RURAL ECONOMY

Measuring Forest Resource Values: An Assessment of Choice Experiments and Preference Construction Methods as Public Involvement Tools

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Project Report 02-03

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Executive Summary

Human values arising from forests include market and non-market values. Timber values and values of non-timber forest products traded in markets (berries, wild rice, etc.) are considered market values. Among non-market values are recreation values and values associated with wildlife harvesting by Aboriginal People. These are considered non-market because participation in these activities does not require the purchase of market based permits; prices do not function as rationing devices in these activities. In addition to non-market values arising from activities, individuals may also have values associated with forest conditions (biodiversity, etc.). These are referred to as passive use values since the value is not associated with any specific use of the resource or activity related to the forest. Since forests in Canada are largely on public land, these passive use values are particularly relevant to Canadian forest management. These values reveal the preferences of the public for components of forest management. Eliciting these values is a form of public involvement in that the public is engaged in assessing forest management options and providing opinions and sentiments regarding these options.

Ideally, values arising from forests would be collected from a broad range of the public and examined to provide guidance to forest managers. However, values over forest outputs and conditions may be very poorly formed when people have little experience with the range and complexity of forest ecology and management. In addition, eliciting values without framing them in a trade-off setting can result in misleading estimates. In this project we attempt to elicit passive use values in a manner that allows for poorly defined initial notions of value through an approach known as preference construction. Preference construction essentially provides for education and information processing in the development of passive use values. These estimates are also developed using a trade-off approach (choice experiments). The project focuses on the values of the local public within the NorSask forest.

More formally, the objectives of this research are to: 1) ascertain the passive use values held by local people associated with forests in the NorSask Forest Management License Area; 2) explore differences in preferences based on the degree and frequency of formal preference construction exercises; and 3) evaluate this approach as a method of public involvement.

A total of 43 individuals from the local community were involved in the valuation exercise. They participated in 3 groups or treatments, each with a different level of involvement

in the valuation assessment. The first group was involved in three separate sessions, allowing for significant preference construction and information acquisition. The second group was involved in only one session and the third group was involved only minimally through a telephone contact and the completion of a survey delivered through the mail. The hypothesis being examined was that the degree of involvement in the exercise would affect the responses either in terms of the variances of the responses or the actual preferences.

Not all forest values can be examined in a single valuation task. In this case values associated with key game species (moose), wildlife species reflecting biodiversity or threatened species (caribou), old age classes of forest, protected areas and local employment were assessed. These were selected based on the preference construction sessions with the first group.
A general trend was found in the ranking of forest values. The values were highest for increases in older forest age classes and protected areas and lower for caribou and moose levels (expressed in percentage changes relative to current levels). The lowest value arose from the local jobs generated by forestry activity. Monetary measures of these values were also developed. The scenario choices made by the individuals revealed that a 5% increase in moose and caribou populations would be worth approximately $10 and $12 per year. A 5% increases in old age classes or protected areas was worth approximately 4 to 5 times as much. They were willing to pay approximately $7 per year in increased taxes for increases in local employment.

The hypothesis that the group preferences would differ was not accepted. The preferences of the first and third groups, while expected to be very different, were in fact quite similar. The second group did appear to be different from these other two but it is possible that significant variation in demographic characteristics was driving that difference, rather than the level of preference construction effort. The sample in the third group did however exhibit more resistance to completing the exercise and registered more protests to the value assessment.

In conclusion, the approach employed was successful in eliciting passive use values for components of forest management. These values alone provide interesting information for managers to consider in the development of management plans. Evidence supporting the hypothesis that preference construction approaches improve these valuation exercises was not found in this study although this result must be tempered by the limitations arising from sample size and demographic composition of the study groups.

Introduction

About 94% of forestland in Canada is public land (National Forest Strategy 1998), and therefore public input into resource management is beneficial and necessary (CSA 1996; FSC 1996; ISO 14001 1996). In an attempt to address public concern, policymakers have used a number of social and scientific research agendas to move towards sustainable development. However, more efficient and sophisticated management of the landbase is required in order to pursue sustainability, meet multiple objectives, and increase well being of a diverse public.

Economic consideration of natural resource allocation involves determination of how choices are made while facing scarcity and uncertainty. The objective is to maximize the well being of society through an optimal allocation of resources. However, in order to arrive at a social optimum, *all of society's values* derived from Crown forestlands must be known in order to manage them in the public interest. In making policy decisions about resource allocation to maximize welfare, it is important to understand the role of preferences and values, and the benefits and costs to landscape planning alternatives. Economic theory assumes that preferences are well defined and stable. These assumptions are a necessary prerequisite to measurement and maximization of social welfare (Freeman 1993). Some of these values, for example for tangible goods and services, are relatively easily discernable as they move through an economic market and are exchanged via prices which are determined through the principles of supply and demand. Conversely, many other values are not expressed in a market and do not have associated market prices. Hence, these values are called non-market values.

