"The basic purpose of development is to enlarge people's choices. In principle, these choices can be infinite and can change over time. People often value achievements that do not show up at all, or not immediately, in income or growth figures: greater access to knowledge, better nutrition and health services, more secure livelihoods, security against crime and physical violence, satisfying leisure hours, political and cultural freedoms and sense of participation in community activities. The objective of development is to create an enabling environment for people to enjoy long, healthy and creative lives."

Mahbub ul Haq[1]

[1] The quote can be found at the United Nations Development Program website, 2006.
Mahbub ul Haq was the former Special Advisor to the Administrator at the United Nations Development Program and the founder of the Human Development Index.

University of Alberta

Modelling Inter-temporal Development Preferences: A Case Study in the Southeast Yukon

By

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Abstract

This research increases the understanding of how Southeast Yukon residents want to see their community develop. The analysis provides information on attribute trade-offs and implicit rates of time preference. The research utilized focus groups and expert consultation to design a choice experiment survey. The participants were asked to vote between two development scenarios that were described by four attributes that vary over 100 years: the regional population, the percentage of local residents who have jobs, the number of moose (an indicator of wildlife populations), and the fish catch rates (an indicator of aquatic ecosystem health). A conditional logit model provides estimates of preferences and their variability across groups in the study region. This information will then be integrated into ALCES North (a large-scale simulation model). The overall process enables planners to understand and incorporate the trade-offs associated with alternative projects. The research also increases the understanding of temporal choice experiments.

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Chapter 1: Introduction & Research Objectives

The Canadian North is a hot spot for resource development. In the Southeast Yukon numerous projects are being considered including railway, tourism, hydro, mining, forestry, and oil and gas pipeline projects. Each of these is expected to have significant economic, social and environmental implications for the region. Development projects in the North are often controversial because of competing visions of how the land should be used. A common disagreement in the Southeast Yukon is between resource extraction projects (mining, forestry or oil and gas) and traditional land use practices (fishing, hunting and trapping). There are a number of environmental concerns about landscape aesthetics, wildlife habitat sensitivity and the overall "health" of the land. There are also social concerns about unemployment rates, out-migration, and the overall "well-being" of the communities. These concerns are complicated by time and distributional aspects, as well as external factors like global climate change and international market pressures. Managing the land and incorporating all of these concerns is therefore a complex and dynamic process.

With many development alternatives being considered it is imperative that Northern planners have access to quality information on the individual and cumulative implications of development projects, and society's evaluation of these changes. Traditionally, this has involved stakeholder meetings and public consultations. However, these consultation modes provide value-based information that are difficult to manage in comparison to technical information (Ananda and Herath, 2003). Moreover, there are currently no systematic methods for incorporating preferences or the trade-offs that people make with respect to alternative uses in the decision making process (Curtain, 2000; Harrison and Qureshi, 2000; Gregory, 2000). This research aims to quantify the value preferences of Southeast Yukon residents and the trade-offs they make with respect to landscape attributes such as population, wildlife and income levels over time. These data can then be incorporated into a computer program that can be used by Northern

land use planners to assess the cumulative impacts and social acceptability of alternative development options. The research will increase the information and tools available for land use planning by working with local stakeholders.

1.1 Background on the project

This project is part of Environment Canada's Northern Ecosystems Initiative "Working Landscapes: Integrated Ecosystems Management" project, which is being undertaken with Northern communities and stakeholders to develop a better understanding of development trade-offs. As alluded to previously, the aim of the larger project is to develop a computer model that can be used as a learning/ negotiation tool to assess alternative development projects. The model is called ALCES North and is a landscape-scale simulation model[2]. It was developed by Brad Stelfox at Forem Technologies and it incorporates technical information to provide simulations of land management decisions on a large regional landscape (over 200 000 ha) (Stelfox, 2005). The model can forecast the footprint of land use practices on wildlife, biology and certain financial and economic indicators.

ALCES has been applied extensively in Western Canada to assess the ecological impacts of development polices. It has been used by academic institutions, environmental organizations, resource companies, government departments and communities in areas such as ALPAC Forest Management Area in Alberta, Muskwa-Ketchika and Kenai National Wildlife Refuge in British Columbia, the Peel Plateau in the Yukon Territory, the Mackenzie Delta and the Colville Hills in the Northwest Territories (Stelfox, June 2005; Holroyd and Retzer, 2005).

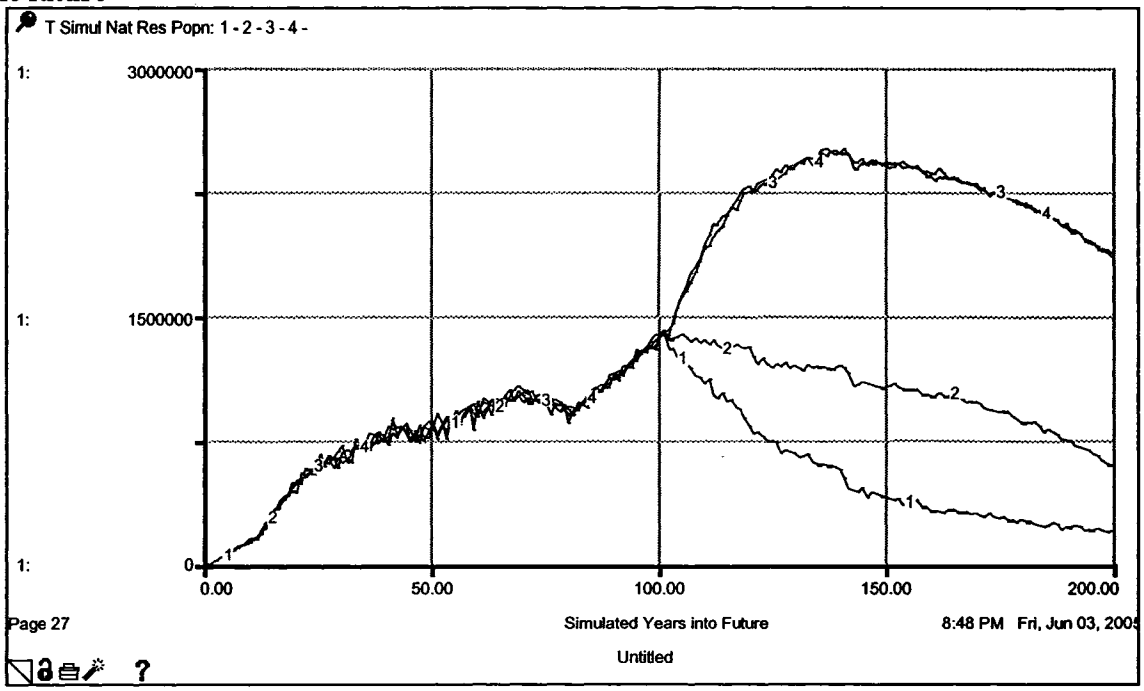
Using ALCES as a learning tool in a planning region is an intricate procedure. It involves defining the stakeholders, the study area, the initial landscape, the land use conditions, and the important ecological, social and economic indicators. It also requires that the

[2] The description of ALCES is drawn primarily from Brad Stelfox's presentation slides and from consultation with Brad Stelfox.

stakeholders identify future plausible land use scenarios and establish thresholds and/or targets. The learning tool can then be used to forecast future indicator levels for the alternative scenarios. This process also enables the exploration of possible mitigation issues if indicator levels are unacceptable.

The output of ALCES provides information about the future landscape in the form of graphs and tables. It is important to remember that ALCES does not provide detailed information about specific sections of land but rather provides aggregate forecasts. An output of ALCES for a hypothetical region is illustrated in the following graph (Stelfox, 2005).

Figure 1.1: ALCES Output Graph: Four alternative development scenarios projected into the future



In the above ALCES output, the baseline (historic trend) is the time period 0 to 100 years. From 100 years to 200 years, the lines diverge reflecting the forecasts that ALCES predicts will result from the four alternative policies. These types of outputs provide information to planners about the expected impact of alternative scenarios or policies.

This computer tool can assist local resource planning agencies such as the Kaska Forest Resources Stewardship Council (KFRSC) and the Kaska Tribal Council (KTC) to explore

different land use strategies and conduct cumulative effects assessments. It can be used to understand the risks and effects associated with human land use practices on a changing landscape. The information generated can also help planners systematically understand the trade-offs associated with development projects and encourage discussion of alternatives or regulations needed to modify the outcomes. However, ALCES in its current form cannot provide all the information necessary to decide which path is better from a societal perspective. In particular, ALCES does not provide information on which development path is preferred by members of society. ALCES, in its current form, can not assess if Pareto efficiency has been obtained[3] nor can it assess if a project(s) meets the Kaldor-Hicks criterion[4].

If the objective of decision makers is to maximize social welfare, then the projects that provide the most net benefit will be implemented (Boardman et al., 2001). In order to make these decisions the planners must have insight into how much benefit each alternative provides to the residents and they must also understand how the residents make trade-offs between different development indicators. Once this information is understood it is then possible to assess which development path is preferred by members of society.

1.2 Research Objectives

The role of this thesis research, in terms of the overall NEI Project, is to improve the understanding of the intertemporal preferences of Southeast Yukoners' for land use alternatives and development trajectories. This requires:

1) **developing a list of appropriate social, economic and environmental indicators,**

[3] Pareto efficiency is a fundament concept of economics. If with a scenario it is possible to make one resident better off without making any others worse off then the scenario is deemed to be a Pareto improvement. If it is not possible to have any Pareto improvements then the scenario is deemed to be Pareto efficient. If a Pareto improvement is possible, but not realized, then the scenario is Pareto inefficient. The Pareto efficiency criterion has been used in cost benefit analysis (Boardman et al, 2001).

[4] The Kaldor-Hicks criterion has also been used in cost benefit analysis and is sometimes referred to as "potential Pareto efficiency". It is the criterion that suggests that a scenario should be adopted if and only if those who benefit could fully compensate those residents that will lose and still be better off (Boardman et al, 2001). It is important to note that neither criteria address equity implications.

2) **quantifying the residents' preferences for the most important landscape indicators,**

3) **understanding the trade-offs that the residents make between the indicators,**

4) **calculating the discount rate(s) that represent the residents' time preferences.**

This information can then be integrated into ALCES North to help planners evaluate alternative scenarios (ALCES outputs). It will provide opportunities to develop management guidelines or targets based on community input. The process will also explore the degree and the source of alternative opinions about development objectives and trade-offs. The data can be tested for heterogeneous in the preferences for economic and environmental outcomes over time. The overall process will also increase the transparency and credibility of the planning exercises.

Once the public preference information is integrated into ALCES, the model can be used to evaluate alternative options and to determine how likely a particular alternative is to be accepted by the residents.

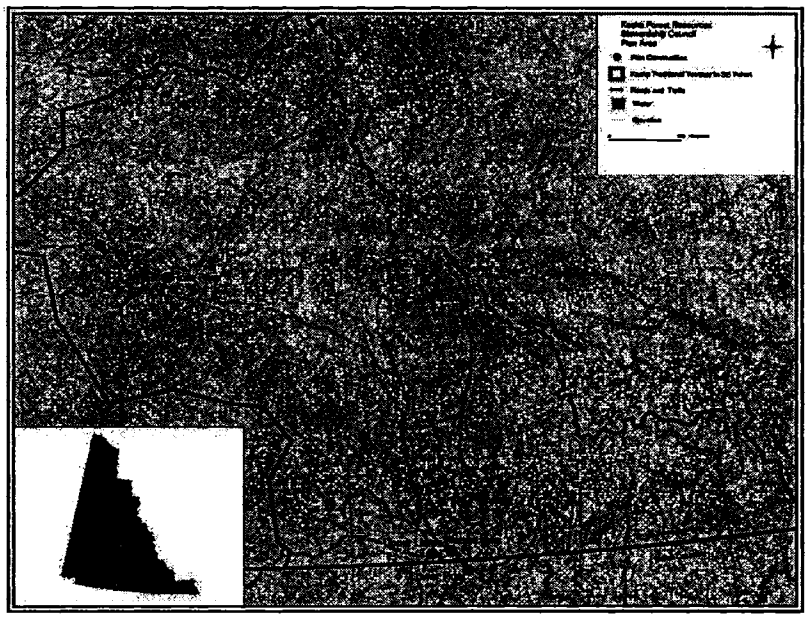
1.3 Thesis Overview

The research is divided into five chapters. Chapter 2 contains a description of the study area. Chapter 3 includes a discussion of the theory that is the bases of this research (stated preferences, attribute based method, marginal rates of substitution, social discount rates). It also presents the methods employed in this study including the survey design and data collection procedure. Chapter 4 summarizes the research analysis and results. Chapter 5 discusses the conclusions of the research and offers recommendations for future research in this area.

Chapter 2: Background & Study Area

The Kaska Traditional Territory in the Southeast Yukon and has been referred to as "the Yukon's Breadbasket" (Witham, 2004). The area has most of the Yukon's mineral wealth, oil and gas potential, and marketable timber. The region is about 83,968 km^2 and is largely covered by boreal forest (Ward, 2005).

Figure 2.1: Map of the Kaska Traditional Territory in the Southeast Yukon



Source: KFRSC, 2006

2.1 Land Use Decisions

Land use decisions in the Southeast Yukon involve many players: the Government of Canada, the Government of Yukon, and the Kaska First Nation.

The Kaska are active stakeholders in any development decisions for the Southeast Yukon but they do not have a settled land claim. In 2001, the Government of Canada transferred the administration and control of the territory's lands and resources over to the Government of Yukon (Government of Canada, 2001). In 2002, the Kaska and the Territorial government signed a forestry Memorandum of Understanding (MOU) with the Government of Canada which acknowledges the role of the Kaska First Nations in land use decisions. The MOU also led to the

creation of the Kaska Forest Resources Stewardship Council (KFRSC) (Government of Yukon, 2004). The Stewardship Council is the local resource planning board that consists of six members with representatives from the Kaska, the Yukon Territorial Government and the Government of Canada. The KFRSC's mandate is to discuss and make recommendations to the Yukon Government concerning the region's boreal forest resources.

2.2 The Study Region

The Southeast Yukon is home to a decreasing residential population of about 2,300 people in the communities of Faro, Ross River, Upper Liard, and Watson Lake. The aboriginal population, predominantly Kaska, represents about 30% of the residents (Statistics Canada, Census 2001).

There is a significant amount of transfer payments to the region in the form of employment insurance and social assistance. The employment rate for the area is about 57% but varies substantially between the communities from 68% in Watson Lake to 47% in Ross River and seasonally (Statistics Canada, Census 2001).

For several years, forestry and mining have been an important part of the commercial economy. However, for many reasons including unfavourable market conditions, there has been little to no activity in these two sectors in the last few years. The primary employer in the region is the public sector (government). There is also a small amount of activity in trapping, tourism, retail, construction, and manufacturing sectors. Many of these activities, especially forestry and mining, have traditionally had significant but localized impacts on the land such as deforestation, habitat destruction and watershed contamination. However, on the whole the footprint from industrial activities in the Southeast Yukon is relatively small and the region is mostly in a natural state.

Numerous development projects are being proposed for the Southeast Yukon such as forestry, mining, hydro-dams, pipelines, oil and gas, coal bed methane, roads and railway. Many of these potential projects will directly affect the Watson Lake area and indirectly affect Ross River and Faro. Watson Lake has significant development potential, as it is a transportation hub and the regional centre for the Southeast. The following is a brief description of the most prominent development possibilities.

Forestry

About 60% of the Yukon's merchantable forest resources are located around Watson Lake (Town of Watson Lake, 2002). The Yukon Government has issued, through open bids, four timber harvest permits (36,000 cubic meters) in the Southeast Yukon (YTG Department of Economic Development, 2005). Another five permits that total about 68,000 cubic meters are also available if there is demand. However, there has been very little production in the region (YTG Department of Economic Development, 2005). In 2005, the Town of Watson Lake contracted Price Waterhouse Coopers to conduct an economic feasibility study of the area's timber resources (Price Waterhouse Coopers, 2005). The findings were not in favour of large-scale harvests (500,000 cubic meters) for the purpose of exportation as the financial costs outweigh the benefits at current market prices.

Mining

The Yukon has a long history of mineral exploration and the Ross River/Faro is a region that is strongly mineralized (Government of Canada et al., 2004). The Finlayson Lake district has seen several companies recently exploring the region (Government of Canada et al., 2004). Two potential projects are the Kudz ze Kayah mine and the Wolverine Mine. Both mines are located southeast of Ross River and are owned mostly by Yukon Zinc Company (Expatriate Group of

Companies, 2006). The Kudz ze Kayah mine has deposits of gold, copper, lead and zinc (AME Mineral Economics, 2001). The Wolverine Mine is near the Kudz ze Kayah mine and has similar mineral deposits. From July to October 2005, the company spent $15 million on an underground development program and on a bankable feasibility study for the Wolverine Mine (Yukon Zinc Corporation, 2006). If market factors are favourable, the two mines have potential to significantly affect the local economy as well as the local environment.

Oil and Gas

The Southeast Yukon, according to Energy, Mines and Resource Minister Archie Lang, is a "promising area for oil and gas development" (YTG Department of Energy, 2005). The region's existing gas well in Kotaneelee field in the Liard Basin (southeast of Watson Lake) currently contributes about $6.5M in royalties a year to the Yukon Territorial Government (YTG) (Witham, 2004). Last year Devon Canada, the operator of this gas well, spent $29 million to develop a new well in the region that began production in May 2005. The well was a success and more than doubled the area's monthly gas production. Several Yukon firms and their employees benefited from the development through related projects such as environmental assessments, site construction, and catering and camp services (YTG Department of Energy, 2005).

Pipelines

The proposed Alaska Highway Pipeline would go through the Kaska Traditional Territory near Watson Lake. If it is approved, the pipeline is likely to increase natural gas exploration in the region and would have significant impacts on the residents of the Southeast Yukon. According to the 2002 Informetrica study, the construction and operation period of the pipeline is estimated to result in a potential 30% increase in Yukon's output and 7,000 more jobs (YTG Department of Energy, 2005).

Hydro

Currently, many Northern communities rely on diesel generators for their electricity needs but with rising energy prices some are exploring the possibility of alternative energy sources. In the early 1990s, the Northern Canada Power Commission and Yukon Energy Corporation investigated the potential hydro sites in the Yukon and identified 82 potential sites (YTG Department of Energy, 2006). According to John Witham of Kaska Minerals Corporation, six of the best ten hydro electrical sites are located within the Kaska Traditional Territory (Witham, 2004).

Rail

There is also a significant interest by the Canadian and American governments to develop an Alaska-Canada Rail Link that would connect the Alaska Railroad to the rest of North America. The Fort Nelson connection would be a large infrastructure project that would pass by Watson Lake. The rail is estimated to decrease "to market" transportation costs and is anticipated to encourage economic development along its route (Charles River Associates, 2005).

In summary, the Southeast Yukon has significant development potential. However, all of the projects, to varying degrees, will have environmental impacts such as wildlife habitat disturbance, altered landscape aesthetics, and changes in water or air quality. The trade-offs between environment quality and economic development will have to be assessed by the land use planners. These decision makers will also have to incorporate into the planning process the residents' preferences and possible thresholds or limits of acceptable impacts on the land and the environment.

Chapter 3: Theory & Methods

3.1 Theoretical Background

This study is designed to understand and quantify the development trade-offs that individuals make by eliciting their inter-temporal and attribute specific preferences. Little or no revealed preference (RP) data are available for the Southeast Yukon on current individual environmental choice behaviour, nor are there preference data for the future development possibilities[5]. Therefore, the research relies on stated preference (SP) methods for data analysis.

Attribute Based Method

SP approaches are designed to collect data and answer questions that could not be answered using actual choices (RP data). When researchers are interested in the valuation of environmental, social and/or economic attributes they often employ the SP technique of Attribute Based Method (ABM). ABM can be used to understand attribute trade-offs and the choice of scenarios from an array of possibilities. This technique accomplishes these tasks by asking participants to make repeated choices between bundles of social, economic or environmental attributes (Holmes and Adamowicz 2002). These attributes and their corresponding levels are varied in a systematic manner utilizing an experimental design (explained further in this chapter).

