs of moose you will see each day. | Signs of 3 moose per day |

| **Choose the site you like best.** | |
|---|---|
| **Hunting site 2** | **Stay at Home** |
| 100 km | |
|  <br>On foot without trails or cutlines | |
|  <br>Logged 10 – 15 years ago | |
| Other hunting parties | |
| Signs of 4 moose per day | |
| | |