Prices in economic theory represent the marginal value one holds for a good or service, and the aggregation of individuals' willingness to pay constitutes the economic value of that good or service to society. Since non-market goods and services do not have prices they have traditionally been undervalued or ignored (McFarlane and Boxall 1998). Recent economic treatment of such values begins with efforts to achieve a common metric (e.g. dollars). Economic theory has progressed and gained credence to the point where these types of values may be delineated, conceptualized, and estimated through the aid of hypothetical markets. Thus the economic values of non-market goods and services may then be commensurate with other private market goods (e.g. wood products) or competing claims that aid the resource allocation process.

The non-market values of interest in this project involve concern for the conservation of the environment, specifically the boreal forest in northwestern Saskatchewan. In order to estimate these environmental non-market values a hypothetical market must be established which presents a realistic milieu for making choices (Freeman 1993). One category of environmental non-market values is known as passive-use (or non-use) values. In economic terms, passive-use values are the monetary values that individuals hold for resources that are independent of their present use of those resources (Freeman 1993). In contrast to private or marketed goods and services, people often have passive use values for environmental public goods (e.g. large forested areas) that are nebulous, complex, and ill considered.

The average person is typically unfamiliar with their passive use values for environmental goods and services. An extension of this idea reaches into the realm of individual values for environmental qualities and quantities (Bowles 1998). This difficulty with environmental passive use values provides difficulty for researchers interested in observing the expression of these economic values in a hypothetical market. Two difficulties arise. First, are the preferences present or "ripe" to be elicited? Second, what is the best way to elicit these preferences from individuals if and when they are present? Attempting to elicit complex passive use values from citizens often results in unstable preferences (Mitchell and Carson 1989; Schkade and Payne 1993). If the elicitation of erroneous responses from individuals occurs (due to unstable or volatile preferences), then the estimation of individual values will be flawed or biased, and related policy prescriptions misguided.

In order to overcome this barrier a process for consideration of these unformed passive use values may greatly benefit their formation, elicitation, and eventual estimation. The process whereby values are formed through a concerted effort such as group discussion, information provisions, and enough time to cogitate is known as *preference construction* (Gregory 2000). Thus, a hypothesis maintained throughout this research project was that a preference construction exercise conducted prior to the administration of a survey designed to elicit such preferences should exhibit an improved method of preference elicitation.

This research allows the impacts of changes in the environmental attributes to be translated into economic values and the benefits to society derived from different forest management scenarios. This information may ultimately be used to assist forest managers in managing publicly owned forests to maximize social values while maintaining the ecological

integrity of the landbase. In order to manage and allocate land to the myriad of competing interests, a fairly comprehensive set of values for the whole suite of activities and interests must be ascertained. Many people value the existence of a standing forest for such qualities as ecosystem services, wildlife habitat, and biodiversity, which are examples of *passive-use non-timber values.* This research is applied to issues in the NorSask Forest in northwestern Saskatchewan in an attempt to construct and elicit well-formed and stable preferences for these values from local citizens in a public involvement process.

Eliciting public preferences via a hypothetical market relies on public involvement. Public involvement is any means by which the public is involved in a decision (CSA 1996). One may envisage public involvement as a continuum of involvement based on the intensity, degree of contact, and information exchanged between two or more parties (e.g. the public and a forest management agency). This research examines a technique for eliciting more stable and well-defined preferences for passive use values through an iterative construction exercise involving the public. The objectives of this research are to: 1) ascertain the passive use values held by local people associated with forests in the NorSask Forest Management License Area; 2) explore differences in preferences based on the degree and frequency of formal preference construction exercises preceding the administration of the survey exercise; and 3) evaluate different methods of public involvement.

In this study, preference construction is examined using split sample techniques. Three separate groups were established and invited to take part in different aspects of preference formation exercises before completing a survey. The specific hypothesis tested here is that there is a positive relationship between the stability of preferences and the intensity and comprehensiveness of preference construction exercises held prior to preference elicitation. In light of these considerations a superior technique of public involvement and preference formation may be available through the deliberative process coupled with a survey. Further, those individuals not participating in pre-elicitation preference formation exercises are more likely to manifest survey protest[1] or increased variability in their responses.

[1] Many different forms of survey protest are possible, for example failing to complete the survey or choosing specific answers to difficult questions that provide an "easy way out."