The common response format for ABM is choice experiments. This format asks participants to make a single choice by selecting the most preferred bundle. It is based on the random utility model of choice and assumes that respondents choose alternatives that maximize utility (Holmes and Adamowicz 2002)[6].

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[5] Revealed preference data are behaviour data that reflect the actual choices of individuals. Stated preference data, on the other hand, are hypothetical data collected usually using surveys that ask individuals what they would do in a particular situation.

[6] ABM and choice experiments both require that the preference assumptions of completeness, transitivity and nonsatiation hold. Completeness assumption means that the consumer can tell the researchers which bundle he or she prefers. Transitivity assumption refers to the idea that preferences among various bundles are consistent (if X is preferred to Y, and Y is preferred to Z, then X must be preferred to Z). Nonsatiation

Random Utility Theory assumes that an individual derives utility not from the scenario (i) itself, but from the specific attributes (X_i) that make up the scenario[7]. Utility (U) is the summation of deterministic / observable (V) factors and stochastic / unobservable (e) components.

$$U = V + e$$

where e is a random error term with a mean of zero and V is an indirect utility function composed of the environmental, social and economic attributes of each scenario.

$$V_i = \beta_k X_i$$

where β is a coefficient vector, and X is a vector of k attributes associated with each scenario (i). For now the unobservable components (e) are assumed to be independent and identically distributed with a type I extreme value distribution which allows the estimation of the above equation using a logit model.

Marginal rates of substitution (MRS) are the amount that the respondent is willing to give up of one good (y) in order to gain one more unit of the other good (x) while holding utility constant. MRS can be calculated from the linear indirect utility function as the ratio of any two marginal utilities[8]. In the logit model the coefficient estimates (β) are the marginal utilities associated with the attributes (the amount that the utility function will increase given a one unit increase in the attribute).

$$MRS_{xy} = -\frac{MU_x}{MU_y} = -\frac{\beta_x}{\beta_y}$$

---

is the assumption that a bundle with more of any attribute is preferred to a bundle with less of that attribute. Katz and Rosen provide a good discussion of these three preference assumptions (1998: 23-25).

[7] This section on Random Utility Theory and conditional logit relies on the description found in Holmes and Adamowicz, 2003.

[8] This result is only for the linear indirect utility function, it is not appropriate for other functional forms.

These ratios directly estimate the rate at which the respondents are willing to trade one environmental or economic attribute for another.

Time Preferences

To elicit time preferences, each attribute is varied over time (t), where t is the discrete time periods of 10, 50 and 100 years.

$$V_i = \beta_k X_{it}$$

Then, in order to isolate the impact of time on preferences, the utility function's attributes are multiplied by a discount factor $\delta = \frac{1}{(1+r)^t}$.

$$V_i = \beta_k (X_{it} * \delta)$$

where r is the discount rate. This discount rate, also referred to the **marginal rate of time preference (MRTP)**, equates consumption in the present (t) with consumption in a future period (t+1)[9].

$$MRS_{t,t+1} = \frac{MU_t}{MU_{t+1}} = (1 + r)$$

As with the MRS, the rate at which the respondent is willing to trade attribute levels in different time periods (MRTP) can be directly estimated from the ABM data collected. These discount rates provide insight into the weights that the residents place on the future. A positive discount rate means that future benefits or costs are worth less than benefits and cost incurred in more recent time periods. A negative discount rate means that future benefits and cost are worth more than the benefits and cost that are incurred in more recent time periods. A zero discount rate means that benefits and costs incurred in the future are worth the same as those incurred today.

[9] The equations for this section on MRTP are developed from Boardman et al., 2001.

It is widely debated in the academic and government literature as to the appropriate discount rate (Boardman et al., 2001; Loewenstein, 1987; Luckert and Adamowicz, 1993, Government of Canada, 1998). The U.S. Panel on Cost-Effectiveness in Health and Medicine recommends a real 3% discount rate for cost-effectiveness studies, with a range between 0% and 7% for sensitivity analysis (Boardman et al., 2001). The Federal Treasury Board Secretariat in Canada recommends a 10% real discount rate with a 5% to 10% sensitivity analysis (Boardman et al., 2001; Government of Canada, 1998). However, the Treasury Board has allowed discount rates of 0% to 3% for health and environment cost-benefit analyses (Boardman et al., 2001). These rates are government recommendations. However, a survey of 90 U.S. municipalities found that 57% of them did not use a discount rate in practice, implicitly using a zero discount rate (Zerbe and Dively 1990). This research aims to calculate the appropriate discount rate for the Southeast Yukon by calculating an implicit discount rate for the individual social time preference[10]. It is critical that planners have the appropriate discount rate for project assessments; if the incorrect discount rate is used, society's resources could be misallocated (Boardman et al. 2001; Lind, 1982).

3.2 Choice Survey Design

As mentioned previously, in ABM the choices and their corresponding levels are varied using an experimental design. The choice combinations must be designed such that they enable the estimation of the utility parameters specified in the previous section (Holmes and Adamowicz 2002). The experimental design should be orthogonal (attributes are not correlated) and as efficient as possible (Street and Burgess, undated). It is also advisable to keep the cognitive demands on the respondents to a minimum; therefore the number of attributes should also be small and described using simple words (Russell et al. 2001).

[10] Individual Social Time Preference is the individual's opinion on how social resources should be allocated (Manning and Adamowicz, 1994).

There are two popular procedures used to generate attribute combinations (choice tasks): random sampling and experimental design principles (Holmes and Adamowicz 2002). The first method involves choosing a random sample from the universe of combinations. This method is orthogonal and enables utility parameter estimation. However, due to the random nature of selecting the sample it is conceivable that not all possible levels are represented. In addition, this method does not necessarily result in the most efficient experimental design.

The second way of generating the choice tasks is to rely on experimental design principles (Holmes and Adamowicz, 2002; Street and Burgess, undated). This method develops the main effects fractional factorial from the full factorial (all possible combinations). In their paper "Quick and Easy Choice Sets: Using Word Processing Packages to Construct Near-Optimal Stated Choice Experiments", Street & Burgess outline how to construct near-optimal stated choice experiments using Excel. Burgess also recommends consulting the SAS website (http://support.sas.com/techsup/technote/ts723_Designs.txt) for existing experimental designs (Burgess, personal communication 08/08/2005). Experimental design principles such as these are orthogonal and highly efficient. The downside is that this design only enables the estimation of attribute main effects and not the interaction effects between attributes. However, according to Dawes and Corrigan (1974) the main effects explain the majority (70 to 90%) of the variation within linear models. It is therefore appropriate for this research to use the fractional factorial design.

The following statistical models can be used to estimate the parameters of the conditional indirect utility functions.

Conditional and Mixed Logit Models

Under certain assumptions, the probability (Pr) that an individual will choose an option (i) depends on the attributes (X_i) of the scenario (Train, 2003).

$$\Pr\{i\} = \frac{\exp(\mu\beta_k X_i)}{\sum_{j \in C} \exp(\mu\beta_k X_i)}$$

where C is for the choice set. The μ is a scale parameter which is usually set to 1 in order to uniquely estimate the parameter vector β using maximum likelihood methods. If the error term of any choice task is independent and identically Gumbel (or type I extreme value) distributed, then the above probability can be estimated using the logit model (Ben-Akiva and Lerman, 1985).

It is important for modelling purposes to be aware that conditional logit assumes homogenous preferences. In other words, all survey participants are assumed to have the same preferences and therefore the same parameter estimates. If this assumption is violated it is possible that bias is introduced into the analysis via the parameter estimates and/or the choice probabilities (Alpizar et al. 2001, p19; Popkowski Leszczyc and Bass, 1998, p98).

There are two types of preference heterogeneity that can be examined as extensions of the simple logit model. **Observed heterogeneity** is based on measurable factors that explain the participant's choice process (Popkowski Leszczyc and Bass, 1998). Observed heterogeneity is accounted for in the indirect utility function by including interaction terms of the scenario attributes and individual (*n*) specific attributes (*Y*) such as age, gender, and ethnicity.

$$V_i = \beta_k X_{it} + \alpha_Y (X_{it} * Y_n)$$

By including these demographic elements as independent variables the standard logit model can be adjusted for observed preference heterogeneity.

Unobserved heterogeneity arises from the unobserved component of the participant's utility function and often results from data limitations (factors that the research was unable to capture) (Popkowski Leszczyc and Bass, 1998). Unlike observed preference heterogeneity, unobserved heterogeneity cannot be calculated using the standard logit model and requires the use of **mixed logit or random effects models** (Train, 1998). In the random effects model,

individual-specific coefficients (β) are assumed to be distributed over the population according to a specified distribution function (Popkowski Leszczyc and Bass, 1998: p98). In this method, a mean and variance of the assumed distribution are estimated thereby allowing different participants to have different parameter estimates.

There are four popular distribution functions for the mixed logit: lognormal, normal, uniform and triangular. All four distributions enable estimation of parameter means and spread but only the later three allow the estimation of positive and negative coefficients (Train, 1998)[11]. This point is important because it is possible that some participants would want more of some scenario attributes while others may want less. Therefore, the lognormal distribution is not applicable for this research. The remaining three distributions were all tested and the results are discussed in Chapter 5.

3.3 Methods: Explanation of the Survey & Data Collection Procedure

The previous section provided an explanation of the theoretical foundations of the ABM. This section explains how this technique was employed in this research. Because it is critical that the chosen survey design captures the salient elements of the choice process underlying a landscape change, public input was incorporated throughout the research. Focus groups and consultation with local experts were used extensively to design the survey. Once designed, the survey was also rigorously evaluated using pilot tests. A local Kaska researcher was also employed as a member of the research team to assist with the data collection. A copy of the final ABM survey is included in Appendix B.

The survey has three basic sections. The first was designed to elicit information about the participant's attitudes on and their perceptions of land use planning and other issues related to development in their communities. These questions were largely developed from the focus

[11] For a detailed discussion of the mixed logit distributions consult Train (1998), or Hensher and Greene (2001).

groups and were designed to gain information that could be helpful in land use planning. They also provided a warm-up for the choice section.

There was also a section designed to gather demographic information about the respondent. This information is helpful for identifying subgroup or cohorts that might have similar preference and to ensure adequate representation of the population.

The primary section of the survey used in this research analysis is the ABM choice experiment. This section of the survey had questions that asked participants to choose between two development trajectories: the current path and an alternative. The illustration method and attributes were designed considering many of the recommendations from the focus groups and consultation with local specialists and community stakeholders.

Framing Decision Instructions

Participants were asked to imagine that there was a regional referendum and that they could vote on different development options for their community. They were told that the options presented are hypothetical and are a few of the many possible future options. They were also told that these options are not necessarily the specific options that the KFRSC is considering.

Participants were informed that land use planners for the Southeast Yukon are considering several development options such as forestry, oil and gas, mining, hydro, rail and tourism. They were reminded that these projects will have effects on the local landscape and communities. They were told that the aim of the research was to understand how they want to see their community 100 years from today.

The participants were given the following instructions: "For each question, you will compare the current state of the region (Option 1) against one alternative future (Option 2). You will choose only one option per question. Imagine that these options represent the future state of the Southeast Yukon and its people. You will be presented with eight sets of options. Please

consider each question separate of the options in previous questions." Each option was described using attributes.

Choice Attributes

There are many social, economic and environmental variables that could be used to track and evaluate the impacts of human activities such as hydrocarbon and mineral extraction. However in order to be effective measures of quality of life and community well-being, these subjective metrics must be meaningful for the respondents and appropriate for modelling purposes (Gregory and Slovic, 1993; Russell et al, 2001)[12]. The subjective nature of indicator identification makes public consultation essential. For this reason, the attributes used in the survey and their descriptions were determined through the recommendations of focus groups with community stakeholders and expert opinion. These involvement techniques are a way to understand the attributes that people use to evaluation land use options.

The four attributes that were identified to be most important to the Southeast Yukon residents were the percentage of local residents who have jobs, the number of moose (an indicator of wildlife populations), the fish catch rates (an indicator of aquatic ecosystem health), and the total human population in the region. For each attribute the development trajectories of 100 years were selected based on feedback from the focus groups. The following table lists the attributes, their levels, and the amount of change between the levels from status quo.

Table 3.1: Choice attributes and their associated levels

Jobs			Moose			Fish			People		
No.	Level	**Change**	No.	Level	**Change**	No.	Level	**Change**	No.	Level	**Change**
1	57	**0**	1	230	**0**	1	7	**0**	1	2450	**0**
2	50	**-7**	2	260	**30**	2	10	**3**	2	2298	**-152**
3	63	**6**	3	170	**-60**	3	4	**-3**	3	3090	**640**
4	69	**12**	4	140	**-90**	4	2	**-5**	4	3850	**1400**

[12] For a good discussion of attributes for evaluate management options consult Gregory, 2005.

1. Jobs

The future employment levels were chosen based on the employment rates currently experienced across Canada. The employment rates for Southeast Yukon are not available so the value of 57% was calculated from averaging the employment rates according to Statistics Canada for Watson Lake (68.3%), Upper Liard (50.0%), Ross River (47.1%), and Faro (64.0%) (Statistics Canada, Census 2001). The levels were designed using Statistics Canada's "Labour Force Survey" (2005) information on seasonally adjusted employment rates. The upper end of the employment rate was set at 69% compared to Alberta's 69.6%. The lower end of employment rate was set at 50% compared to Newfoundland 50.7%. The second highest employment rate of 63% was set exactly half way between the current rate of 57% and the upper level of 69%.

2. Moose

The current moose density of 232 / 1000 km^2 was obtained via personal communication with Rick Ward, Yukon Moose Management Biologist (11/6/2005). For simplicity this number was rounded to 230 / 1000 km^2 for the choice experiment. According to the "Yukon Moose Management Guidelines" (1996), the moose populations in the Yukon tend to be at naturally low levels with average densities in the south ranging between 150 to 250 moose for every 1000 km^2 depending on the area. However, little information is available on future moose estimates. The levels for the survey were based on a decrease that was 10 moose less than the rest of the Yukon average (150-10= 140), 30 above the lowest level (140+30= 170), and 30 above the current level (230+30= 260).

3. Fish

The fish catch rate levels were based on guidance from a local fishing Elder and verified by other residents who also fish in the Southeast Yukon. A typical catch rate for a lake or a river

in the area is about 7 fish per day. A high catch rate, typical of a lake with lower access is about 10 fish per day. A low catch rate currently experienced in some lakes is 4 fish per day. A lower level catch rate would be 2 fish per day. It is important to note that the current catch rates in many regions in southern Canada are often as low as 1 or less fish per day. However, the catch rate of 2 fish per day was quite shocking for many residents and the possibility of 1 fish per day was too extreme for many to comprehend or accept.

4. Population

The current population for the Southeast Yukon was based on data from Yukon Bureau of Statistics' "Population Report" (2005). The population estimate of 2,407 people was rounded up to 2,450. The population attribute levels were chosen based on the historical ranges of population fluctuations for the last 10 years according the Yukon Community Profiles (Government of Canada et al., 2004). The Southeast Yukon has had a history of large population fluctuations mostly due to the boom and bust cycle of mining in the region. The upper end is a function of the highest population change in the last 10 years. Between 1996 and 2003, the population decreased by 1,279 people. The upper end is 1.5 times the 1,279 population change (approximately 1,900). The second increase level was half the 1,279 population change (approximately 640). The decreasing level was based on the Yukon Bureau of Statistics' Population Projections to 2015. In this report, the low-growth projection is that the population for the whole Yukon will fall by 6.2%, which for the Southeast Yukon would be approximately 152 people (2450*0.062). These three levels are likely to be on the lower end of estimates, especially the two increase population levels. However, the upper level was shocking to many residents and higher estimates would have been rejected by many respondents. It is important to note though, that a few residents did indicate that they believed the population estimates should be higher.

Experimental Design

These 4 attributes, 3 levels, and 3 time periods result in a full factorial of 12^4 (20,736 profiles). Given the population size and logistic restrictions the full factorial was deemed to be too large. Instead, an orthogonal main effects experimental design was used to construct the attributes and the levels. This technique is used to systematically construct the choice sets by sampling from the universe of alternative development trajectories. The smallest orthogonal main effects design is 48 profiles (SAS Institute Inc., 2006). Due to cognitive constraints, it was decided that 8 profiles was the maximum number that each participant would have to answer. One profile was used as the base scenario and was removed from the experimental design. Therefore, the 47 pairs were divided into 6 sets of 8 (with one profile repeated so all participants completed the same number of sets).

This design strategy produced a survey in which participants were shown 8 pairs of development trajectories. The participants would compare the current development trajectory (which remained constant through out the survey) with an alternative development trajectory (which changed between questions). They were then asked if these were the only two options available, which development trajectory they would vote for (which they preferred).

Pilot Tests

The survey content and design were evaluated for clarity and comprehension using 32 pilot tests in sets of 3 in Watson Lake and Upper Liard. Significant changes in attribute levels and illustration techniques were made between the sets, especially for the choice section. The third set consisted of 10 participants completing the final version of the survey.

3.4 Sampling Frame, Recruitment & Data Collection

Once the survey had been designed and tested, the next stage of the research was to administer the survey to 252 randomly selected residents in the study region (approximately 10% of the total population). Because the survey was lengthy and considerably complex, it was determined that telephone and mail surveys were not appropriate. It was deemed culturally appropriate to drop the survey at the participant's home and return a couple of days later to pick up the survey. On the drop-off day all participants were given a gift of saskatoon jam as a "thank you for helping out"[13]. Participants were also told that if they so choose they could return the survey incomplete. On both the drop-off and pick-up day the participants were prompted to ask any questions that they might have had.

At the guidance of the KFRSC, the KTC and several local residents, the survey sample was divided into three strata to ensure adequate representation: Kaska Elders, local business owners or prominent political figures, and the local residents. The Elders were randomly chosen from the "List of Elders" obtained from the Liard First Nations and the Ross River Dene Council. From the telephone book and from the local researcher's guidance a list of local business owners and prominent political individuals in Watson Lake and Upper Liard were identified. Participants were randomly selected from this list. In Ross River and Faro the primary researcher and the local researcher went randomly to businesses to contact local business persons. Some Elders and local business owners were also contacted in the door-to-door procedure that is explained in the following paragraph. The final sample size included 16 Elders, 12 business or political people and 224 local residents.

The local residents were chosen using two sampling methods: randomly from the telephone book and random house selection. It was originally planned to do a large part of the

[13] The jam was well received by the local residents and was culturally appropriate. Berries such as blueberries, cranberries and raspberries are a common and favourate fruit in the Southeast Yukon. However, the summer of 2005 was a bad year for berry picking. Saskatoon trees do grow in the region, but they do not produce many berries. The Saskatoon Jam was low in sugar, homemade, and sold at the Edmonton Strathcona Farmer's Market (hence not available for purchase in the Yukon).

sampling via telephone and then a smaller size in door-to-door contact. The latter method was included because it was anticipated that some residents would not have telephones (especially in the settlement community of Upper Liard, and the town of Ross River). For the first 5 days that the survey was conducted, participants were chosen at random from the local telephone book (every 5th number). Using a script as a guide (Appendix C), the local researcher telephoned potential participants, informed them who she was, where she was calling from, explained the survey and asked if they would like to participate. At first this method was successful but then on the weekend of November 26th a telephone interview company contacted residents about their political opinions. After November 26th local residents were less willing to talk with the local researcher or to participate in the survey. As a result, the initiation telephone procedure was changed to involve more door-to-door contacting.

In the door-to-door method the researcher and the local researcher went randomly to houses in each of the communities. The door-to-door method was fairly successful (83% participation rate)[14] and in general the project was well received by the residents.

[14]The data collected from the two different methods were not found to be statistically different.

Chapter 4: Results

Of the 252 surveys that were administered in the study region, 225 were returned. Of those that were returned, 196 surveys had the choice section completed (78% completion rate).

4.1 Sample Representation

Overall, the survey sample represented the population of the Southeast Yukon fairly well[15]. When the survey was administered there were four main sampling targets: ethnicity, gender, income, and community[16]. The following table outlines the targets for each category and the actual survey representation.