Theory of Preference Construction

Informing public policy through the use of discursive and deliberative approaches in the formation of public values is growing (Fishkin 1995). Common techniques include public meetings, focus groups, and workshops. In these sessions the focus involves group learning, discourse, and consensus building. This approach to gathering information from citizens highlights a synthesis of economic theory with political science theory in that deliberation and consensus formation are distinct from the aggregation of individual values in the evaluation of public goods in policy. Ultimately, when these approaches are applied to direct economic valuation, the groups of people involved in the exercise are provided with "adequate and appropriate information." Then they are encouraged to engage in discussion and deliberation to determine their economic values for particular public policy choices.

The precise method(s) required for fostering the development and identification of citizen preferences are generally unknown. However, different criteria for judging the success of these processes are emerging. Such criteria reflect an important distinction that researchers and policy analysts must understand. This distinction is between *consumer preferences*, which reflect conceptions of the good life individuals seek for themselves, and *citizen preferences*, which reflect conceptions of the good society offered for the consideration and agreement of others (Sagoff 1998). Individual views may be expressed and are encouraged in preference construction exercises, but should be couched in terms of what 'society should do' and evaluated on merit rather than rent-seeking or lobbyist behavior which are more subject to power and personal stature. The debate should ideally proceed without reference to personal well-being.

The hypothesized advantages of preference construction approaches are numerous. First, they offer opportunities for social learning on the part of participants. The exercise allows them to participate in a social process, gain empowerment, and construct a collective judgement as citizens about the value of a public environmental good. Second, deliberative approaches allows participants to clarify among themselves explicitly what they may be valuing and why. This could serve to avoid the ambiguity commonly thought to occur in some economic survey questions (e.g. contingent valuation). Third, such exercises can provide access to relevant and timely information on complex subjects (such as passive use values associated with boreal forests). This may serve to reduce the frequency of protest responses in economic surveys of passive use values and tend to avoid the missing values. Fourth, the process can be developed to

seek responses from participants to parts of a problem to reduce the risk of cognitive overload. Fifth, the preference construction approach can include exercises to develop metrics to assess trade-offs among competing policies. This can serve to avoid protests since the participants themselves have constructed the means by which to compare various policy scenarios. Finally, the process can assist participants in combining various costs and benefits into a single package for overall assessment and evaluation.

A Model of Preference Construction

If preferences are constructed, it is expected that preferences are highly sensitive to features of the task and context that influence the process of construction. For example, preference formation for non-market goods may be endogenous to the survey, or in other words, the results from a survey intended to collect values are the result of the survey exercise and may not really exist. (Schkade and Payne 1993; Hanemann 1994). One relatively new technique that can be used to reduce the chance for this problem to occur is a multi-attribute approach. The multi-attribute approach is aimed at eliciting thoughtful, informed judgements from a small number of key participants[2] (or stakeholders) who are gathered to discuss an issue in depth via an intensive workshop or a 'public value forum' (Keeney et al. 1990). It relies on the *depth* of respondents' understanding to replace the *breadth* of representative population sampling. The individuals involved are from specific groups important to the decision-maker. The object of the exercise is to gain insight into their views regarding the relevant policy objectives and trade-offs (McDaniels and Roessler 1998).

Ideally, the group does not negotiate, but rather the discussion provides a forum for participants to learn from discourse, reflecting iteration and different framings of some complex questions in order to make more informed value judgements about the uncertainties and explicit trade-offs. The workshop process initially begins with the provision of information on the problem at hand. The amount and type of information is known to affect judgements (Fischhoff et al. 1980).[3] The group should be probed to ask questions and air their views so that learning

[2] Numbers may range from around 20 to 50 or more depending on time, budget constraints, importance and complexity of issue. The proper identification of stakeholders is imperative to the valuation process and omissions will result in an incomplete range of values.

[3] This is a difficult area to determine what information is relevant and credible and aiding in the process versus irrelevant and potentially inflammatory. GIS information may useful in passive-use values in describing an area.

and discourse is promoted. Questions should be rephrased with comparisons and consistency checks in order to refine thinking on the topic (McDaniels and Roessler 1998).

A series of five steps can be used to operationalize the method and guide participants through the valuation process. First, is the process of structuring the problem – i.e., why the problem is relevant to the participants? This stage of problem representation relies on mental models, analogy, and the decision frame. Thus, failures may occur due to inappropriate analogies, embedding effects depending on how a question or issue is framed.

Second, the process requires measuring the objectives using attributes and levels that stakeholders can understand and relate to. The selection of attributes and their levels involves the use of information that comes from personal and group memory, as well as external sources. The processing limitations of humans mandate the choice of few rather than many attributes. Furthermore, information is often encoded to some reference value (i.e. this is the current level of an attribute). This phase confronts problems of context effects and arbitrary reference points.

Third, information combination refers to the required tradeoffs to consider (make trade-offs across objectives). Pitfalls to preference construction may occur due to avoiding tradeoffs, or range and quantity insensitivity.