Table 4.1: How representative the sample is of the Southeast Yukon population

Demographic Characteristic	Target	Actual Survey Representation
Ethnicity:		
First Nations	30%	34%
Non-First Nations	70%	65%
Gender:		
Male	56%	51%
Female	44%	48%
Income:		
Average (household)	~ $36 600	$40 000 to $49 999
Community:		
Watson Lake	63%	66.0%
Upper Liard	7%	8.6%
Ross River	14%	14.2%
Faro	16%	11.2%

Ethnicity

The share of First Nations and non-First Nations is amply represented in the survey. The target was 30% aboriginal respondents. The sample has 34% First Nations (Kaska 24.4% and non-Kaska 9.6%), and 65% non-First Nations.

[15] The sample representation was assessed based on the Census 2001 statistics (Statistics Canada, Census 2001).

[16] These four targets are in addition to the sample strata referred to in the previous section (Kaska Elders, business owners and prominent political individuals, and local residents).

Gender

Gender was also well divided in the sample (51% male and 48% female). The sample contains slightly more females than targeted (4 % more females).

Income

In the sample the mean survey household income for 2005 before taxes was $40,000 to $49,999. This was fairly close to Statistics Canada's median income for the region in 2001 (the census individual income was $18,282, if the house has 2 income earners the household income would be approximately $36,600).

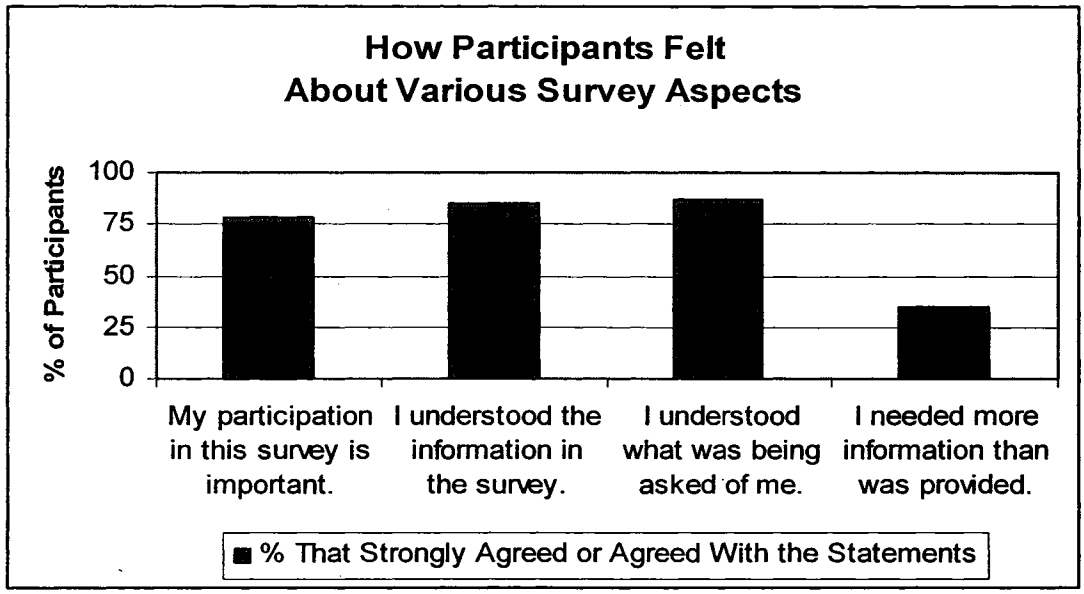
Community

The four communities in the Southeast Yukon were also well represented in the survey. However, Watson Lake was a little over represented (3% more), while Faro was a little under represented (5% less).

4.2 How Participants Felt about the Survey

Respondents were asked several debriefing questions about the research survey. Overall, participants felt that their participation in the survey was important (79%) and that they understood the information (85%) and what was being asked of them (87%). However, the participants were split on whether or not they felt that they needed more information than was provided: 35% wanted more information, 37% felt they did not need more information, and 25% were not sure. These statistics are illustrated in Figure 4.1.

Figure 4.1: Graph of the percentage of respondents that strongly agreed or agreed with statements about the questionnaire



Land Use Awareness

The respondents were also asked questions to understand the extent of their land use awareness. Most of the survey respondents are interested in how the Southeast Yukon's resources are managed which is what was expected based on the focus groups. Almost 74% of respondents reported that they give some or a great deal of attention to forestry or land use related issues while only about 21% stated that they give only a little attention to these topics. However, when it comes to hearing about forestry or land use issues in the region, the residents appear to be a little divided. On one hand, there is a group (33%) who, in the last year, have heard about resource related issues daily or weekly. On the other hand, there is a slightly larger group (38%) who have read or heard about these issues only once or twice. There is even a small group (9%) who have never read or heard about forestry or land use related issues in the region. Considering that there are numerous development projects being considered for the region and that the KFRSC is working on the region's resource management plan there appears to be room for

increased public awareness. In fact, 74% of the respondents stated that more opportunities need to be provided for public involvement in resource planning.

Land Use Management Preferences

Although the participants vary in their awareness of forestry or land use related issues, the respondents exhibited quite homogenous feelings about the land. About 88% of the residents stated that the forests let them feel close to nature and rejuvenate the human spirit. Almost all participants (93%) stated that even if they are not able to go out on the land it is important for them to know that the wilderness exists. About the same number of participants (94%) believed that it is important to maintain the forests in a sustainable way for future generations. A large percentage (45.6%) also stated that the primary function of the forest is more than just the products and services that are useful to humans. It is therefore not surprising that most (90%) believe that it is a good idea to have protected lands that are not developed. Interestingly enough there are currently no protected lands in the Southeast Yukon. Yet only a little over half (57%) believe that more should be done to increase the amount of protected areas.

In general the participants agreed that there is a role for humans in managing the land and its resources. When asked if forests could be improved through management, 73% of participants stated that they agree or strongly agree. About 78% stated that more needs to be done to reduce water pollution and about 67% stated there should be more fire suppression effort.

Management and Social Objectives

Although the participants were interested in environmental conservation and protection, they were also quite homogenous in their belief that the region needs more economic growth and jobs (about 90% of respondents). The majority (68%) are aware that there has to be a trade-off between jobs and some environmental quality. However with the region's high social assistance

reliance and low employment rates, it is reasonable that many people (in both the focus groups and the surveys) expressed strong desires for more or better jobs (e.g. longer term, fulltime, better pay, more rewarding). Note that 17% of survey respondents are looking for work and almost 44% of the sample has a household income of less than $40,000 per year. When asked what factors might encourage them to leave the Southeast Yukon about 24% of respondents reported the prospect of a higher paying job would influence their decisions.

There was also an almost unanimous opinion (91%) that the education and training opportunities need to be improved for the residents. Watson Lake, Ross River and Faro all have secondary education schools. The region even has a branch of the Yukon College in Watson Lake. However, there is a split in the educational obtainment of the residents. While about 50% of the respondents have some post secondary education (university, college or technical school training), the other half of the participants only have either a high school diploma (19%) or have not completed high school (30%). Education and training are important in order for the local residents to capture the benefits of the proposed development projects.

In the focus groups and also in some surveys, several participants drew a correlation between unemployment and "lack of things to do [social events]", with many of the social problems in the region such as crimes, and drug and alcohol abuse. Not surprisingly about 83% of the survey respondents stated that more should be done to decrease crime rates. While, more than half of the participants (65%) reported that recreational activities and programs should be increased.

Overall, the sample size is representative of the Southeast Yukon's population. In general, residents appear to want more jobs, more education, more things to do, more environmental protection and more involvement (of the public) in resource planning.

4.3 Data Analysis and Results

As indicated in the previous sections the objective of the analysis is to understand the trade-offs that the participants make across scenario attributes and through time. This analysis involves developing a conditional logit model to explain individual choices. It also involves exploring social discount rates, attribute elasticities, marginal rates of substitution, utility thresholds and the impact of demographics.

4.3.1 Variable Definitions

In the models the dependent variable is defined as 0 if the respondent chose Option A (status quo), and 1 if he or she chose Option B (alternative path).

The main independent variables in all of the models are the 4 scenario attributes with 4 levels each: the percentage of local residents who have jobs, the number of moose per 1000 km^2, the number of fish caught per day, and the number of people living in the Southeast Yukon. From here on, these variables will be referred to as jobs, moose, fish, and population respectively. Each of the 4 scenario attributes have 3 time periods for a total of 12 model variables:

Jobs in 10 years	Moose in 10 years	Fish in 10 years	Population in 10 years
Jobs in 50 years	Moose in 50 years	Fish in 50 years	Population in 50 years
Jobs in 100 years	Moose in 100 years	Fish in 100 years	Population in 100 years

4.3.2 Model Estimation (attribute trade-offs)

Four different logit models were estimated using Limdep 3.0.1: the basic linear utility attribute model with 12 scenario attributes, the basic linear utility attribute model with 4 attributes (restricting all time periods to have the same effect on utility), as well as the quadratic and log linear utility functional forms. The sign of the coefficients estimated in each model describes

their associated effects on individual utility. The summary statistics for the four models are included in Table 4.2.

Table 4.2: Conditional logit parameter estimates for alternative utility functional forms

	Basic 12 -linear	Basic Linear	Quadratic	Log Linear
Adjusted Rsq	0.04364	0.04265	0.04190	0.03274
Log Likelihood	-1017.68	-1023.98	-1024.78	-1034.58
Variable	**Coefficient**	**Coefficient**	**Coefficient**	**Coefficient**
Jobs in 10 yrs	0.0204* (2.710)			
Jobs in 50 yrs	0.0262* (3.135)			
Jobs in 100 yrs	0.0330* (4.417)			
Moose in 10 yrs	0.0058* (5.046)			
Moose in 50 yrs	0.0033* (2.838)			
Moose in 100 yrs	0.0076* (6.648)			
Fish in 10 yrs	-0.0043 (-0.244)			
Fish in 50 yrs	0.0360** (2.099)			
Fish in 100 yrs	0.0369** (2.117)			
Population in 10 yrs	0.0001 (0.639)			
Population in 50 yrs	0.0000 (0.198)			
Population in 100 yrs	0.0001 (1.166)			
Constant	0.0056 (0.043)	0.0021 (0.016)	0.1555 (1.279)	0.0717 (0.541)
Jobs		0.0263 * (5.344)		
Moose		0.0055 * (7.698)		
Fish		0.0228 ** (2.208)		
Population		0.0001 (1.058)		
(Jobs)^2			0.0002 * (5.367)	
(Moose)^2			0.0000 * (7.587)	
(Fish)^2			0.0018 ** (2.196)	
(Population)^2			0.0000 (1.149)	
(ln jobs) * 100				0.0146 * (5.200)
(ln moose) * 100				0.0100 * (6.485)
(ln fish) * 100				0.0011 ** (2.054)
(ln population) * 100				0.0021 (1.252)

Note: * is 0.01 significance level ** is 0.05 significance level
The numbers in the brackets below the coefficients are the t-ratios.

Basic Linear Model (12 attributes)

The basic linear utility model can be estimated using conditional logit. The indirect utility function has 12 attributes and is as follows:

$$V_i = \beta_0 + \beta_1(jobs\ 10\ yrs) + \beta_2(jobs\ 50\ yrs) + \beta_3(jobs\ 100\ yrs)$$
$$+ \beta_4(moose\ 10\ yrs) + \beta_5(moose\ 50\ yrs) + \beta_6(moose\ 100\ yrs)$$
$$+ \beta_7(fish\ 10\ yrs) + \beta_8(fish\ 50\ yrs) + \beta_9(fish\ 100\ yrs)$$
$$+ \beta_{10}(population\ \ 10\ yrs) + \beta_{11}(population\ \ 50\ yrs)$$
$$+ \beta_{12}(population\ \ 100\ yrs)$$

The model performs reasonably well with an adjusted rho squared of 0.044 and a log likelihood function of -1017.68.

The basic model indicates that jobs, moose and fish are the most important scenario attributes for predicting choice behaviour. Ceteris paribus, the residents want more jobs, moose, fish (except in 10 years), and people. It is important to note that although fish in 10 years is negative and the population coefficients are positive, both variables are not statistically significant implying that caution should be taken in their explanatory power.

Interestingly, the respondents appear to value jobs and fish slightly more through time. This is evident in the relative increase in coefficient values between the three time periods. In contrast, it appears respondents are more concerned about moose populations in the short term (10 years) and in the long term (100 years). However, the difference between time periods is small.

As a tool for explaining individual choice behaviour, the basic model is effective with most scenario attributes significant at either the 0.01 or 0.05 level. However, it is recommended that no more than one independent variable is included in the estimation for each 10 cases in the sample (Garson, 1998). Given that the sample size in this study is only 196 observations, the number of coefficients should be kept to less than 19 independent variables. With the basic linear conditional logit model 12 attributes must be estimated for just the scenario attributes, leaving

little freedom for estimating demographic / individual specific attributes. If the assumption that the value of any given scenario attribute is the same in each of the time periods (accounting for discounting), then it is possible to apply model restrictions and simplify the model and its interpretation.

Restricted Linear Model (4 Attributes)

If the assumption of zero discounting holds, then it would be possible to restrict the betas of the scenario attributes in each of the three time periods to be equal to one another.

$$\beta_{jobs\ 10\ yrs} = \beta_{jobs\ 50\ yrs} = \beta_{jobs\ 100\ yrs}$$
$$\beta_{moose\ 10\ yrs} = \beta_{moose\ 50\ yrs} = \beta_{moose\ 100\ yrs}$$
$$\beta_{fish\ 10\ yrs} = \beta_{fish\ 50\ yrs} = \beta_{fish\ 100\ yrs}$$
$$\beta_{population\ 10\ yrs} = \beta_{population\ 50\ yrs} = \beta_{population\ 100\ yrs}$$

These eight restrictions simplify the twelve attributes to only four and thereby providing additional degrees of freedom. The indirect utility function for the restricted linear model is as follows:

$$V_i = \beta_0 + \beta_1(jobs\ 10\ yrs) + \beta_1(jobs\ 50\ yrs) + \beta_1(jobs\ 100\ yrs)$$
$$+ \beta_2(moose\ 10\ yrs) + \beta_2(moose\ 50\ yrs) + \beta_2(moose\ 100\ yrs)$$
$$+ \beta_3(fish\ 10\ yrs) + \beta_3(fish\ 50\ yrs) + \beta_3(fish\ 100\ yrs)$$
$$+ \beta_4(population\ \ 10\ yrs) + \beta_4(population\ \ 50\ yrs)$$
$$+ \beta_4(population\ \ 100\ yrs)$$

A likelihood ratio test demonstrates that the twelve attribute model is not significantly different from the attribute model with restricted betas (chi squared calculated < chi squared critical).

Likelihood Ratio Test for the Twelve Attribute verses Four Attribute Models:

$$2(LL_{base} - LL_{estiamted\,model}) \sim X^2$$
$$X_{calculated} = 2(-1017.68 - -1023.98) = 12.6$$
$$X_{critical} = X_{8df}^{0.050} = 15.51$$

The two models also have very similar parameter estimates. The job, moose and fish variables are all positive and statistically significant in their explanatory power. The restricted model simplifies the time dimension enabling a clearer interpretation for the trade-offs across scenario attributes which is discussed in the threshold section.

Given that the restricted model is not rejected it will be employed in further analysis. The question then becomes whether the utility function is linear in the attributes or if it has another functional form.

Utility Functional Form

A quadratic and a log linear utility model were estimated (Table 4.2). Both the quadratic and the log linear indirect utility functions reflect the economic theory of diminishing marginal utility (that the marginal value of an attribute decreases as the attribute level increases). The scenario attributes in the quadratic utility function are squared before entering the model.

$$V_i = \beta_0 + \beta_1(jobs\ 10\ yrs)^2 + \beta_1(jobs\ 50\ yrs)^2 + \beta_1(jobs\ 100\ yrs)^2$$
$$+ \beta_2(moose\ 10\ yrs)^2 + \beta_2(moose\ 50\ yrs)^2 + \beta_2(moose\ 100\ yrs)^2$$
$$+ \beta_3(fish\ 10\ yrs)^2 + \beta_4(fish\ 50\ yrs)^2 + \beta_4(fish\ 100\ yrs)^2$$
$$+ \beta_5(population\ \ 10\ yrs)^2 + \beta_5(population\ \ 50\ yrs)^2$$
$$+ \beta_5(population\ \ 100\ yrs)^2$$

The natural logs of the scenario attributes were calculated and then multiplied by 100 before the log linear model was estimated[17].

[17] The attributes were multiplied by 100 in order to facilitate estimation. If they were not scaled up Limdep would have difficultly estimating the coefficients as there is not a lot of variability between levels.

$$V_i = \beta_0 + \beta_1((\ln\ jobs\,10\,yrs)*100) + \beta_1((\ln\ jobs\,50\,yrs)*100)$$
$$+ \beta_1((\ln\ jobs\,100\,yrs)*100) + \beta_2((\ln\ moose\,10\,yrs)*100)$$
$$+ \beta_2((\ln\ moose\,50\,yrs)*100) + \beta_2((\ln\ moose\,100\,yrs)*100)$$
$$+ \beta_3((\ln\ fish\,10\,yrs)*100) + \beta_3((\ln\ fish\,50\,yrs)*100)$$
$$+ \beta_3((\ln\ fish\,100\,yrs)*100) + \beta_4((\ln\ population\ 10\,yrs)*100)$$
$$+ \beta_4((\ln\ population\ 50\,yrs)*100) + \beta_4((\ln\ population\ 100\,yrs)*100)$$

Although the job, moose and fish attribute coefficients in the quadratic and the log linear utility functions are statistically significant, the overall models themselves do not significantly improve the predictability of the model. The adjusted rho squared for the quadratic model only increases by 0.8. The adjusted rho squared for the log linear model actually worsens by 9.8. Because neither the quadratic nor the log linear models significantly improve the predictability, the basic linear utility model with 4 attributes was selected for further analysis.

4.3.3 Social Discounting Model (time trade-offs):

It is important for project evaluation techniques such as cost benefit analysis to have an appropriate social discount rate to compare benefits and cost incurred in different time periods. As described above, the choice experiments used here allow for the empirical assessment of time preferences (discount rates). For the discounting analysis, rates were mathematically calculated and estimated using econometric software. The econometric methods of grid search and maximum likelihood are explained further in this section while the method of mathematical calculated discount rates is included in the Appendix D. Overall, for the data collected, the most appropriate discount rate for projects in the Southeast Yukon is approximately zero. In other words, benefits and liabilities incurred in the future are worth the same as benefits and liabilities experienced today.

Typically for most project evaluations the same social discount rates are applied equally to all variables and across time (Government of Canada, 1998; Loewenstein and Prelec, 1992).

The next two sections explore the possibility of estimating the discount rate over all scenario attributes. Both the grid search and the maximum likelihood method vary the discount rate (r) until the best fitting model results. For these analyses the twelve choice attributes (independent variables) are multiplied by a discount factor of $\frac{1}{(1+r)^t}$.

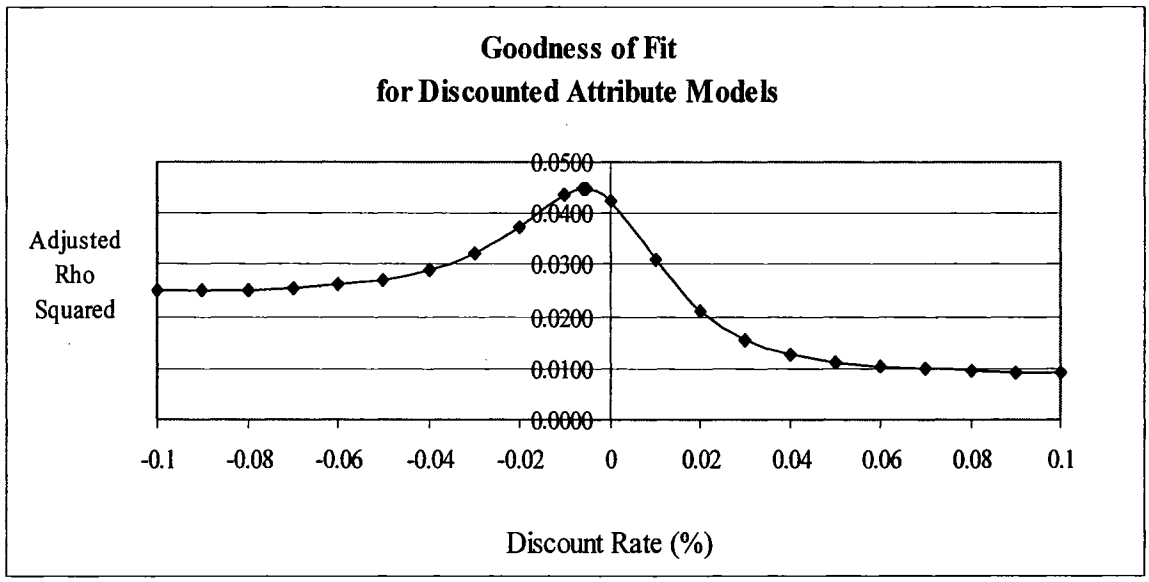
Estimation of discount rates using a grid search

With the grid search method the discount rate is varied and the best model is chosen by inspection. The following chart and graph illustrate the goodness of fit for models with varying discount rates.

Table 4.3: Testing the goodness of fit for discounted attribute models

Discount Rate (r %)	Adjusted Rho Squared	Likelihood Function
-0.1	0.02481	-1043.074
-0.05	0.02706	-1040.655
-0.01	0.04369	-1022.861
-0.0059	0.04488	-1021.593
-0.0058	**0.04489**	-1021.587
-0.0056	**0.04489**	-1021.581
-0.0055	**0.04489**	**-1021.580**
-0.0054	**0.04489**	-1021.581
-0.0053	**0.04489**	-1021.583
-0.0052	**0.04489**	-1021.587
-0.0051	0.04488	-1021.592
0	0.0427	-1017.685
0.01	0.0310	-1036.452
0.05	0.0112	-1057.619
0.1	0.0091	-1059.881

Figure 4.2: Graph of the goodness of fit for models with a range of discount rates



Between -0.0058% and -0.0052% the discount rate has the same impact on the adjusted rho squared while the model with a discount rate of -0.0055% has the highest likelihood value. The small but negative discount rate implies that residents value the future slightly more than the present. Although this is interesting, the discounted model does not increase the performance of the overall model (recall that the non-discounted linear model has an adjusted rho squared is 0.0427). In other words, a non-discounted model is as good at explaining development preferences as a discounted model. To test if the discount rate itself is significant, the maximum likelihood simulation method needs to be employed.

Estimating the discount rate using maximum likelihood

The maximum likelihood estimation procedure within Limdep can be used to actually estimate a discount rate coefficient and its statistical significance. For this analysis five coefficients were estimated: a constant, jobs, moose, fish, and the discount rate. The population variable was dropped because it was not statistically significant in pervious models. It was also not included because the software was not able to find a solution to the six coefficient model due

to the complex nature of the estimation. The Table 4.4 illustrates the estimation results from using maximum likelihood estimation to calculate the appropriate discount rate.

Table 4.4: Attribute model and estimated discount rate

	Basic Linear Utility Attribute Model **with no / zero Discount Rate**	Basic Linear Utility Attribute Model **with Estimated Discount Rate**
RsqAdj	0.04265	-----
Log Likelihood Function	-1023.98	1022.20
	Coefficient	**Coefficient**
Constant	0.0021 (0.016)	-0.0938 (-0.972)
Jobs	0.0263* (5.344)	0.0192* (3.963)
Moose	0.0055* (7.698)	0.0041* (4.637)
Fish	0.0228** (2.207)	0.0189** (2.379)
Population	0.0001 (1.058)	
r (discount rate)		-0.0054** (-2.197)

Note: * is 0.01 significance level ** is 0.05 significance level
The numbers in the brackets below the coefficients are the t-ratios.

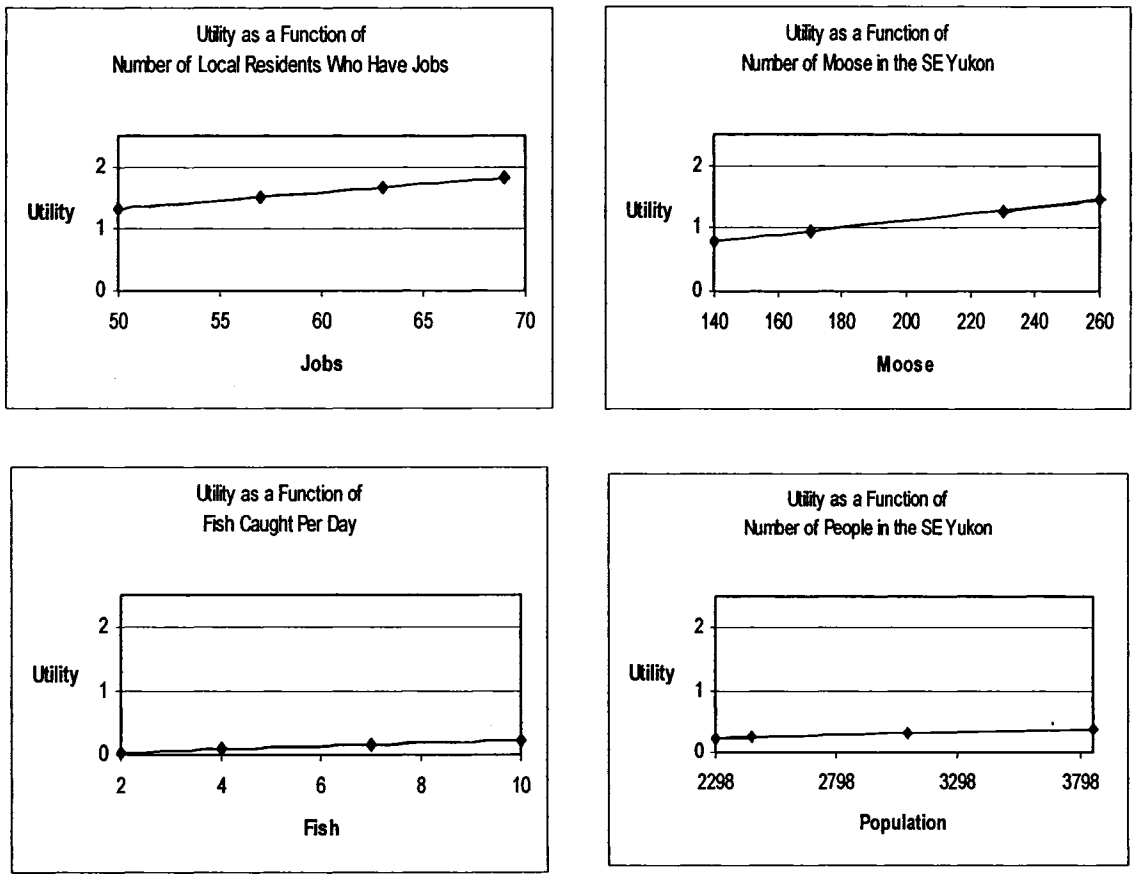
The above estimated discount rate of -0.0054% is very similar to the -0.0055% discount rate estimated using the grid search technique. By using the maximum likelihood method it was determined that the discount rate is statistically significantly. However, in practical terms the discount rate is essentially zero. Therefore, the most appropriate model for analysis of the development trajectory choice questions is the linear utility four scenario attribute model with a zero discount rate. This result is not surprising as it consistent with the focus group discussions and with most of the consultations with local stakeholders. The zero discount rate is also consistent with some of the discounting literature and has been strongly argued for by economic philosophers like Frank Ramsay and Edmund Phelps (Ramsey, 1928; Phelps, 1961). These economists contend that implications for future generations of development decisions made today should be weighed exactly the same as current implications (Boardman et al, 2001).

4.3.4 Attribute Preferences

In the previous sections it was determined that the best model for predicting participant preferences was the linear indirect utility without discounting. This section expands on the interpretation of the linear function results by graphing it and exploring elasticities and the marginal rates of substitution.

The linear indirect utility function means that the "happiness" that the participant obtains from a scenario increases at a constant rate as the attribute levels increase. In other words, the function exhibits the economic axiom of non-satiation, but does not reflect diminishing marginal utility. The following four graphs illustrate how utility varies as a result of changes in each scenario attribute for one time period.

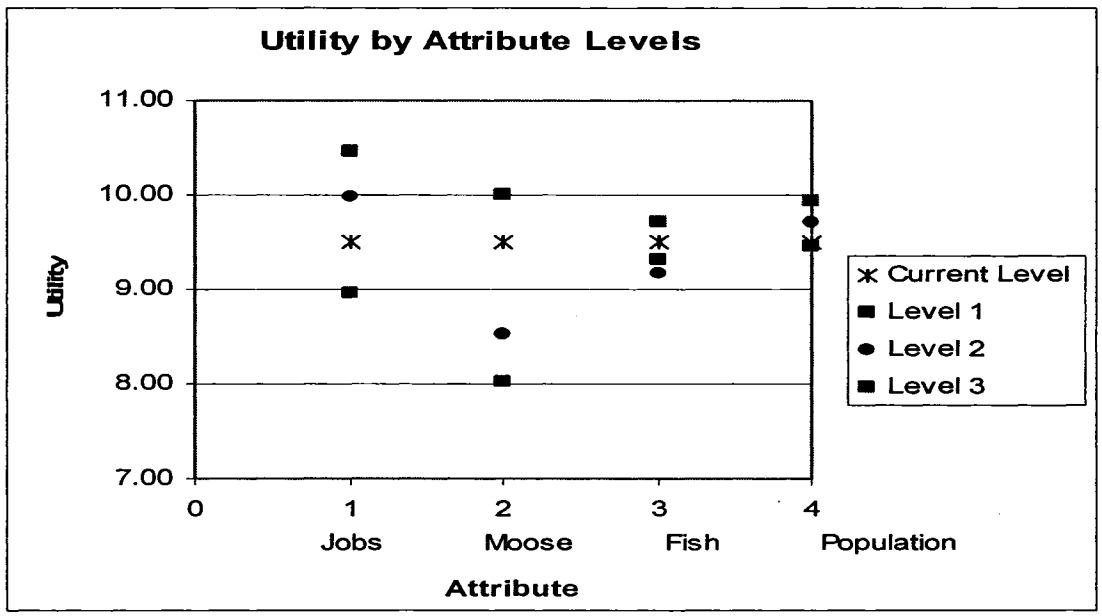
Figure 4.3: Graphs of linear utility functions for one time period



Notice that in Figure 4.3 that as the amount of each attribute increases the utility level also increases (all have positive slopes). However, the amount that utility increases depends on the attribute. For example increasing population from 2,298 people to 3,798 people only increases utility by a small amount, compared to increasing moose from 140 to 260 per 1000/km^2. From a planning perspective this illustration provides insight into the amount of "happiness" that the residents would have based on each attribute level. Assuming the objective of the planner is to maximize utility, they would choose a project that for example increases jobs to 69 as opposed to one that would decrease jobs to 50.

Another way to illustrate the level of utility associated with each attribute level is the Figure 4.4. Note that each point on this graph is the amount of utility associated with a different attribute level but keeping all other attributes at the current level. For simplicity, the calculations assume the same attribute level for all three time periods.

Figure 4.4: Graph of the utility associated with each attribute level



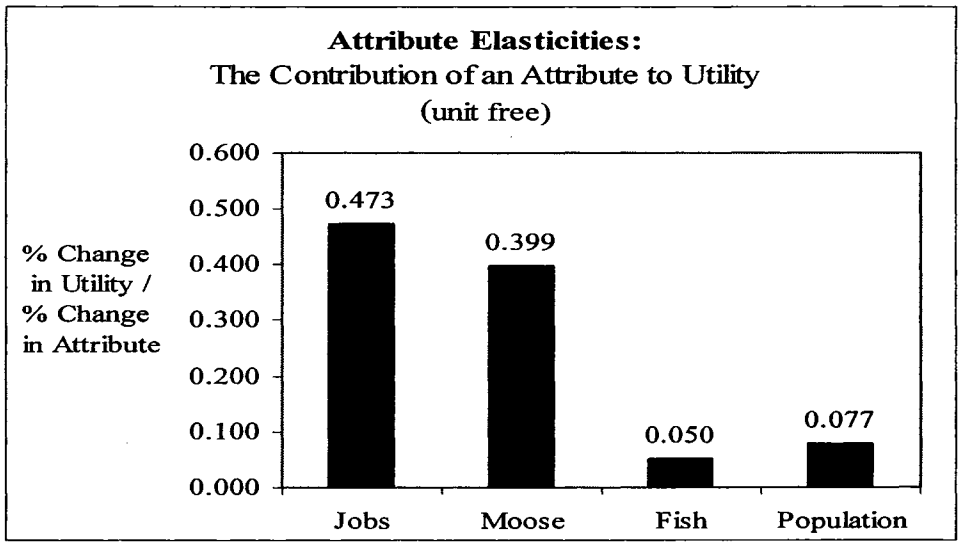
To interpret the graph start at the current level of utility (9.51 utils) and assesses the utility associated with a change in a single attribute level at a time (reading the changes vertically). For example increasing the percentage of local residents who have jobs from 57 to 69 (while all other

attributes are held constant at the current level) increases the utility from 9.51 to 10.46 utils. Alternatively, decreasing jobs from 57 to 50 decreases the utility to 8.96 utils. The same interpretation applies for the remaining 3 attributes. Note that the range of utility calculated in this study is large for jobs and moose but relatively small for fish and even smaller for population.

Attribute Elasticities

By calculating attribute elasticities it is possible to compare the contribution of different attributes to the utility function (unit free). Elasticities vary among the attributes because some are more essential to the respondent. A large elasticity (greater than 1) indicates that a small change in the attribute level results in a large change in utility. A small elasticity (less than 1) indicates that a large change in the attribute level results in only a small change in utility[18]. The following graph illustrates the four attribute elasticities (percentage change in utility divided by the percentage change in the attribute).

Figure 4.5: Graph of the elasticities for the jobs, moose, fish and population attributes



The above graph shows that all four attributes are inelastic. Projects that impact the level of jobs, moose, fish, or population result in small changes in utility: a 1% change in jobs results in a 47%

[18] If the elasticity is greater than or equal to 1 the attribute is deemed elastic. If the elasticity is less than 1 then the attribute is referred to as inelastic.

change in utility; a 1% change in moose results in a 40% change in utility; a 1% change in fish results in a 5% change in utility; a 1% change in population results in a 8% change in utility. These response rates are helpful for land use planners to evaluate development options that affect the level of jobs, moose, fish and population.

Marginal Rates of Substitution

Another useful analysis for project evaluation is the rate at which the residents are willing to trade one attribute for another, also referred to as marginal rates of substitution (MRS). By understanding these rates planners can apply "preference weights" to the outcomes of alternative projects (ALCES outputs). MRS can be calculated from the restricted linear regression model. Table 4.5 lists the MRS for the basic linear four attribute model.

Table 4.5: Marginal rates of substitution for the basic linear utility function (4 attributes)

Trading MOOSE for another attribute		
In order to increase this attribute by 1 unit, and keep utility the same	**This amount of MOOSE must be given up**	**MRS Formula**
Jobs	4.7429	$\frac{\partial JOBS}{\partial MOOSE} = -\frac{\beta_1}{\beta_2}$
Fish	4.1137	$\frac{\partial FISH}{\partial MOOSE} = -\frac{\beta_3}{\beta_2}$
Population	0.1018	$\frac{\partial POPULATION}{\partial MOOSE} = -\frac{\beta_4}{\beta_2}$
Trading JOBS for another attribute		
In order to increase this attribute by 1 unit, and keep utility the same	**This amount of JOBS must be given up**	**MRS Formula**
Moose	0.2108	$\frac{\partial MOOSE}{\partial JOBS} = -\frac{\beta_2}{\beta_1}$
Fish	0.8673	$\frac{\partial FISH}{\partial JOBS} = -\frac{\beta_3}{\beta_1}$
Population	0.0215	$\frac{\partial POPULATION}{\partial JOBS} = -\frac{\beta_4}{\beta_1}$
Trading FISH for another attribute		
In order to increase this attribute by 1 unit, and keep utility the same	**This amount of FISH must be given up**	**MRS Formula**
Jobs	1.1529	$\frac{\partial JOBS}{\partial FISH} = -\frac{\beta_1}{\beta_3}$
Moose	0.2431	$\frac{\partial MOOSE}{\partial FISH} = -\frac{\beta_2}{\beta_3}$
Population	0.0247	$\frac{\partial POPULATION}{\partial FISH} = -\frac{\beta_4}{\beta_3}$
Trading POPULATION for another attribute		
In order to increase this attribute by 1 unit, and keep utility the same	**This amount of POPULATION must be given up**	**MRS Formula**
Jobs	46.615	$\frac{\partial JOBS}{\partial POPULATION} = -\frac{\beta_1}{\beta_4}$
Moose	0.9828	$\frac{\partial MOOSE}{\partial POPULATION} = -\frac{\beta_2}{\beta_4}$
Fish	40.431	$\frac{\partial FISH}{\partial POPULATION} = -\frac{\beta_3}{\beta_4}$

* Note: Units for the attributes are
Jobs= percentage of local residents who have jobs
Moose= number of moose per 1000 km^2
Fish= number of fish that an average angler could catch in a day
Population= total number of people living in the Southeast Yukon

** Note: The coefficients for the Linear Utility Function are

$\beta_1 = 0.0263$ $\beta_2 = 0.0055$ $\beta_3 = 0.0228$ $\beta_4 = 0.0001$

The respondents, on the whole, would be willing to accept a decrease of 0.21 local resident jobs, 0.24 fish per day or 0.98 people in order get one more moose / 1000 km^2, ceteris paribus. In order to get one more job for local residents out of 100, the respondents would be willing to trade 4.74 moose, 1.15 fish, or 46.62 people. The respondents would be willing to accept a decrease of 4.11 moose, 0.87 jobs, or 40.43 people in order to increase the fish catch rate by 1 fish/day. Remembering that the population variables are not significant in the regression model, the respondents would trade 0.10 moose, 0.02 jobs, or 0.02 fish to increase the region's population by people.

Not surprisingly, this implies that in order for the residents to be as well off as before a decrease in environmental quality they would have to be compensated by another attribute. Considering a resource development path this attribute is likely to be jobs. If fish catch rates were to decrease by 1 fish per day then the residents would require an increase of about 21 local resident jobs (assuming population of 2,450). If moose per 1000 km^2 were to decrease by 1 moose then the residents would require an increase of about 5 more local resident jobs (assuming a population of 2,450).

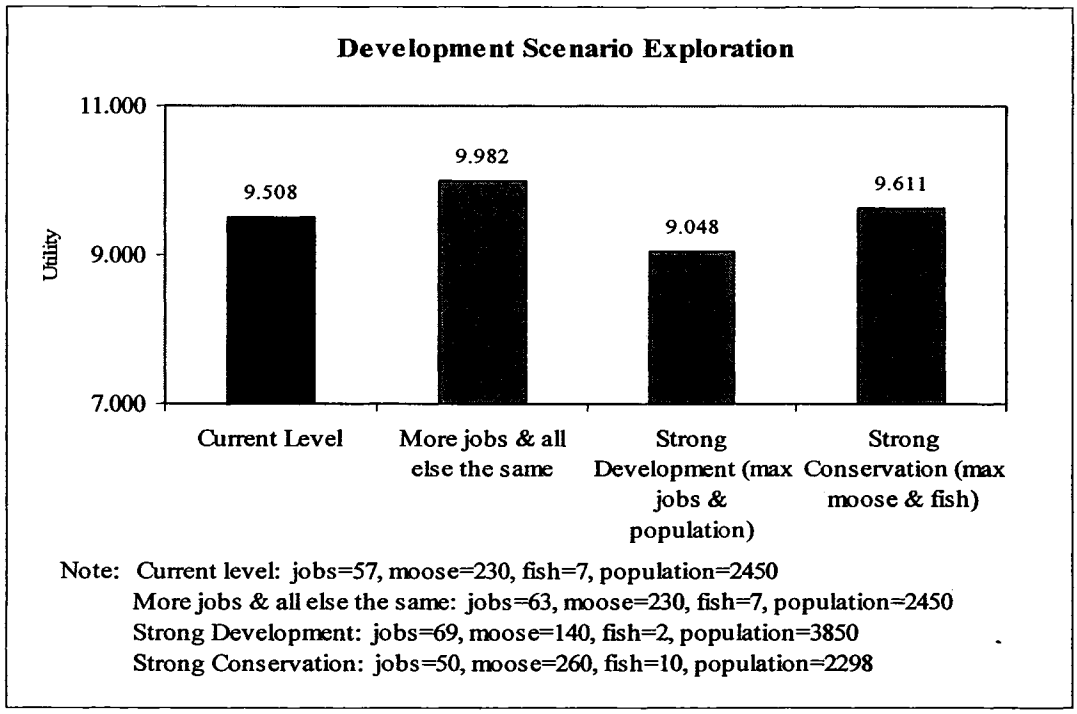
The reverse also holds for the conservation path. If jobs are going to decrease by 1 local resident job/ 100 locals (a total of about 24.5 jobs if the population is 2,450), the residents would require an increase of 4.74 moose/ 1000 km^2 or an increase of 1.15 fish/day. If population is required to decrease by 10 people, the residents would require an increase of 1 moose/ 1000 km^2, or 0.2 fish/day.