Fourth, in the exercise the researchers must present and compare policy alternatives, and relate these to the expression of preferences (the mapping from value to response). Individuals lacking relevant preference maps may construct them on the spot (Fischhoff and Furby 1988). Even if established values exist, or if they do not transfer well from memory to the response scale, errors may occur due to incompatibility.

Finally, in the process one must assess sensitivities and in some instances search for group consensus (Payne et al. 1997; Gregory et al. 1995). Consensus was not sought in this research, as individual utility remained central to survey completion.

The Model Applied to the NorSask Forest

In this study a discursive, information-rich, and deliberative process was employed to enable respondents to construct well-informed and considered preferences regarding forest passive use values. The participants were instructed to consider issues relating to forest landscape changes assessed through variations in five forest environmental attributes. The participants were required to regard the implications in changes of these attributes for present

and future generations. In general, circumstances that promoted stable preferences and values are more likely to occur when the issues considered are familiar, simple, and in some instances been directly experienced. Thus, beyond familiar experiences, individuals were given the opportunity to think and reflect in an informed and more critical way on their "pre-existing preferences." This framework was adapted and employed to the study area in a quest to understand the passive-use values and issues in the NorSask Forest region.

To fully understand preferences among the five attributes, multi-attribute elicitation methods in a group setting were used. The advantages of this multi-attribute approach are:

1) It may reduce the cognitive burden on participants by breaking down the process into stages.
2) It may provide informational benefits by allowing subjects to ask questions, interact with the elicitor, and hear the comments and views of others. This serves to augment limited individual experiences with the collective wisdom of their social group (Conlisk, 1996).
3) The procedure maintains a degree of legitimacy that comes from asking questions that directly reflect the actual policy trade-offs. For example, increased passive-use-values in lieu of forestry jobs and revenues. This approach differs from the gathering of individual values through estimating respondent's willingness to pay, which is typically used in contingent valuation surveys. Many respondents may view the elicitation of willingness to pay as irrelevant or inappropriate for many environmental goods.
4) The multi-attribute method may generate lower rates of refusal or 'protest' values than the contingent valuation approach. In addition, lower research costs may be experienced since high quality data is collected from fewer individuals (McDaniels and Roessler, 1998).

The town of Meadow Lake in the province of Saskatchewan is the epicenter for forestry operations (timber management and location of both the sawmill and pulp mill) in the NorSask Forest Management License Agreement (FMLA). The NorSask Forest is entirely on Crown land as are most of the resource extraction industries in the province. The ownership of the Saskatchewan forest (and most natural resources in the province) is 97% Provincial Crown Land

and 2% Federal Crown Land (Saskatchewan Forest Facts 1998).[4] Thus, the public interest in the management of these resources seems clear. Denial of this reality may result in conflict, as was the case in the expansion of the Saskatchewan forest industry in 1992 when environmental and aboriginal groups established a blockade on a major access highway north of Meadow Lake (Beckley and Korber 1996). Accordingly, this research centres on the NorSask forest and the town of Meadow Lake.

The demographic composition of NW Saskatchewan varies from the more southern part (i.e. Meadow Lake) of the region to the more northern. In general, the demographic characteristics of the population of Meadow Lake are similar to the provincial averages, while the population resident in the northern part of the FMLA is very different. A comparison of the population of four different communities (Meadow Lake, Green Lake, Beauval, and La Loche) with that of Meadow Lake demonstrates that the northern populations have more aboriginal peoples, a higher rate of population growth, a younger population, less education, higher unemployment and lower income compared to the rest of the province (see Appendix). This age-class structure and impending population momentum has present and future policy implication for the province.

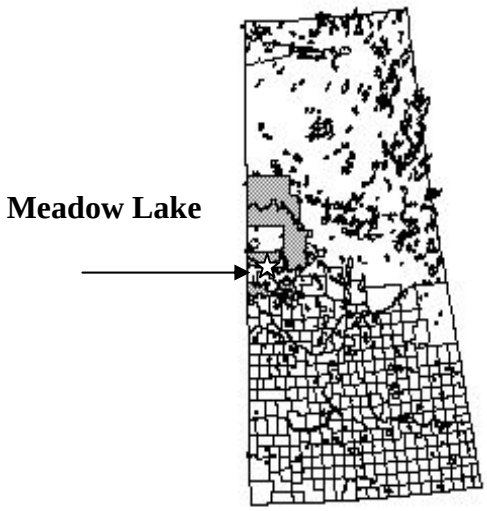
Mistik Management, located in Meadow Lake, is a not-for-profit company that was formed in 1990 and is responsible for planning, harvesting, and reforesting the NorSask FMLA. The two parent companies are NorSask Forest Products Inc. (owners of the Sawmill which requires softwood – mostly spruce and pine) and Millar Western Pulp Ltd. (owners of the pulp mill which requires hardwood – Aspen) (Beckley and Korber 1996). Mistik Management's objective is to manage the forests to meet the timber demands of both Meadow Lake mills. This objective is interesting because the tenure area must be managed for two separate mills with different fiber demands. In other parts of Canada similar fiber demands have led to overlapping tenures with separate companies harvesting softwood and hardwood in an uncoordinated manner. This generally results in conflict between competing timber resource users and greater fiber wastage due to separate companies with different incentives and interests working simultaneously on the landbase (Cumming and Armstrong, 1999).