Scenario Utility Calculations

The estimated linear indirect utility function can also be used to assess the total utility that would be generated in different development options that might be generated from ALCES North. If the land use managers' objective is to maximize society's welfare, the option which

provides the most utility should be selected. There is a large array of possible development paths that could be explored; this section calculates the total utility for four possible paths (Figure 4.6). For simplicity, the same attribute level was used for each of the three time periods. The "current level" scenario is where there are 57 local residents out of 100 who have jobs, 230 moose / 1000 km^2, 7 fish per day, and 2,450 people in the region. The next utility level is when jobs are increased slightly to 63 while all other attribute levels remain at their current levels. This scenario is a realistic proposal for the Southeast Yukon. Another scenario that has been proposed is "strong development" where planners maximize the number of local residents who have jobs (69) and the number of people living in the Southeast Yukon (3,090). A downside of this scenario is that the moose per 1000 km^2 might decreases to 140 and fish to 2 fish per day. The "strong conservation" scenario is another possible management decision. For this scenario there is an increase in the number of moose per 1000 km^2 (260) and the fish catch rates (10). A downside of this scenario is that there might be a decease in the jobs per 100 local residents (50) and population (2,298).

Figure 4.6: Graph of utility calculations for difference development scenarios



Note: Current level: jobs=57, moose=230, fish=7, population=2450
More jobs & all else the same: jobs=63, moose=230, fish=7, population=2450
Strong Development: jobs=69, moose=140, fish=2, population=3850
Strong Conservation: jobs=50, moose=260, fish=10, population=2298

Of these four scenarios the "more jobs and all else the same" option would provide relatively more utility to the residents, ceteris paribus. The strong conservation scenario is a small improvement compared to the current level. However, the strong development option would provide relatively less utility than the current level.

4.3.5 Utility Thresholds

The previous section explores the amount of utility residents would obtain from alternative scenarios. This section explores the possibility that the residents might have "utility thresholds". In other words, is there a level of a scenario attribute that the residents are not willing to accept regardless of an increase in the other attributes? For example, it might be possible that if fish catch rates go below 4 fish per day the residents are not willing to accept any amount of increase in moose, jobs or population in compensation.

A number of methods were explored to assess utility thresholds. However, in summary, no evidence was found for "utility threshold" over the range of scenario attributes that were tested in the choice experiment.

The first method examined the actual choice data to see if there were any observed scenarios where no respondents chose options when the attribute levels were particularly low. This method did not result in any obvious utility thresholds. It did appear that when jobs were at 50 per 100 local residents or when moose was at 140 /1000 km^2 fewer respondents chose these scenarios, which is consistent with the survey results and focus group comments. However, there was no attribute level where the respondents refused to be compensated for the low level by an increase in another attribute (to make trade-offs). This procedure was also employed to search for possible thresholds at the upper end of each attribute level. No threshold trends were found on the upper end of attribute levels in the data.

The second method used to explore the existence of utility thresholds was to include dummy variables in the regression analysis either as interaction terms or as intercepts (Table 4.8

and Appendix E). The following table lists the four dummy variables created to test for utility thresholds: lowest attributes, highest attributes, below status quo, and above status quo.

Table 4.6: List of dummy variables used to test utility thresholds

Dummy Variable	Is equal to 1 if Variable Level is:
Lowest Attributes	Jobs= 50 Moose= 140 Fish= 2 Population= 2298
Highest Attributes	Jobs= 69 Moose= 260 Fish= 10 Population= 3850
Below Status Quo	Jobs= 50 Moose= 170 or 140 Fish= 4 or 2 Population= 2298
Above Status Quo	Jobs= 63 or 69 Moose= 260 Fish= 10 Population= 3090 or 3850

Each of these dummy variables (Table 4.6) were independently included in the regression models. However, the regressions do not provide strong evidence for utility thresholds as none of the models that included the dummy variables significantly improved the predictability of the basic linear behavioural model (Table 4.8).

The coefficients for dummy variables of attribute levels above or below the status quo value are not statistically significant and therefore do not improve the linear model (Appendix E).

Alternatively, the coefficients for the dummy variable of lowest attribute level of jobs in 50 years and moose in 100 years are both statistically significant and negative (Table 4.7). Similar to the data exploration method, these results indicate that the respondents are less likely to choose a scenario that has jobs at 50 local residents out of 100, or moose at 140 moose / 1000 km^2. However, although these two variables are statistically significant the overall choice model is not improved by including dummy variables for the lowest level attributes.

Table 4.7: Regression models testing for utility threshold effects

	Basic Linear Utility Attribute Model	Lowest Level of Attributes
RsqAdj	0.04265	0.04237
Log Likelihood Function	-1023.977	-1016.413
Variables	**Coefficient**	**Coefficient**
Constant	0.0021 (0.016)	-0.1958 (-0.629)
Jobs	0.0263 * (5.344)	0.0171 (2.000)
Moose	0.0055 * (7.698)	0.0050 (4.942)
Fish	0.0228 ** (2.208)	0.0265 (1.650)
Population	0.0001 (1.058)	0.0001 (1.115)
[redacted]		
Jobs in 10 yrs =50		-0.1289 (-0.749)
Jobs in 50 yrs =50		-0.3074*** (-1.725)
Jobs in 100 yrs =50		-0.2155 (-1.273)
Moose in 10 yrs =140		-0.2212 (-1.468)
Moose in 50 yrs =140		0.1222 (0.790)
Moose in 100 yrs =140		-0.2993* (-2.007)
Fish in 10 yrs =2		0.1264 (0.838)
Fish in 50 yrs =2		0.0226 (0.146)
Fish in 100 yrs =2		-0.1253 (-0.797)
Population in 10 yrs =2298		0.1595 (1.144)
Population in 50 yrs =2298		0.1184 (0.819)
Population in 100 yrs =2298		-0.0885 (-0.624)

Note: * is 0.01 significance level ** is 0.05 significance level *** is 0.10 significance level
The numbers in the brackets below the coefficients are the t-ratios.

Likelihood ratio tests (Table 4.8) reveal that neither using dummy variables nor interaction variables significantly improve the behaviour model. In other words, the

basic linear attribute model predicts the respondents' development preferences just as good.

Table 4.8: Likelihood ratio test for utility threshold models

	[redacted]				
$X_{critical} = X_{12df}^{0.050} = 21.03$	**Lowest Level of Attribute Variable**	**Below the Status Quo Variable**	**Above Status Quo Variable**	**(Below the Status Quo) * (Attribute)**	**(Lowest Level of Attribute) * (Attributes)**
X calculated	-15.1288	-14.2848	-7.4588	-13.6168	*insufficient observations*

In summary, the study fails to find evidence that there are attribute levels that the respondents are not willing to accept compensation by increasing some other attribute. In other words the analysis failed to find utility thresholds (limits of acceptable change) over the range of scenario attribute levels tested in the choice experiment.

4.3.6 Demographic Models: Observed Heterogeneity

The focus group discussions and consultations with local experts suggested that there may be significant differences in how people believe the Southeast Yukon should develop. It was expected that there would be significant heterogeneity in scenario choices based on subgroups / cohorts within the community. This section explores the similarities and differences that were found.

Differences in Community Preferences

Less observable heterogeneity was found in the data than expected. The most prominent differences were between respondents with the following demographic variables: gender, government employees, and people looking for work. **Women** are slightly more likely than men to desire increased population in the region. People who are **government employees** (First

Nations, municipal, territorial, or federal) are more likely to desire increased fish populations than the rest of the community. People **looking for work** are more likely to want an increased percentage of local residents who have jobs in the region. The regression results are illustrated in Table 4.9.

Table 4.9: Basic attribute model and demographic variables

	Basic Linear Utility 4 Attribute Model	Gender	Has a govern-ment job	Is looking for work
RsqAdj	0.04265	0.04529	0.05123	0.04557
Log Likelihood Function	-1023.977	-1018.537	-1012.207	-1018.246
	Coefficient	**Coefficient**	**Coefficient**	**Coefficient**
Constant	0.0021 (0.016)	-0.0068 (-0.052)	-0.0556 (-0.417)	-0.0413 (-0.305)
Jobs	0.0263 * (5.344)	0.0224 * (3.350)	0.0276 * (5.242)	0.0211 * (0.3.968)
Moose	0.0055 * (7.698)	0.0054 (5.864)	0.0056 * (7.245)	0.0057 * (7.414)
Fish	0.0228 ** (2.208)	0.0179 (1.284)	0.0153 (1.389)	0.0308 * (2.722)
Population	0.0001 (1.058)	0.0000 (-0.540)	0.0001 (1.389)	0.0001 (0.956)
Gender * jobs		0.0085 (0.906)		
Gender * moose		0.0004 (0.288)		
Gender * fish		0.0139 (0.714)		
Gender * population		0.0002 ** (2.424)		
Has government job * jobs			-0.0187 (-1.359)	
Has government job * moose			0.0014 (0.776)	
Has government job * fish			0.0878 * (2.913)	
Has government job * population			-4.78E-05 (-0.406)	
Looking for Work * jobs				0.0320 ** (2.111)
Looking for Work * moose				0.0006 (0.343)
Looking for Work * fish				-0.0380 (-1.355)
Looking for Work * population				-4.64E-05 (-0.401)

Note: * is 0.01 significance level ** is 0.05 significance level
The numbers in the brackets below the coefficients are the t-ratios.

Similarities in Community Preferences

Although there are some differences, there are more similarities in the respondents' development preferences in terms of community subgroups. Several demographic variables typically believed to be sources of community heterogeneity were found to not be statistically different from their counterparts: persons of First Nations background (Kaska or non-Kaska); people who are hunters or trappers; people who own businesses; people who stated that they would or would not move out of the Southeast Yukon; people from different Southeast Yukon communities; people of varying age categories; households with varying income levels; and households with children. Likelihood ratio tests conclude that these explanatory variables fail to improve the original four attribute choice model and therefore are not sources of community preference heterogeneity. The following table lists the calculated chi-squares statistics from the models associated with each of these demographic variables. The critical chi-squared value with four degrees of freedom and significance of 0.05 is 9.49.

Table 4.10: Calculated chi-squared values for demographic models

$\chi^2_{4,0.05}$ = 9.49	House-hold has a child	Has Post Secondary Education	House-hold income	Community
X calculated	-6.26	-8.18	-1.94	-7.61

$\chi^2_{4,0.05}$ = 9.49	Age	Son or senior (less than 55 years old)	Lived in SE more than 10 years	Lived in SE more than 20 years
X calculated	-7.26	-8.39	-4.37	-8.09

$\chi^2_{4,0.05}$ = 9.49	Person of First Nations Background	Owns a business	Occupation is hunter or trapper	Would move out of the SE Yukon	Would not move out of the SE Yukon
X calculated	-5.49	-8.62	-7.46	-3.10	-0.55

4.3.7 Unobserved Heterogeneity

The previous section indicated that there was little observed heterogeneity. This section tests for unobserved heterogeneity. It explores the hypothesis that although there may not be differences associated with community subgroups, there might actually be differences that are not

measurable with these demographic variables. Using Limdep 3.0.1 the parameters and the distribution of the parameters were estimated. The summary statistics for the original standard logit model and for the three mixed logit models of distribution normal, triangular and uniform distributions are included in Table 4.11.

Table 4.11: Random parameters and mixed logit models

	Standard Logit Model	Mixed Logit with Normal Distribution	Mixed Logit with Triangular Distribution	Mixed Logit with Uniform Distribution
RsqAdj	0.0427	---	---	---
Log Likelihood Function	-1023.9774	-905.0992	-905.1348	-906.3541
	Coefficient	**Coefficient**	**Coefficient**	**Coefficient**
Constant	0.0021 (0.016)	-0.0297 (-0.146)	-0.0649 (-0.321)	-0.0749 (-0.368)
Jobs	0.0263 * (5.344)	0.0457* (5.901)	0.0463* (5.772)	0.0468* (5.652)
Moose	0.0055 * (7.698)	0.0089* (6.610)	0.0093* (6.458)	0.0097* (6.157)
Fish	0.0228 ** (2.208)	0.0471* (2.678)	0.0488* (2.755)	0.0471* (2.685)
Population	0.0001 (1.058)	0.0001 (0.864)	0.0001 (0.685)	0.0001 (0.613)
Derived standard deviations of parameter distributions				
Ns (Jobs)		0.0239 (0.997)		
Ns (Moose)		0.0095* (6.097)		
Ns (Fish)		0.0989* (4.213)		
Ns (Population)		0.0009* (6.333)		
Ts (Jobs)			0.0748 (1.571)	
Ts (Moose)			0.0227* (6.031)	
Ts (Fish)			0.2514* (4.694)	
Ts (Population)			0.0019* (5.785)	
Us (Jobs)				0.0608** (2.013)
Us (Moose)				0.0162* (6.930)
Us (Fish)				0.1734* (4.933)
Us (Population)				0.0012* (6.379)

Note 1: * is 0.01 significance level ** is 0.05 significance level
The numbers in the brackets below the coefficients are the t-ratios.
Note 2: The mixed logit model parameters of jobs, moose, fish, and population are random parameters in the utility function. Only the constant is a non-random parameter.
Note 3: Ns, Ts, Us, refer to the normal, triangular, and uniform distributions.
The associated estimates refer to the standard deviations of the random parameter estimates.

There is evidence of unobserved heterogeneity in the development preferences of the respondents. Mixed logit models estimate the mean coefficients and a range around that estimate based on a specified distribution function. The mean estimates for the attributes of jobs, moose and fish were found to be highly statistically significant, while the population variable continues to have little statistical significance (explanatory power). The interesting result is that the standard deviations of the moose, fish and population variables are statistically significant in all three mixed logit models. Yet, the standard deviation of the jobs variable is slightly statistically significant only with the uniform distribution.

Overall, these results imply that the respondents are fairly unified in their desire for more local residents to have jobs. However, they are divided on their preferences for the region's moose, fish and population. Table 4.12 provides the range of attribute coefficient. Notice that almost all of the attributes have both positive and negative values, which is characteristic of these three distributions. This reveals that some residents prefer decreases in the attribute level while others prefer increases.

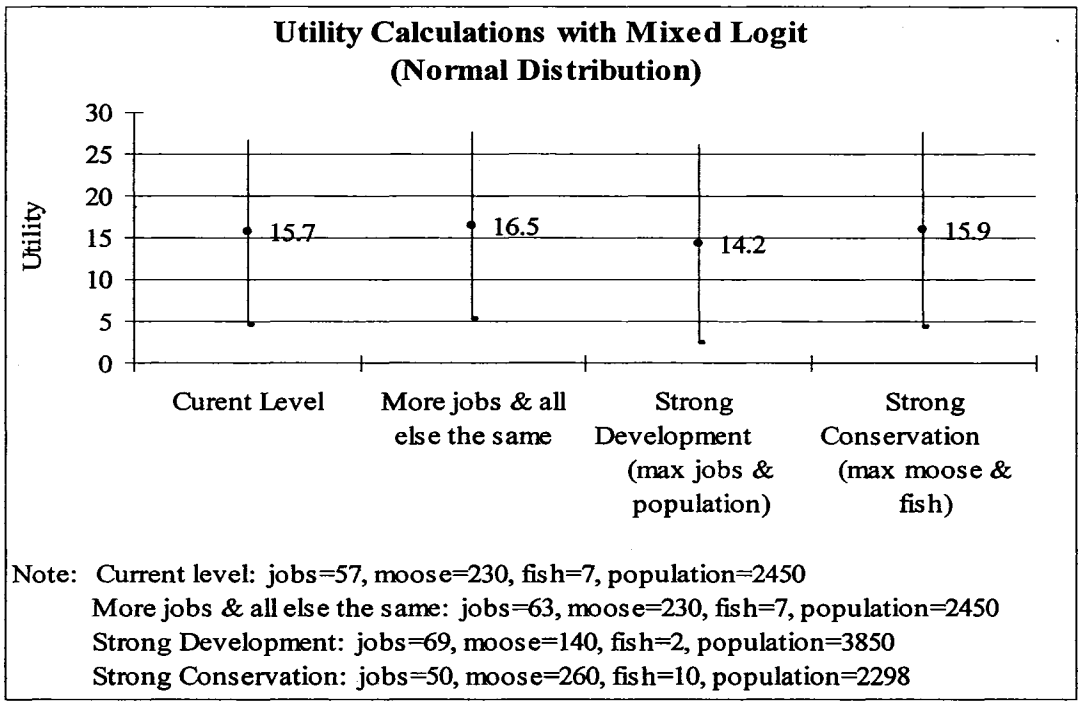
Table 4.12: Calculating the coefficient range of the scenario attributes

Normal	Jobs	0.0457	0.0239	0.070	0.022
	Moose	0.0089	0.0095	0.018	-0.001
	Fish	0.0471	0.0989	0.146	-0.052
	Population	0.0001	0.0009	0.001	-0.001
Triangular	Jobs	0.0463	0.0748	0.121	-0.029
	Moose	0.0093	0.0227	0.032	-0.013
	Fish	0.0488	0.2514	0.300	-0.203
	Population	0.0001	0.0019	0.002	-0.002
Uniform	Jobs	0.0468	0.0608	0.108	-0.014
	Moose	0.0097	0.0162	0.026	-0.007
	Fish	0.0471	0.1734	0.221	-0.126
	Population	0.0001	0.0012	0.001	-0.001

From these results it is obvious that the residents in the Southeast Yukon have very different preferences and marginal rates of substitution. This finding complicates land use planning. Instead of having a single number to represent preferences, planners are now faced with a range of preferences with a distribution that can not be identified using demographic characteristics.

As was provided in the marginal rate of substitution section, utility calculations for scenario possibilities are also calculated using the mixed logit results for the normal distribution (Figure 4.7). The following graph illustrates the mean utility calculation and one standard deviation.

Figure 4.7: Graph of the utility calculations using mixed logit with a normal distribution



Note: Current level: jobs=57, moose=230, fish=7, population=2450
More jobs & all else the same: jobs=63, moose=230, fish=7, population=2450
Strong Development: jobs=69, moose=140, fish=2, population=3850
Strong Conservation: jobs=50, moose=260, fish=10, population=2298

The above results were calculated using Excel's @ *Risk* program to randomly generate 100 coefficients for each of the four attributes (β_1, β_2, β_3 and β_4) from a distribution with the mean and standard deviations estimated in the mixed logit regressions. Then the coefficients were multiplied by each scenario's attribute levels

(lowest utility, highest utility, strong development and strong conservation). The four products for a given scenario were then added up to result in 100 total utility calculations.

$$V_i = \beta_0 + \beta_1(jobs) + \beta_2(moose) + \beta_3(fish) + \beta_4(population)$$

Of these 100 utility calculations the mean and one standard deviation were determined and graphed in Figure 4.7.