The Saskatchewan government stipulated in the agreement that both fiber and non-fiber values must be considered in the FMLA. Thus, in order to manage the FMLA in a manner

[4] The other 1% is private forest land.

consistent with ecosystem management and sustainability principles, the extant non-fiber values must be known and regularly re-estimated. The research described in this report is a first step towards this goal.

Figure 1. The NorSask Forest (shaded area) and the Town of Meadow Lake in Saskatchewan



Methods

Development of the Choice Experiment and its Administration

The study involved two main components: 1) the development and application of a multi-attribute choice experiment designed to elicit preferences for passive use values associated with the boreal forest; and 2) the administration of the choice experiment to subjects in different settings which varied by the degree of deliberation and discussion preceding the completion of the experiment. The hypothesis examined through this approach is that different degrees of deliberation proceeding completing the choice task could lead to different rankings of specific forest management scenarios. Further, it was predicted that the variation in preference rankings (or the "noise" inherent in the resulting economic values) would increase inversely with the levels of cogitation.

To examine these ideas three separate groups of individuals residing in the local area were formed. Two of these groups involved a focus group or workshop with the researchers. The size of these groups was typical of focus group ranging between twelve and twenty people. The third group was somewhat larger (initially forty individuals) and did not meet with the

researchers, but was contacted by mail. Each group had a different experience and involvement with the researchers and the choice experiment instrument (or survey), different exposure to information on forest management, and access to the researchers before completing the choice experiment. Table 1 provides a summary of the differences in the conduct and experiences of participants in each of the three groups.

Table 1. The Level of Involvement and Information Provision for Each of the Three Groups

Group Number	**GP1**	**GP2**	**GP3**
Completion of the attitude and belief survey	Yes	Yes	Abridged version
Complete Forestry Familiarity Assessment (True/False)	Yes	Yes	No
Number of Group Meetings (PIWs attended)	3	1	None
Phone contact with researchers in between meetings	Yes	Yes, follow up call post meeting	N/A
Group discussion preceding administration of the choice experiment	Yes	Yes – limited	No
Reading material provided by researchers	Yes	No	No
Participants provided with an opportunity to ask relevant questions	Yes – direct and submitted	Yes – limited to direct questions	No
Explanation of choice experiments – how they are developed, used, and the results available	Yes – on *two* separate occasions	Yes – on a *single* occasion	No
Survey completion method	Central Location	Central Location	Mail out

GP1 – public involvement group 1; 3 sessions, significant involvement in the development of the choice experiment instrument.
GP2 – public involvement group 2: 1 sessions, no involvement in development of the survey instrument but participation in discussion and learning about forest management.
GP3 – public involvement 3: telephone contact and mail distribution of the survey.

Group 1 (GP1) participated in three separate workshops (called Public Involvement Workshops [PIWs]) held at approximately one month intervals. These participants were allowed to submit questions to the researchers that required the latter to contact the forest managers at Mistik Management for answers.[5] This group was also involved in actually designing the choice

[5] Questions entertained and answered had to do with any aspect of forestry in northwestern Saskatchewan including Mistik Management's operations, our research techniques and the development of the survey.

experiment instrument with the researchers. Group 2 (GP2) participated in a single PIW, and after discussing forest management issues and raising questions with the researchers that had to be answered "on the spot", completed the choice experiment instrument. The final group, Group 3 (GP3), received the choice experiment instrument through the mail and did not have the benefit of meeting with the researchers to discuss forest management issues.

Two survey instruments were used to gather information from the participants in all three PIW groups. The first instrument was a attitude and beliefs survey aimed at gathering general information on attitudes, beliefs, and knowledge of forests and forestry using rating (or Likert) scales, ranking tasks, and open-ended questions. All participants in the three groups completed this survey. Completing this survey served as a warm-up exercise that established a baseline for some feelings or sentiments toward the forest. The final section of this survey solicited socio-demographic information from participants and provided an invitation to attach comments on forests and the public involvement exercise they participated in.

The second survey was a choice experiment (CE) which challenged the respondents to value and trade-off different attributes related to forest management scenarios. Every participant in each group was required to complete this survey as well. The discussion among participants and researchers in GP1 and GP2 allowed for a very open process flexible enough to absorb as many opinions and ideas as possible. For example, among participants in GP1 there was considerable discussion surrounding the selection of attributes that relate to the desires of individuals regarding forest management, as well as the selection of levels in those attributes. The final attributes and levels used in the CE (Table 2) were also used in the CE for GP2 and GP3.

Table 3 summarizes various characteristics of the participants in each of the three groups and related characteristics for the Saskatchewan provincial population. The participants in the PIW were on average, older in age, contain fewer women, have a higher education level and have a higher household income than the provincial average. McFarlane and Boxall (2000) found a similar pattern for public advisory groups constructed by forest companies in Alberta. It is noteworthy that the group characteristics in this present study are similar with respect to their median age. However, there were fewer women in GP3, lower income levels among participants in GP2, and more individuals in GP2 whose livelihood depended on the resource extraction industries in the area.

Table 2. The Attributes and Levels Used in the Choice Experiment for the Three Groups

Attribute	**Level**[1]
Moose population	2,000; 6,000; **7500;** 14,000
Woodland Caribou population	50; **300 to 500;** 600; 1,600
Forest Age (% Old growth)	Less than Current Amount; **Current Amount**; More than; Considerably more than
Recreation Restrictions & Forest Access	**Two-wheel drive (2WD) access;** 4WD required; ATV required; Foot Access only
Amount of Protected Areas	**Current Amount**; 5 %; 10 %; and 15 % Above Current Amount
Forestry Employment	Jobs ranged between 270 and 860 **(Current = 600)**
Provincial Household Income Tax Changes	**(Current = No Change)** Taxes ranged between a decrease of 120$ to an increase of 205$ year

[1] The bold text refers to the current level of this attribute in the NorSask forest.

Table 3. The Characteristics of Participants in the Three Groups

Characteristic	**Sask.**	**GP1**	**GP2**	**GP3**
Number of participants	NA	13	11	19
Mean age (SD)	35.7	45.2 (16.9)	46.9(12.2)	48.8 (11.0)
Median age		43	44	51
Number of women	50.6 %	4 (31%)	5 (45%)	4 (21%)
Number of men	49.4 %	9 (69%)	6 (55%)	15 (79%)
Median education* (SD)	4	5 (2)	6 (2.25)	5 (1.83)
Median household income (SD)	22,541	65,000 (35,000)	40,000 (18,700)	70,000 (32,000)
No. of participants dependent on energy industry, forestry, mining, etc.	NA	6 (46%)	8 (72%)	6 (32%)
No. of participants members of natural history organizations	NA	1 (8%)	2 (18%)	2 (11%)
No. of participants members of hunting/fishing organizations	NA	7 (54%)	5 (45%)	11 (58%)
No. of participants members of environmental or conservation organizations	NA	5 (38%)	5 (45%)	8 (42%)

Education was recorded by a category of increasing levels. See appendix for survey and scale used.

Results and Discussion

PIW Results - The Attitudes and Beliefs Survey

Each participant was required to rank six statements on the importance of environmental services. The combined results for each group were very similar. The first rank in all groups was the benefits of clean air, water, and wildlife habitat (Table 4). The lowest rank was social benefits such as recreation and relaxation. Wealth and jobs were ranked second lowest, while maintaining global ecosystems was second highest overall.

Table 4. Ranked Importance (1 signifying most important through 6 least important) of Various Statements Relating to Concern for the Environment

Statement	**GP1**	**GP2**	**GP3**	**Overall Combined Ranking**
Environmental benefits i.e. clean air, water & wildlife habitat	1	1	1	1
Maintaining the global ecosystem	1	2	6	2
Wilderness preservation	4	4	2	3
As a place for a variety of animal and plant life	5	3	3	4
Economic benefits such as wealth and jobs	3	5	5	5
Social benefits such as recreation and relaxation	6	6	4	6

The highest perceived threats to the boreal forest were considered to be arising from the amount of trees being logged, logging practices, and the amount of allocated land to industry for timber harvesting (Table 5). The lowest threats were perceived as coming from recreation, insects and disease, and negative publicity about forest management. Medium risks were considered from oil and gas exploration, forest fires, and loss of forested land due to agriculture and urbanization.

Participants felt strongly about the existence of the forest (now and for the future) and that forests let people feel close to nature and give spiritual meaning. There was also agreement, albeit weaker, with the statement that human management and needs may be met through the use of the forest. At the other end of the spectrum, people disagreed strongly with the statements about forests existing mostly to serve human needs, and that forests not being used for human

benefits are a waste of resources. These statements are strong indicators that there are passive-use values (e.g. existence, bequest) for the forest beyond the use (instrumental) values.