The graphical illustration demonstrates that although there are significant overlaps between the utilities generated by the four scenarios, there are definite differences. The scenario that provides the most utility is the second scenario ("More jobs and all else the same"), yet for some residents this path would not generate the highest utility. The strong development and strong conservation scenario also would result in some residents being very unhappy relative to other scenarios. This result reflects the complex nature of resource development decisions and indicates while one project may please some residents it will undoubtedly displease others.

Chapter 5: Implications, Conclusions, and Future Research

5.1 Summary

The purpose of this thesis research, in terms of the overall NEI Project, was to understand the attribute and inter-temporal preferences of Southeast Yukoners' for land use alternatives and development trajectories. To achieve this, an Attribute Based Choice Survey was designed with the recommendations of focus group participants and local experts. The survey was subsequently administered to 252 residents in the region. From the data collected a conditional logit model modified to account for the temporal nature of the data was developed to provide estimates of the preferences and to test the variability of preferences over groups of Yukon residents. The results provide insight into how changes in scenario attributes affect individual utility and the likelihood that one development path would be preferred over another.

The results showed that in general individuals preferred development paths that have more local jobs, moose, fish and people. When presented with varying levels the majority of respondents made trade-offs between these four attributes. There was no attribute level at which all respondents were unwilling to make a trade-off and thus no evidence was found for utility thresholds over range of attributes levels tested. A brief summary of the findings is as follows:

Development Preferences

- Ceteris paribus, the residents want more local jobs, moose, fish, and people.
- Overall, a conservation path that increases the moose and fish populations is preferred to strong development path that increases the local jobs and the rural population. A path that would provide even more social welfare is one in which local jobs are increased slightly while keeping the other three attributes the same.

Attribute Trade-offs

- Overall, the majority of respondents did make trade-offs between the four scenario attributes.

- Based on the linear regression results and the elasticity calculations the percentage of local residents who have jobs is the largest and most significant contributor to the respondents' utility. The second largest contributor is fish and then moose. Population was small and not significant.
- Utility thresholds were not observed over the tested range of scenario attributes.
- There was not a lot of observable heterogeneity in development preferences between community members. This could be due to the small sample size.
- There were some differences between the preferences of men and women, government employees and non-government employees, people looking for work and people not looking for work.
  - Women are more likely than men to want increased population in the region.
  - Government employees are more likely to desire increased fish populations than the rest of the community.
  - People who are looking for work are more likely than others to want to increase the percentage of local residents who have jobs.
- Although the respondents were fairly unified in their desire for more local residents to have jobs there were substantial differences in preferences relative to moose, fish and population. These differences in opinion could not be identified using demographic variables.

Time Trade-offs

- The social discount rate calculated for the Southeast Yukon is zero percent. In other words, residents value future and current benefits and liabilities the same.

5.2 Limitations and Future Research

Because actual development choice behaviour was not available this study relied on collecting stated preference data. Stated preference data has been criticized because the choices

are hypothetical and cannot be externally validated. Surveys are also criticized for biases that result due to strategic behaviour[19]. Another potential problem with SP data in small communities is that there may be interactions between respondents or some other influences between members[20]. The study attempted to deal with these problems by making the scenarios as realistic as possible for the local residents, by reminding the residents that the survey was to be answered "individually as we are interested in your opinion", and that their responses are "strictly confidential". Another method was to frame the choice questions as regional referendums. Several follow-up questions were also used throughout the survey to check for strategic behaviour and to check if respondents understood what they were being asked to do. For example after each choice question the respondent was asked how confident they were in their vote. They were also asked at the end of the choice section if they felt the options were realistic. Pilot tests were also used to identify possible strategic behaviour and explore possible alternative survey design. Overall, extensive efforts were employed to decrease strategic behaviour and hypothetical biases. However, it is important when exploring the research results to consider this possible limitation of the research.

An important strength of this research has been the involvement of Southeast Yukon residents in the research and survey design. Incorporating many of their recommendations has helped this research reflect local understandings of quality of life and community well-being. As more information becomes available and as society's preferences change, these understandings will evolve. In order to reflect these changing objectives and concerns, it is recommended that panel data on land use preferences be collected. When panel data are collected it would be possible to construct measures such as marginal rates of substitution as indicators. These

[19] Strategic behaviour happens when a respondent misrepresents their true preference in order to achieve a different outcome. For example a respondent might choose one option when really they prefer an alternative.

[20] Recall that SP survey design and analysis assumes that each survey represents the preferences of one individual.

longitudinal data would facilitate adaptive management practices, encourage mitigation discussion and continue the systematic involvement of residents in the planning process.

From a planning perspective it is advantageous to have levels of attributes that the residents are not willing to accept. If clear limits of acceptable change exist policy makers can set regulations on development that reflect these boundaries or thresholds. However, this research did not find evidence for thresholds over the range of attribute levels investigated. The survey tested four attribute levels that were designed using background research and recommendations of local experts. These levels were also chosen because they were comprehendible to the respondents and because they were useful for modelling purposes. An interesting expansion of this study would be to try different levels of attributes and test if the individual utility functions have nonlinear dimensions or if utility thresholds exist.

Another interesting and important expansion of this study would be to investigate the distributional implications of land use decisions across groups in the community and across the region. This research did not explicitly address how the benefits and cost of alternative projects are distributed within the Southeast Yukon. It is foreseeable that some trajectories will benefit some residents and not others. It is also foreseeable that benefits and costs might not be distributed the same throughout the region. For example environmental degradation might be experienced in one area (maybe the north) while local jobs are realized in another part of region (maybe the south). In meetings and in the focus groups, several residents expressed concerns about distribution especially in terms of who gets the jobs and where the environmental liabilities incur. Understanding how the impacts will be distributed could provide a basis for regulation and mitigation discussions.

5.3 Conclusion

The study provides value-based information about landscape attributes and time preferences. The analysis showed that, on average, individuals in the Southeast Yukon prefer development scenarios that have more local residents with jobs, more moose per 1000 km^2, more fish to be caught and more people living in the region. On average, these respondents assigned equal values to attribute changes that occurred in different time periods. Analysis also revealed that the largest differences in development preferences could not be attributed to observable characteristics such as age, education, income or ethnicity. This later finding makes development and mitigation discussion particularly complicated because distinct preference groups are not obvious.

The results of this research can be used for developing management guidelines and setting targets that reflect local preferences. Moreover, once the preference information is incorporated into ALCES North, resource planners and interested stakeholders can use the learning tool to systematically assess alternative development options. With many alternatives being considered it is imperative that Northern planners have access to quality information on the individual and cumulative implications of development projects and society's evaluation of these changes.

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APPENDIX A: Letter of Support & Yukon Research Licence

KASKA TRIBAL COUNCIL

P.O. Box 530
Watson Lake, Yukon
Y0A 1C0

March 31, 2005

Marion Weber
Socio-Economic Team Leader
NEI Cumulative Effects Thresholds Project
c/o Sustainable Ecosystems
Alberta Research Council
250 Karl Clark Road
Edmonton, Alberta
T6N 1E4
Fax: 1-780-450-5083

Dear Marion,

Thank you for the March 16 letter regarding the Socio-Economic component of the NEI Cumulative Effects Thresholds Project. Overall, Kaska Tribal Council is agreeable for the project to commence and that it will involve Kaska community individuals with non-First Nation individuals. Furthermore, it is my understanding that individuals will be selected through Kaska consultation that they will be compensated, translators will be available, and all costs will be covered through the NEI project.

However, before any information can be collected that is considered traditional knowledge, a Traditional Knowledge protocol must be agreed to by the parties and the methods reviewed to ensure they are consistent with our policies.

The process to engage communities and individuals for this project once a protocol has been signed will be to contact the Kaska Tribal Council and this office will then work with Kaska community Traditional Knowledge Coordinators to respond to your needs.

I hope this response is satisfactory to be able to submit the project for ethics review. I am available for any further discussion or questions.

Sincerely,

Lammond Dick
Tribal Chief

Telephone: (867)-536-2805 Fax: (867)-536-2806

Yukon
Tourism and Culture

License Number 05-32S&E

YUKON-CANADA
SCIENTISTS AND EXPLORERS ACT
LICENSE

PURSUANT to the provisions of the Scientists and Explorers Act (1958) of the Yukon, permission is hereby granted to:

Dr. Marian Weber (Alberta Research Council & University of Alberta)

to enter the Yukon Territory to conduct scientific research with respect to:

Northern Ecosystems Initiative Cumulative Effects Thresholds Project: Socioeconomic Indicators and Limits of Acceptable Change.

GENERAL CONDITIONS

1. A complete, final report of the research conducted under this license shall be submitted, in duplicate, within one year of completion or termination of the project.
   a) A field or progress report, including descriptions or catalogues of collections made (where applicable) shall be submitted in duplicate on, or before, the expiry date written below.
   b) The Licensee shall provide two copies of any report or article published on the research conducted under this license.

2. All camps shall be established according to the provisions of the Territorial Land Use Regulations.

3. All steps shall be taken to avoid unnecessary disturbance of wildlife.
   a) No camp site shall be established within 2 km of an active raptor nest.
   b) When using aircraft, maintain a minimum of 1,000 feet over wildlife such as sheep, raptor nests and migrating caribou.
   c) Pay particular attention to bear habitat, and take all steps necessary to avoid contact with bears.

4. The Licensee shall meet with and inform any nearby First Nation(s) of the field activities conducted under this license, and shall not proceed as long as there are irreconcilable objections from the First Nation(s).

5. The Licensee shall strictly observe all applicable Territorial and Federal legislation and regulations.

OTHER CONDITIONS

NIL

THIS License is valid for the period April 25th to December 31st, 2005.

DATED at the City of Whitehorse, in the Yukon Territory, this 10th day of May, A.D., 2005.

Manager, Heritage Resources Unit
Cultural Services Branch
Tourism and Culture

APPENDIX B: Information Sheet and Survey

Information Sheet for the Questionnaire on Land Use Management in the Southeast Yukon

You have been selected to participate in a University of Alberta research project funded in part by Environment Canada and the Alberta Research Council.

The project has the approval of the Kaska Forest Resources Stewardship Council (KFRSC), the Kaska Tribal Council, and the Yukon Territorial Government.

The aim of this work is to understand the development opinions of Southeast Yukon residents. A summary of the information collected will be provided to planning institutions such as the Kaska Forest Resources Council and the Kaska Tribal Council, where they might consider it in their planning decisions.

Project Title:

Northern Ecosystems Initiative (NEI) Cumulative Effects Thresholds Project: Socio-economic Indicators and Limits of Acceptable Change

Project Team:

Amanda Spyce
(MSc Student)
Email: aspyce@ualberta.ca
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Dr. Marian Weber
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(780) 450-5193
Alberta Research Council
250 Karl Clark Road
Edmonton, AB TGN 1E4

Background:

This research project is one of nine integrated projects that are working with the KFRSC to develop models that examine tradeoffs associated with natural resource development.

This questionnaire is being distributed at random **to approximately 200 residents of the Southeast Yukon. You have been selected at random to participate in this study.** The questionnaire will be dropped off at your home and then picked up at an agreed upon time. It will take you between **15 to 30 minutes to complete** the questionnaire. Contact information for a liaison in the community is provided at the bottom of the page. You may contact this person about any issues or concerns about the questionnaire.

The purpose of the questionnaire is **to understand the opinions** of Southeast Yukon residents about land use planning as well as other issues related to development in your communities. The questionnaire will ask you to choose between different possible "futures". Please **answer individually** and remember that **there are no right or wrong answers.** We are interested in your opinion. There is a section that asks questions about your background such as age and gender. If there are any questions you do not wish to answer, you may skip them and move on to the next question.

Use of the Information: The information generated by this project will be summarized and used to develop a computer program called ALCES. The program can help land use planners understand the cumulative effects and tradeoffs of land management decisions.

A copy of the data (without the participants' names) will remain with the KFRSC in the Southeast Yukon. The data will be in computer files and will not be the original completed surveys. The information and the computer model may be used by the KFRSC or the Kaska Tribal Council for forest resource planning.

The results will also be used in the thesis of Amanda Spyce as well as related research publications and presentations. Possible publications are academic journal articles or summary reports.

Additional uses of the information collected in this study will require the prior approval of the KFRSC.

Risks: There are no foreseeable risks for you as a participant.

Benefits: By participating in this study, you will have an opportunity to provide information that may be used for resource planning.

Confidentiality: The researchers are individuals from the University of Alberta. They are not employees or members of the KFRSC or any another regional organization. These people will maintain the confidentiality of the participants and their specific comments. Any additional individuals that are employed by the project will sign a confidentiality agreement.

You will not be directly identified in any reports or presentations resulting form the research. If you choose to do so, you may anonymously provide additional comments to the researchers by mailing or emailing your comments to any of the above addresses.

The researchers will take several steps to maintain confidentiality:

- The data will be **anonymous** with no way to identify the responses of particular individuals.
- An individual's name and questionnaire will be **separated**.
- The completed surveys will be kept in the research team's office in **a locked storage room**.
- The questionnaires and other data in which individuals are identified will only be accessible to the researcher, her supervisors and the local researcher.

Consent & Withdraw from the Study:

In completing and returning the questionnaire, you agree that you understand that you have been asked to participate in a research study. You also agree to the use of your responses for the previous specified uses.

You may withdraw from this study, **up to one week** after the questionnaire has been returned. To withdraw you must contact one of the researchers at the above addresses and indicate that you wish to have your responses removed from the study.

Additional Contacts: If you have any complaints or concerns about this research that you feel you cannot discuss with the researchers you may contact:

Georgie Jarvis
Secretary to the Human Research Ethics Board
2-14 Ag./Forestry Centre, University of Alberta,
Edmonton AB T6G 2P5
Phone: (780) 492-8126
Email: georgie.jarvis@ualberta.ca

Vanessa Law
Kaska Forest Resource Stewardship Council
Watson Lake, YK
Phone: (867) 536-2031

Drop-off Date:

Pickup Date:

A Questionnaire on Land Use Management in the Southeast Yukon

Thank you for participating in our questionnaire.

You have been selected to participate in a University of Alberta research project funded in part by Environment Canada and the Alberta Research Council. The project has the approval of the Kaska Forest Resources Stewardship Council, the Kaska Tribal Council, and the Yukon Territorial Government. The aim of this work is to understand the development opinions of Southeast Yukon residents. A summary of the information collected will be provided to planning institutions such as the Kaska Forest Resources Stewardship Council and the Kaska Tribal Council where they might consider it in their planning decisions.

Please try to answer all of the questions. Most of the questions can be answered by marking ☒ the boxes provided. Please remember that there are no right or wrong answers. Please answer the questions individually as we are interested in your opinion. If there are any questions you do not wish to answer, please skip them and move on to the next question. All information you provide is voluntary and strictly confidential. Your name will never appear with your answers or comments. Only a summary of the results will be publicized.

In completing and returning the questionnaire, you agree to participate in the research study and you agree to the use of your responses for the reasons specified in the information sheet.

We appreciate your help with this project.

Amanda Spyce
Email: aspyce@ualberta.ca
Phone: (780) 492-4225

Dr. Vic Adamowicz
vic.adamowicz@ualberta.ca
(780) 492-4603

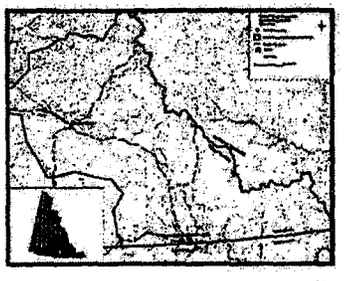
Dr. Marian Weber
weber@arc.ab.ca
(780) 450-5193

ALBERTA RESEARCH COUNCIL

Quick Facts about the Southeast Yukon

The Area:

- The Kaska Traditional Territory
- The 83 968 km^2 is largely covered by boreal forest.
- It includes the communities of Faro, Ross River, Upper Liard, Watson Lake as well as the surrounding areas.



Map from the KFRSC

Economic Land Use in the SE Yukon:

- The **public sector** (government) employs a significant share of the population.
- For several years, **forestry** and **mining** have been an important part of the economy. However, in the last few years there has been little to no activity in these two sectors.
- There is a small amount of economic activity in the areas of **trapping, tourism, construction, manufacturing, retail and services.**
- There is also a small amount of **natural gas** and **agriculture** production (such as eggs, poultry, and honey).





Part A **Your Opinion on Land Use Management in the Southeast Yukon**

In the following exercise, we would like **your opinion about land use planning** for the Southeast Yukon (Kaska Traditional Territory).

Please put an X in the box that corresponds to your opinion.

1) Over the past year, how often have you read or heard about industry land use related topics in the Southeast Yukon?

Daily	Weekly	Monthly	Once or twice	**Never**
☐	☐	☐	☐	☐

2) How much attention do you give to forest or land use issues in the Southeast Yukon?

A great deal	Some	Only a little	**None**
☐	☐	☐	☐

3) We are interested in how people feel about the land and how it should be managed.

Please rate **how strongly do you agree or disagree with each of the statements by putting an X in the box** that corresponds to your opinion.

		Strongly Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	**Strongly agree**
a)	Whether or not I get out on the land, it is important for me to know that the wilderness exists in the Southeast Yukon.	☐	☐	☐	☐	☐
b)	It is a good idea to have protected areas that will not be developed.	☐	☐	☐	☐	☐
c)	It is important to maintain the forests in a sustainable way for future generations.	☐	☐	☐	☐	☐
d)	The natural resources should be managed to meet as many human needs as possible.	☐	☐	☐	☐	☐
e)	Forests let us feel close to nature and rejuvenate the human spirit.	☐	☐	☐	☐	☐
f)	Some species are more important than others because of their cultural and economic importance.	☐	☐	☐	☐	☐
g)	Forests can be improved through management by humans.	☐	☐	☐	☐	☐
h)	The primary function of forests should be for the products and services that are useful to humans.	☐	☐	☐	☐	☐

4) There are many important issues facing Southeast Yukon residents such as yourself. To help us place these issues in perspective, please answer the following questions.

For each issue, in comparison to what is currently being done, do you think we should be doing about the same, doing less, or doing more?

Please put an X in the box that corresponds to your opinion.

		Do a lot less	Do less	Do about the same	Do more	Do a lot more
a)	Improve existing roads and highways	☐	☐	☐	☐	☐
b)	Decrease crime rates	☐	☐	☐	☐	☐
c)	Encourage economic growth and jobs	☐	☐	☐	☐	☐
d)	Improve education and training opportunities	☐	☐	☐	☐	☐
e)	Reduce taxes	☐	☐	☐	☐	☐
f)	Reduce water pollution	☐	☐	☐	☐	☐
g)	Increase the amount of protected areas	☐	☐	☐	☐	☐
h)	Increase opportunities for public involvement in resource planning	☐	☐	☐	☐	☐
i)	Step up efforts of fire suppression	☐	☐	☐	☐	☐
j)	Increase recreational activities and programs	☐	☐	☐	☐	☐
k)	Other (please specify): _____	☐	☐	☐	☐	☐

Part B — Considering the Options in the Southeast Yukon

Instructions:

In this part of the questionnaire, we would like you to imagine that you can vote on different development options for your community. The options that you will be presented with are hypothetical and are a few of the many possible future options. They are not necessarily the specific options that the KFRSC are considering.

> For each question, you will **compare** the current state of the region (Option 1) against one alternative future (Option 2). You will **choose only one option per question.** Imagine that these options represent the future state of the Southeast Yukon and its people. You will be presented with 8 sets of options. **Please consider each question separate** of the options in previous questions.

Description of the Options:

The individual **options will be described by attributes** (characteristics or qualities used to identify something). The Southeast Yukon landscape has many different attributes. Of these many attributes, only four are discussed in this questionnaire: the number of jobs, moose, fish, and people. These attributes have been identified, through public consultation, as some of most important attributes to keep track of in the present and in the future. These attributes may be described or understood in many different ways.

Please take a few minutes to **read through the attribute descriptions on the next page before starting the questions.**

Considering Possibilities:

Land use planners for the Southeast Yukon are considering several development options such as forestry, oil and gas, mining, hydro, rail, and tourism. Each of these projects will have effects on the local landscape and communities. We would like to understand how you want to see your community 100 years from today.