Table 5. Perceived Threats (1 Representing "Not a Threat" and 4 "A Great Threat") to the Boreal Forest

Statement	**Mean rank (SD)**			
	GP1	**GP2**	**GP3**	**Combined**
The amount of trees being logged	3.47 (0.92)	3.64 (0.5)	3.40 (0.71)	3.47 (0.73)
Logging practices	3.20 (0.86)	3.45 (0.52)	3.12 (0.78)	3.22 (0.76)
The amount of forested land in the province allocated for timber harvesting	3.21 (0.97)	3.30 (0.95)	2.92 (0.97)	3.08 (0.96)
Climate change or global warming	3.14 (1.03)	2.82 (0.87)	3.04 (0.98)	3.02 (0.96)
Loss of forested land for other purposes such as agriculture or urbanization	2.73 (1.10)	2.9 (0.99)	3.12 (0.88)	2.96 (0.97)
Forest fires	2.87(0.83)	2.64 (0.81)	2.88 (0.97)	2.82 (0.89)
Oil and gas exploration and pipelines	2.67 (0.62)	2.82 (0.75)	2.60 (0.91)	2.67 (0.79)
Negative publicity about forest management	2.36 (0.84)[1]	2.33 (1.22)	2.92 (0.91)[1]	2.65 (0.98)
Insects and diseases	2.67 (0.62)	2.60 (0.84)	2.62 (0.58)	2.62 (0.64)
The amount of recreation use occurring in the forest	1.71 (0.61)[2]	2.45 (0.93)[2]	2.04 (0.61)	2.04 (0.73)

[1] Identifies that these two means are statistically significantly different (t=1.95, p=0.05)
[2] Identifies that these two means are statistically significantly different (t=2.27, p<0.05). All other paired combinations of means are statistically insignificant.

The differences amongst the groups in their aggregate feelings towards the forest are interesting in that they occur only between GP1 and GP2 and between GP1 and GP3 (Table 6). In other words the differences between GP2 and GP3 were insignificant. The significant differences between GP1 and GP2 are in the statements where members of GP2 tended to express greater agreement in areas of forests providing peace and well-being, having sacredness and having the right to exist for their own sake. The difference between GP1 and GP3 also suggest that GP3 members tended to agree with statements suggesting greater 'rights' conferred

on the forest such as respect and admiration versus human exploitation and instrumental use. This information suggests that members of GP2 and GP3 tend to be more biocentric in value orientation and less anthropocentric in comparison to members of GP1.

Table 6. The Level of Agreement by PIW Participants with Various Statements Reflecting Feelings Towards Forests (1 Represents Total Disagreement to 5 Representing Total Agreement)

Statement	**Mean (SD)**			
	GP 1	**GP 2**	**GP 3**	**Combined**
It is important to maintain forests for future Generations	5.00 (0.0)	5.00 (0.0)	4.92 (0.3)	4.97 (0.2)
Whether or not I get to visit the forest as much as I like, it is important for me to know that forests exist in NW Saskatchewan	4.60 (1.2)	5.00 (0.0)	5.00 (0.4)	4.93 (0.7)
Forests let us feel close to nature and rejuvenate the Human spirit	4.57 (0.9)[1, 2]	5.0 (0.5)[1]	4.68 (0.5)[2]	4.75 (0.7)
Humans should have more respect and admiration for the forests	4.00 (1.0)[2]	4.64 (0.9)	4.63 (0.6)[2]	4.44 (0.9)
If forests are not threatened by human actions, we Should use them to add to the quality of human life	4.00 (1.2)	4.00 (1.2)	4.60 (0.9)	4.29 (1.1)
Forests can be improved through management by Humans	4.10 (1.0)	3.91 (1.2)	4.25 (0.9)	4.12 (1.0)
Forests are sacred places and give us a sense of peace and well-being	3.72 (1.3)[1]	4.54 (0.6)[1]	4.0 (1.3)	4.05 (1.2)
Wildlife, plants, and humans should have equal rights to live and develop	3.27 (1.5)	4.0 (1.2)	4.1 (1.3)	3.82 (1.4)
Forests should have the right to exist for their own sake, regardless of human concerns and uses	3.21 (1.5)[1]	4.30 (1.3)[1]	3.80 (1.3)	3.77 (1.4)
Forests should be managed to meet as many human needs as possible	3.93 (0.9)	3.10 (0.9)	4.0 (1.3)	3.68 (1.5)
Disagreement				
The primary function of forests should be for the Products and services that are useful to humans	2.80 (1.3)[2]	2.30 (1.3)	1.8 (0.9)[2]	2.18 (1.2)
Forests should be left to grow, develop, and succumb to natural forces without being managed by humans	2.07 (1.0)	2.36 (1.1)	1.92 (0.8)	2.12 (0.9)
Forests should exist mainly to serve human needs, if not then it is a waste of our natural resources	2.28 (1.4)[2]	1.68 (1.2)	1.60 (1.1)[2]	1.89 (1.3)