Making Choices:

The choices in this questionnaire are designed so that the different attributes of the landscape are represented in a realistic manner. In land use planning, not all of the valuable features can be enjoyed without limit.

In other words, as a community **we make choices based on our priorities** or the attributes that we believe have the highest value for us. As a result of this, a "trade off" occurs. For example, if people want more mining or forestry jobs they understand that less of something else might be the consequence – like less moose habitat.



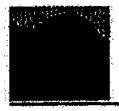
Description of Attributes

Please use the following descriptions when answering Part B of the questionnaire.

Jobs:

This attribute refers to the **percentage of local residents who have jobs** in the Southeast Yukon. The percentage is the number of local residents who have jobs out of 100 local residents. A local resident is a person who refers to a community in the Southeast Yukon as their permanent home.

Right now, it is estimated that **57% local residents have jobs**.



Moose:

This attribute refers to the **amount of moose per 1000** km^2 in the Southeast Yukon. These animals are an important cultural food resource as well as a key sport hunting species. Moose are most likely found on land that has their favourite food types which are aspen, birch and willow twigs.

Human activities can have positive or negative impacts on the moose populations in the Southeast Yukon. The size and type of impacts can be regulated by government legislation and guidelines. Fire, logging and insects can increase the amount of moose habitat. These landscape changes can be beneficial to moose as long they do not remove too much forest cover and the moose can still hide from bears, wolves and hunters. Activities such as building new roads or quad trails can also increase the number of moose that die due to predators and humans.

Right now, it is estimated that **there are 230 moose/1000** km^2 in the Southeast Yukon. In comparison, the Yukon wide average is about 150 moose/1000 km^2.

Fish:

This attribute refers to the **fish catch rate of an average angler on a typical outing** in the Southeast Yukon. Some of the species caught are whitefish, grayling, trout, pike and salmon. In the Southeast Yukon, fish are caught for household consumption as well as for sport and recreational angling.

Similar to moose, fish populations in the Southeast Yukon **may change due to habitat changes, changes in fishing pressure, or natural fluctuations.**

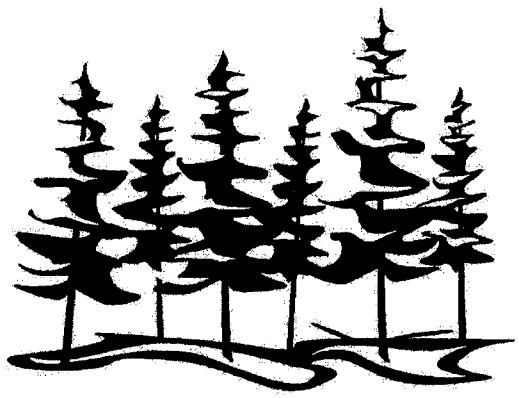
Right now, a typical catch rate is **7 fish per day** in the Southeast Yukon (includes both fish caught to eat and fish that are released).

Total Number of People

This attribute refers to the **total number of people** living in the Southeast Yukon. This includes **both the permanent and the nonpermanent residents.** An example of an nonpermanent resident might be a person who moves temporarily to the Southeast Yukon because they have been hired for the construction phase of a project.

Similar to the other attributes, the population of communities in the Southeast Yukon can increase or decrease. In the past, some projects such as a new mine, have increased the number of people living in the region. Alternatively, the ending of a project can decrease the number of people in the Southeast Yukon.

Right now it is estimated that the population of the Southeast Yukon is **2 450 people**.



Instructions for Choice Questions

Imagine the following choices are **different "futures".**

Suppose that a **regional referendum** on land use planning was being held today, which option would you favour for the Southeast Yukon?

Read the options and then **vote by checking the box** below your choice. You can **only choose one** possible future.

Please consider **each question separate** of the previous questions.

Feel free to ask questions or to check the attribute definitions on the previous page.

EXAMPLE: Here is an example of how to answer the questions in this section. Suppose Options 1 and 2 are the only available paths for the Southeast Yukon. For each option consider what is happening with the percentage of local residents who have jobs, the number of moose, the fish catch rates and the number of people. If you preferred Option 1, you would check the box for Option 1 as shown below:

Descriptions of Option 1 & Option 2:

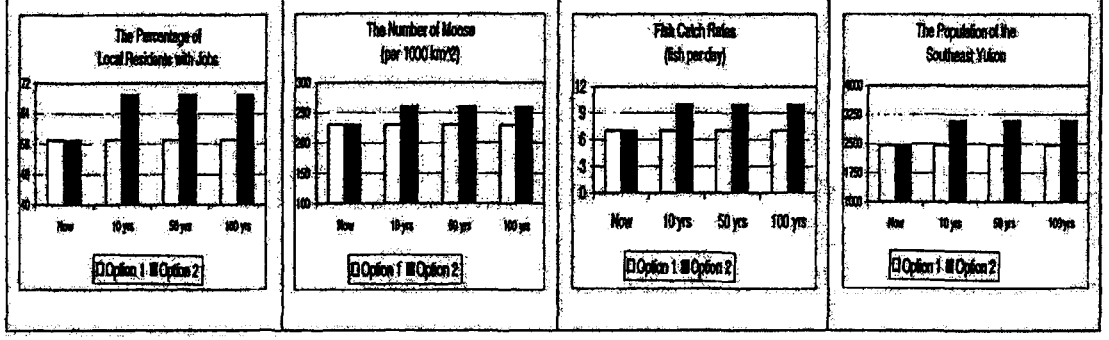
Notice the difference between Option 1 & Option 2 for each characteristic

	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	57	69	69	69

	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	260	260	260

	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	10	10	10

	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	3090	3090	3090



Vote for one path:

I would vote for OPTION 1. ← Make your choice here

I would vote for OPTION 2.

Now please answer ALL questions from Part B.

Feel free to ask questions or to check the attribute definitions.

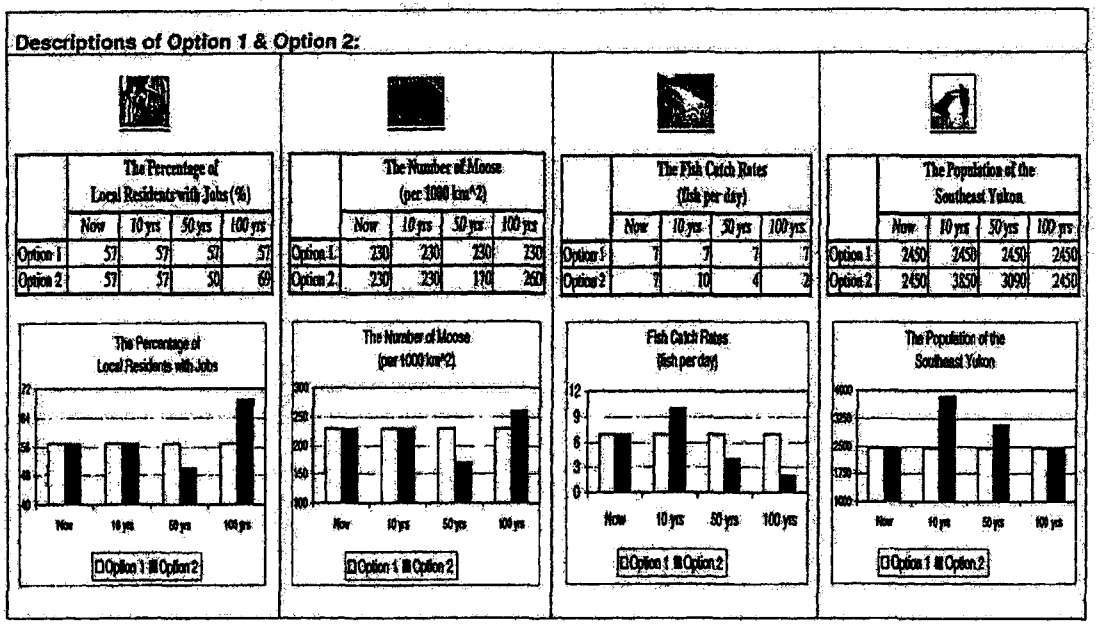
Tip:

✓ You will notice that Option 1 remains the same for all the questions.

Question 1: Suppose Option 1 and Option 2 are the **ONLY futures available**, which would you vote for?

Read the options and their attributes. *Please assume these two options differ only on the features shown.* Then vote by checking box at the bottom that corresponds to your choice.

Descriptions of Option 1 & Option 2:



	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	57	57	50	69

	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	230	190	260

	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	10	4	2

	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	3850	3090	2450

Vote for one path:

- I would vote for OPTION 1.
- I would vote for OPTION 2.

How confident are you in your vote? (Circle the number)

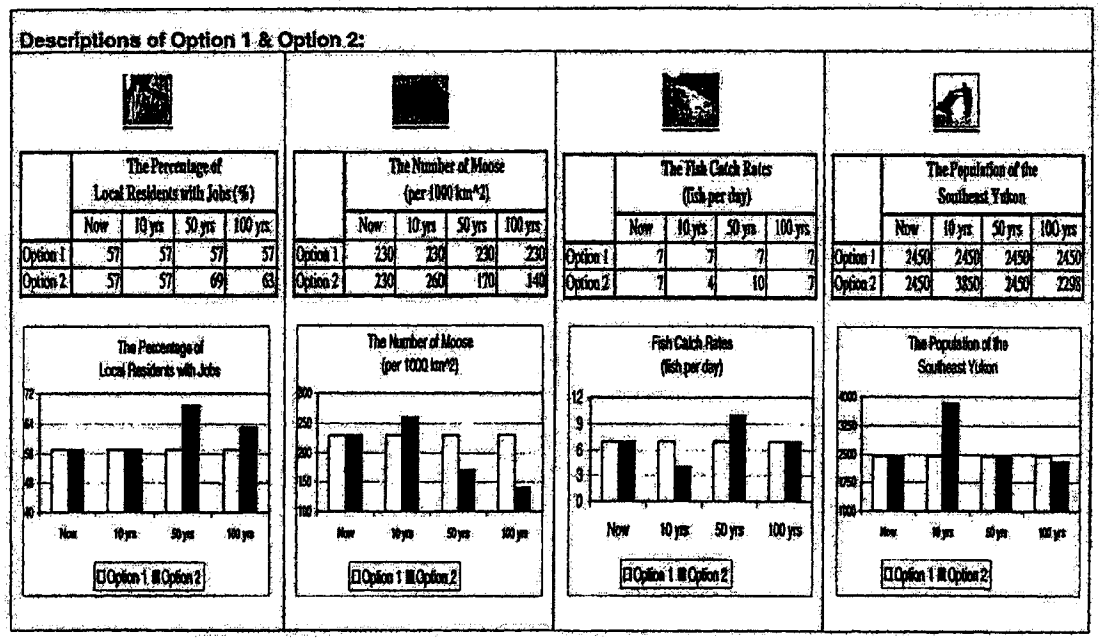
1 2 3 4 5

Confident Neutral Unsure

Question 2: Suppose Option 1 and Option 2 are the **ONLY futures available**, which would you vote for?

Read the options and their attributes. ***Please assume these two options differ only on the features shown.*** Then vote by checking box at the bottom that corresponds to your choice.

Descriptions of Option 1 & Option 2:



	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	57	57	69	63

	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	260	170	140

	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	4	10	7

	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	3350	2450	2298

Vote for one path:

- I would vote for OPTION 1.
- I would vote for OPTION 2.

How confident are you in your vote? (Circle the number)

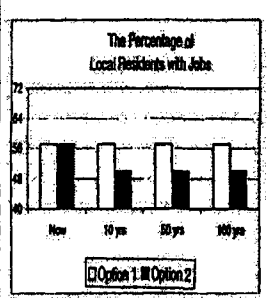
Confident Neutral Unsure

Question 3: Suppose Option 1 and Option 2 are the **ONLY futures available**, which would you vote for?

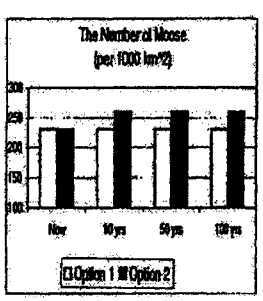
Read the options and their attributes. *Please assume these two options differ only on the features shown.* Then vote by checking box at the bottom that corresponds to your choice.

Descriptions of Option 1 & Option 2:

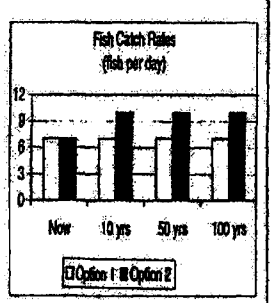
	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	57	50	50	50



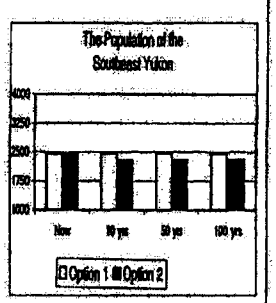
	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	260	260	260



	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	10	10	10



	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	2298	2298	2298



Vote for one path:

I would vote for OPTION 1.

I would vote for OPTION 2.

How confident are you in your vote? (Circle the number)

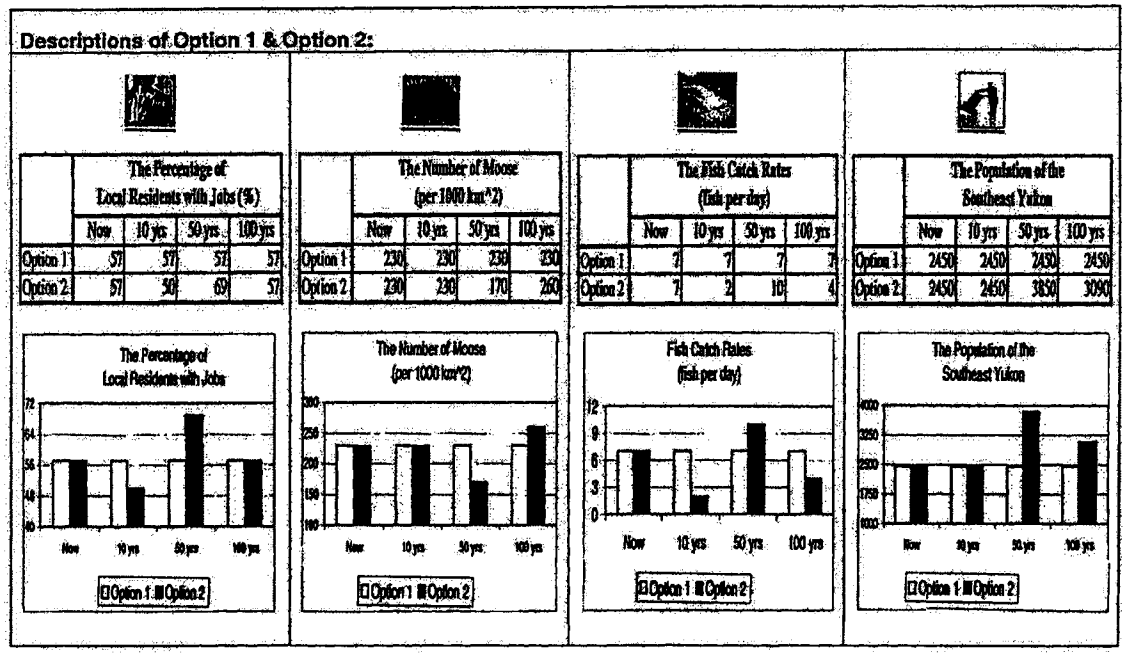
1_____2_____3_____4_____5

Confident Neutral Unsure

Question 4: Suppose Option 1 and Option 2 are the ONLY futures available, which would you vote for?

Read the options and their attributes. *Please assume these two options differ only on the features shown.* Then vote by checking box at the bottom that corresponds to your choice.

Descriptions of Option 1 & Option 2:



	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	57	50	69	57

	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	230	170	260

	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	2	10	4

	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	2450	3850	3090

Vote for one path:

- I would vote for OPTION 1.
- I would vote for OPTION 2.

How confident are you in your vote? (Circle the number)

1 2 3 4 5

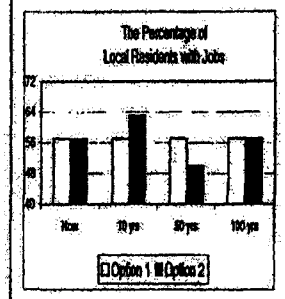
Confident Neutral Unsure

Question 5: Suppose Option 1 and Option 2 are the **ONLY futures available**, which would you vote for?

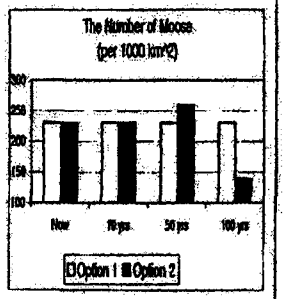
Read the options and their attributes. *Please assume these two options differ only on the features shown.* Then **vote by checking box at the bottom that corresponds to your choice.**

Descriptions of Option 1 & Option 2:

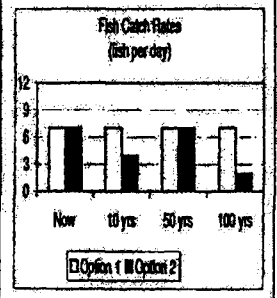
	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	57	63	50	57



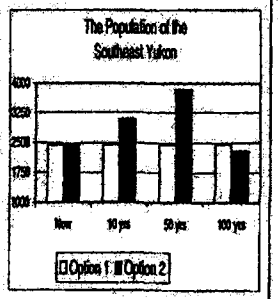
	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	230	260	140



	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	4	7	2



	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	3090	3850	2298



Vote for one path:

I would vote for OPTION 1.

I would vote for OPTION 2.

How confident are you in your vote? (Circle the number)

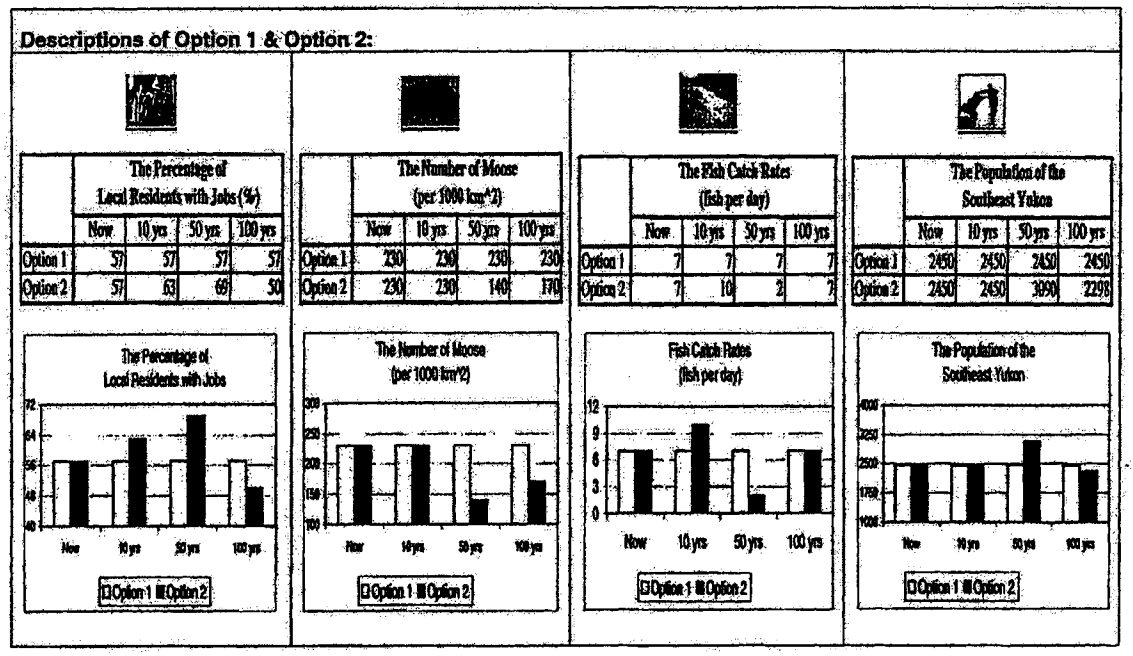
1 2 3 4 5

Confident Neutral Unsure

Question 6: Suppose Option 1 and Option 2 are the **ONLY futures available**, which would you vote for?

Read the options and their attributes. *Please assume these two options differ only on the features shown.* Then vote by checking box at the bottom that corresponds to your choice.

Descriptions of Option 1 & Option 2:



	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	57	63	69	50

	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	230	140	190

	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	10	2	7

	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	2450	3090	2298

Vote for one path:

- I would vote for OPTION 1.
- I would vote for OPTION 2.

How confident are you in your vote? (Circle the number)

1 2 3 4 5

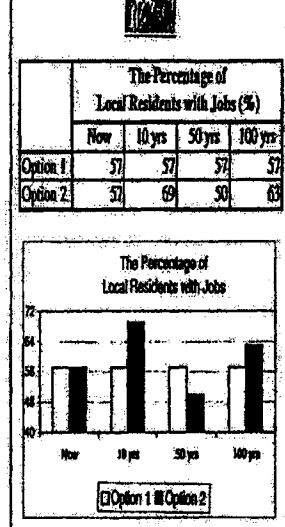
Confident Neutral Unsure

Question 7: Suppose Option 1 and Option 2 are the **ONLY futures available**, which would you vote for?

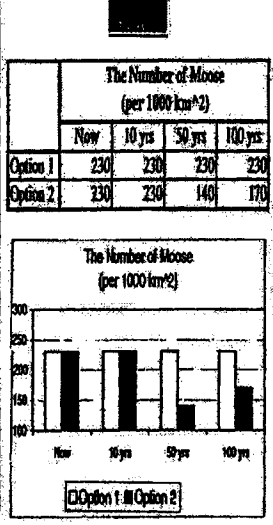
Read the options and their attributes. *Please assume these two options differ only on the features shown.* Then vote by checking box at the bottom that corresponds to your choice.

Descriptions of Option 1 & Option 2:

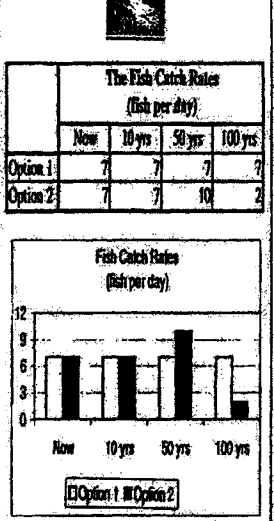
	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	52	69	50	63



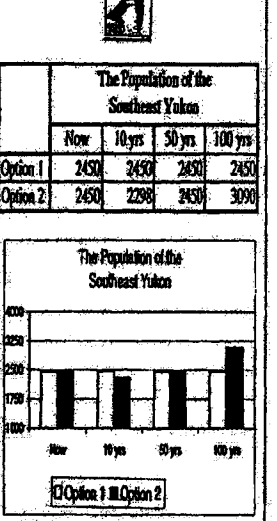
	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	230	140	170



	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	7	10	2



	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	2298	2450	3090

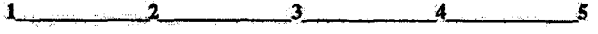


Vote for one path:

☐ **I would vote for OPTION 1.**

☐ **I would vote for OPTION 2.**

How confident are you in your vote? (Circle the number)

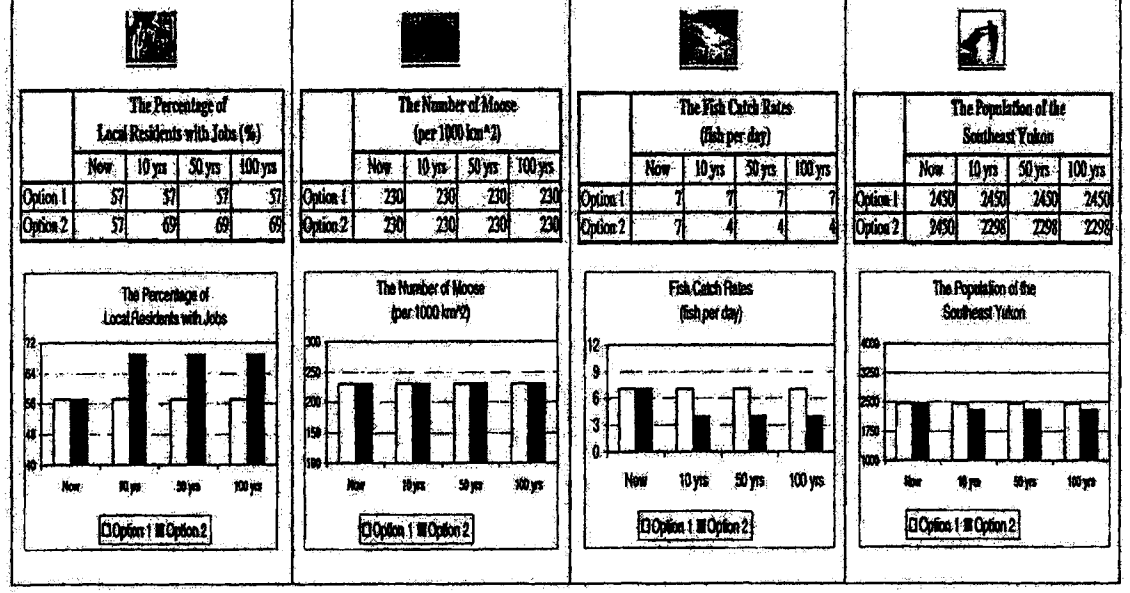


Confident Neutral Unsure

Question 8: Suppose Option 1 and Option 2 are the **ONLY futures available**, which would you vote for?

Read the options and their attributes. *Please assume these two options differ only on the features shown.* Then vote by checking box at the bottom that corresponds to your choice.

Descriptions of Option 1 & Option 2:



	The Percentage of Local Residents with Jobs (%)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	57	57	57	57
Option 2	57	69	69	69

	The Number of Moose (per 1000 km^2)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	230	230	230	230
Option 2	230	230	230	230

	The Fish Catch Rates (fish per day)			
	Now	10 yrs	50 yrs	100 yrs
Option 1	7	7	7	7
Option 2	7	4	4	4

	The Population of the Southeast Yukon			
	Now	10 yrs	50 yrs	100 yrs
Option 1	2450	2450	2450	2450
Option 2	2450	2298	2298	2298

Vote for one path:

I would vote for OPTION 1.

I would vote for OPTION 2.

How confident are you in your vote? (Circle the number)

1 2 3 4 5

Confident Neutral Unsure

Do you think that the options presented are realistic? (Circle the number)

1_____2_____3_____4_____5

Very realistic Neutral **Very unrealistic**

Comment(s):_____

_____

_____

Question 10

Thinking about the information provided earlier, please indicate **how strongly you agree or disagree** with EACH of the following statements **by putting an X in the box** that corresponds to your opinion.

		Strongly Agree	Agree	Disagree	Strongly Disagree	I am not sure
a)	I understood the information in the questionnaire	☐	☐	☐	☐	☐
b)	I understood what was being asked of me	☐	☐	☐	☐	☐
c)	My participation in this survey is important	☐	☐	☐	☐	☐
d)	I found part B (questions 1 to 8) confusing	☐	☐	☐	☐	☐
e)	I needed more information than was provided	☐	☐	☐	☐	☐
f)	The information provided was in favour of development	☐	☐	☐	☐	☐
g)	The information provided was in favour of conservation	☐	☐	☐	☐	☐
h)	I think that there has to be a tradeoff between jobs and some environmental quality	☐	☐	☐	☐	☐

Part C **Demographic Questions**

Information about You –These questions will help us understand if there are connections between people's backgrounds and their opinions. Your name will not be associated with your answers. If there are any question you do not feel comfortable answering please leave it blank and go on to the next question.

1. In the last year, **have you gone** (please check all that apply):

	Yes	No
Camping	☐	☐
Fishing	☐	☐
Hunting	☐	☐
Trapping	☐	☐
Hiking/ walking	☐	☐
Collected mushrooms, berries or other plants	☐	☐
Bird watching	☐	☐
Viewing wildlife	☐	☐
Horseback riding	☐	☐
Mountain biking	☐	☐
Canoeing, rafting or boating	☐	☐
Quadding, A-TVing, dirt biking	☐	☐
Snowmobiling	☐	☐
Cross country skiing or snowshoeing	☐	☐
Other: _____		

2. What is your age?

- ☐ Under 24
- ☐ 25 - 34
- ☐ 35 - 40
- ☐ 41 - 54
- ☐ 55 – 64
- ☐ 65 or over

3. What is your gender?

- ☐ Male
- ☐ Female

4. How many **adults** live in your house (over 18 years of age, **including yourself**)? _____

5. How many **children** live in your house (under 18 years of age)? _____

6. What **community** do you live in?

- ☐ Watson Lake & surrounding
- ☐ Upper Liard
- ☐ Ross River
- ☐ Faro
- ☐ Other (please specify): _____

7. How **long have you lived** in the Southeast Yukon?

- ☐ Less than a year
- ☐ 1 to 5 years
- ☐ 6 to 10 years
- ☐ 11 to 20 years
- ☐ 21 to 30 years
- ☐ 31 or more years
- ☐ Your whole life

8. What is the **highest level of education** that you have completed?

- ☐ never attended school
- ☐ completed elementary school (k-7)
- ☐ some high school (8-12)
- ☐ completed high school
- ☐ technical school or college
- ☐ some university
- ☐ undergraduate university degree
- ☐ some graduate study
- ☐ graduate university degree
- ☐ post graduate university degree

9. What is **your background**? (You may check more than one)

- ☐ Yukoner (person born in the Yukon)
- ☐ Canadian originally from another territory or province
- ☐ Canadian originally from another country (born outside of Canada)
- ☐ Kaska
- ☐ First Nations (other than Kaska)

Other (please specify): _____

10. Which of the following best **describes your occupation (job)** in the community? (You may check more than one)

- ☐ Tourism (restaurant/ guiding)
- ☐ First Nations Government
- ☐ Municipal Government
- ☐ Territorial Government
- ☐ Federal Government
- ☐ Local business owner
- ☐ Forest industry
- ☐ Mining industry
- ☐ Retail and Sales Industry
- ☐ Public service provider (education, health care professional, etc.)
- ☐ Trapper or hunter
- ☐ Member of an environmental group
- ☐ Stay at home parent
- ☐ Student
- ☐ Retired
- ☐ Unemployed
- ☐ Looking for work

Other (please specify): _____

11. What **factors might encourage you to move out of** the Southeast Yukon?

- ☐ The prospect of a higher paying job
- ☐ Being able to sell your home or business
- ☐ I would not leave
- ☐ Other (please specify): _____

12. What category best describes your **total household income** (before taxes) for 2004?

- ☐ less than $10 000
- ☐ $10 000 to $19 999
- ☐ $20 000 to $29 999
- ☐ $30 000 to $39 999
- ☐ $40 000 to $49 999
- ☐ $50 000 to $59 999
- ☐ $60 000 to $69 999
- ☐ $70 000 to $79 999
- ☐ $80 000 to $89 999
- ☐ $90 000 to $99 999
- ☐ $100 000 or more

If you would like to make any other comments about this issue, or about this questionnaire, please make them in the space provided below.

Thank you very much for completing the questionnaire.

We hope that you enjoyed taking part.

Please feel free to contact Amanda, Vic or Marian if you have any further comments or concerns.

A summary report should be available by April 2006.

APPENDIX C: Participant Contact Procedure for Survey

Setting up Appointments for Questionnaire Drop off

Script:

Hello my name is ____ and I am calling from the KFRSC office in Watson Lake. I am calling because you have been selected to participate in a University of Alberta project. The project has the approval of the KFRSC, the Kaska Tribal Council and the Yukon Territorial Government.

We are interested in your opinion on land use planning and related issues in your community. We would like your help by filling out a questionnaire. It should take between 15 to 30 minutes to complete, and we drop it off at your home and then pick it up the next day. All information you provide is voluntary and strictly confidential. Your name will never appear with your answers or comments.

A summary of the information collected will be provided to planning institutions such as the KFRSC, and the Kaska Tribal Council.

What time would be best for us to come by and drop off the questionnaire?
(Today, tomorrow? Morning or afternoon? Say around ___?)

Let me make sure I have your correct name and address. (Read the info we have)

Thanks very much. See you _____ at _____.
(day) (time)

Points:

- Record the participants name, address, and phone number on the sheet.
- Record ones that do not wish to participate so that we do not contact them twice.

- Try to schedule the appointments for drop off between 12:00 and 6:00.
- Try to schedule 5 drop offs per day.
- Try to schedule drop offs only within the next 2 days (ex: if today is Tuesday I could arrange a drop off Wed, or Thur).

- At the time of drop off: -try to make the pick-up date 1 or 2 days later (3 at most)

Additional Information about:

1. Questionnaire:

   Purpose: to understand the opinions of Southeast Yukon residents on land use planning & related issues in their communities.

   What will it ask? : It will ask your opinion about land use planning for the Southeast Yukon. There is also be a section that will ask you to choose between different possible "futures". Another section that asks questions about your background such as age and gender.

   Do I have to? : If there are any questions you do not wish to answer, you may skip them and move on to the next question. If you do not wish to participate you may decline or return the questionnaire in complete.

   Questions later? If you have additional questions or concerns when you are filling out the questionnaire you may contact Amanda Spyce, or Vanessa Law at the KFRSC office (536-2031)

   Translator: If you require a translator please let us know and we would be happy to provide one.

2. Use of the information:

   A **summary of the information collected will be provided to planning institutions** such as the KFRSC, and the Kaska Dene Tribal Council.

   The information generated by this project will be summarized and used to develop a computer program called **ALCES**. The program can help land use planners understand the cumulative effects and tradeoffs of land management decisions.

   An **electronic copy of the data (without the participants' names) will remain with the KFRSC** in the Southeast Yukon. The information and the computer model may be used by the KFRSC or the Kaska Tribal Council for forest resource planning.

   The results will also be **used in the thesis** of Amanda Spyce as well as related research publications and presentations. Possible publications are academic journal articles or summary reports.

   Additional use of the information collected in this study will require the prior approval of the KFRSC.

APPENDIX D: Calculated Discount Rates

Mathematical/Calculated

The discount rate was calculated for each of the 4 scenario attributes by solving for β and r from the discount utility function equation and estimated utility function equation from the basic 4 attribute linear utility function. An example of the solutions for the jobs attribute is as follows:

AttributeCoefficients:
$J10 = 0.02037$
$J50 = 0.02620$
$J100 = 0.03303$

UtilityFunction:
$0.02037(J10) + 0.02620(J50) + 0.03303(J100)$

DiscountedUFunction:
$$\beta J10(\frac{1}{(1+r)^{10}}) + \beta J50(\frac{1}{(1+r)^{50}}) + \beta J100(\frac{1}{(1+r)^{100}})$$

Steps to Calculate Discount Rate (Using the Jobs Variable as an example):

1. Set estimated coefficient (β) equal to associated section of the discounted U function:
$$0.02037 = \beta(\frac{1}{(1+r)^{10}}).$$

2. Solve for β and get $\beta = ((1+r)^{10}) * 0.02037$

3. Do the same steps for time period 50 (solving for r)
Solutions to the β equations:
$\beta = ((1+r)^{10})0.02037$
$\beta = ((1+r)^{50})0.02620$
$\beta = ((1+r)^{100})0.03303$

4. Restrict the β in the two equations to be the same. Solve for r (results for all four attributes are illustrated in the following table).

Table A: Mathematically calculated discount rates

	Discount Rates (%)	
Attribute	10 to 50 years	50 to 100 years
Jobs	0.0063	0.0046
Moose	-0.0143	0.0170
Fish	0.0143	-0.0307
Population	-0.0289	0.0362
Period Average	**-0.00565**	**0.00678**
Overall Average	**0.000563**	

The solution results imply that there are varying discount rates depending on the scenario attribute and the time period. This finding is consistent with several studies in the literature (Boardman, 2001; Laibson, 1997; Luckert and Adamowicz, 1993; Cropper et al 1992; Harvey, 1994; Weitzman, 1994).

To interpret the calculated results (Table A) recall that a positive discount rate means that future benefits or costs are worth less than benefits and cost incurred in the more recent time periods. A negative discount rate means that future benefits and cost are worth more than the benefits and cost that are incurred in the more recent time periods. The positive social discount rate for jobs means that the Southeast Yukon residents prefer to have jobs for the local residents today rather than tomorrow. The residents value moose and population more in 50 years than they do in either the near future (10 years) or the far future (100 years). However, when it comes to fish the residents value the fish in the far future (100 years) more than in the near future.

These discount rates are very close to zero but this method of solving for the discount rate does not say if the rates are statistically significantly different from zero.

APPENDIX E: Results of Threshold Regressions

Table B: Regression models testing for utility threshold effects

	Basic Linear Utility Attribute Model	**Lowest Level of Attributes**	**Below the Status Quo**	**Above Status Quo**
RsqAdj	0.04265	0.04237	0.04197	0.03876
Log Likelihood Function	-1023.977	-1016.413	-1016.835	-1020.248
	Coefficient	**Coefficient**	**Coefficient**	**Coefficient**
constant	0.0021 (0.016)	-0.1958 (-0.629)	0.0242 (0.055)	-0.2971 (0.534)
Jobs	0.0263 * (5.344)	0.0171 (2.000)	0.0192 (2.205)	0.0310 (0.005)
Moose	0.0055 * (7.698)	0.0050 (4.942)	0.0068 (2.850)	0.0060 (0.000)
Fish	0.0228 * (2.208)	0.0265 (1.650)	0.0301 (1.063)	0.0236 (0.288)
Population	0.0001 (1.058)	0.0001 (1.115)	0.0001 (1.032)	0.0002 (0.209)
(Jobs in 10 yrs =50)*		-0.1289 (-0.749)		
Jobs in 50 yrs =50		-0.3074 (-1.725)		
Jobs in 100 yrs =50		-0.2155 (-1.273)		
Moose in 10 yrs =140		-0.2212 (-1.468)		
Moose in 50 yrs =140		0.1222 (0.790)		
Moose in 100 yrs =140		-0.2993* (-2.007)		
Fish in 10 yrs =2		0.1264 (0.838)		
Fish in 50 yrs =2		0.0226 (0.146)		
Fish in 100 yrs =2		-0.1253 (-0.797)		
Population in 10 yrs =2298		0.1595 (1.144)		
Population in 50 yrs =2298		0.1184 (0.819)		
Population in 100 yrs =2298		-0.0885 (-0.624)		
Jobs in 10 yrs =50			-0.0611 (-0.343)	
Jobs in 50 yrs =50			-0.2501 (-1.393)	
Jobs in 100 yrs =50			-0.1467 (-0.845)	

(Continued)	Basic Linear Utility Attribute Model	Lowest Level of Attributes	Below the Status Quo	Above Status Quo
Moose in 10 yrs =140 or 170			0.1350 (0.550)	
Moose in 50 yrs =140 or 170			0.2984 (1.252)	
Moose in 100 yrs =140 or 170			-0.0802 (-0.327)	
Fish in 10 yrs =2 or 4			0.1755 (0.845)	
Fish in 50 yrs =2 or 4			-0.0646 (-0.313)	
Fish in 100 yrs =2 or 4			0.0321 (0.154)	
Population in 10 yrs =2298			0.1283 (0.906)	
Population in 50 yrs =2298			0.1129 (0.808)	
Population in 100 yrs =2298			-0.0857 (-0.642)	
Jobs in 10 yrs =63 or 69				-0.1973 (-1.033)
Jobs in 50 yrs =60 or 63				-0.1046 (-0.606)
Jobs in 100 yrs =60 or 63				0.0340 (0.193)
Moose in 10 yrs =230				-0.0678 (-0.435)
Moose in 50 yrs =230				-0.1861 (-1.168)
Moose in 100 yrs =230				0.0565 (0.345)
Fish in 10 yrs =10				-0.1543 (-0.840)
Fish in 50 yrs =10				0.0833 (0.455)
Fish in 100 yrs =10				0.0787 (0.437)
Population in 10 yrs =3090 or 3850				-0.2042 (-1.003)
Population in 50 yrs =3090 or 3850				-0.1752 (-0.856)
Population in 100 yrs =3090 or 3850				-0.1608 (-0.798)
Note: ** is 0.01 significance level	* is 0.05 significance level			