[1] Signifies that the means for GP1 and GP2 are significantly different (*t* tests, $p \leq 0.05$)
[2] Signifies that the means for GP1 and GP3 are significantly different (*t* tests, $p \leq 0.05$)

The opinions about forest management in Saskatchewan reflected a grave concern over industrial control of the forests (i.e., not enough community or local control), issues relating to sustainability, environmental quality, future generations, the amount of protected area, and whether there will be enough trees for future timber demands (Table 7). From these results it may be interpreted that GP2 was the most critical of present forest management practices in Saskatchewan, GP3 the next most critical, and GP1 the least critical of all three groups. However, all three groups were critical of forest management and this may not necessarily reflect

concern specifically with Mistik Management, but rather all forestry operators and the provincial government's role in forest policy.

Table 7. Participants' Opinions on Forest Management in Saskatchewan (1 Represents Totally Disagree to 5 Indicating Totally Agree)

Statement	Mean (SD)			
	GP1	GP2	GP3	Combined
Forest management should try to minimize impacts on Traditional rural ways of life (e.g. hunting and fishing for food)	4 .00 (1.10)	4.36 (0.92)	4.64 (0.96)	4.4 (1.00)
The forest industry controls too much of Saskatchewan's Forests	4.10 (1.34)	4.18 (1.2)	4.17 (1.03)	4.14 (1.14)
The present rate of logging is too great to sustain our forests in the future	3.93 (1.43)	4.20 (1.03)	3.90 (1.28)	3.95 (1.26)
When making forest decisions, the concerns of Communities close to the forest should be given higher priority than other distant communities	3.86 (1.23)	3.73 (1.42)	4.04 (1.12)	3.92 (1.21)
Forest management should try to create more jobs through commercial recreation and tourism, harvesting plant and animal products, mining, etc	4.07 (1.14)	3.90 (1.10)	3.88 (1.27)	3.94 (1.20)
Forest are being managed for a wide range of uses and values, not just timber	3.88 (1.21)	3.36 (1.21)	3.84 (1.28)	3.72 (1.23)
Forest management does a good job at including Environmental concerns	3.00 (1.46)	2.81 (1.25)	3.04 (1.33)	2.98 (1.33)
Communities that depend on the forest for their economic well-being are given adequate consideration in forest management	3.13 (1.55)	2.64 (1.03)	2.87 (1.25)	2.90 (1.3)
Economic stability of communities is more important than setting aside forests from logging	3.14 (1.29)	2.64 (1.29)	2.44 (1.36)	2.68 (1.33)
Forests are being managed successfully for the benefit of future generations	3.00 (1.31) [1]	2.00 (1.00) [1]	2.65 (1.4)	2.61 (1.32)
There will be sufficient wood in Saskatchewan to meet our future needs	3.40 (2.1) [1,2]	1.91 (1.14) [1]	2.32 (1.14) [2]	2.56 (1.58)
Disagreement				
Forestry practices generally produce few long-term negative effects on the environment	2.67 (1.45) [1]	1.60 (0.97) [1,3]	2.54 (1.47) [3]	2.39 (1.41)
Saskatchewan has enough protected areas such as Provincial and national parks or wilderness areas	3.14 (1.56) [1,2]	1.82 (1.25) [1]	2.17 (1.38) [2]	2.38 (1.48)
Enough harvested trees are being replaced by planting new ones or by natural seeding to meet our future needs	2.93 (1.44) [1]	1.60 (0.70) [1,3]	2.28 (1.46) [3]	2.34 (1.4)
The citizens of Saskatchewan have enough say in forest Management	3.00 (1.46) [1,2]	1.44 (0.53) [1,3]	2.04 (1.04) [2,3]	2.23 (1.24)
The economic benefits from forestry usually outweigh any negative consequences	2.47 (1.30) [1]	1.45 (0.69) [1,3]	2.33 (1.52) [3]	2.18 (1.35)

[1] Signifies that the means for GP1 and GP2 are significantly different (*t* tests, $p \leq 0.05$)
[2] Signifies that the means for GP1 and GP3 are significantly different (*t* tests, $p \leq 0.05$)
[3] Signifies that the means for GP2 and GP3 are significantly different (*t* tests, $p \leq 0.05$)

The issue of sustainability, despite its mounting cliché status, is a very important issue in forest management and was a large concern to the participants. The majority of participants in

all three groups (40-70%) felt present forest management in Saskatchewan was not sustainable. Roughly 10–15% felt it was sustainable, and 10-30% were unsure. This was a common and recurrent theme voiced to the researchers during the meetings and present in the written comments of the surveys. The individuals surveyed in this study were dubious of present harvesting practices and their ability to meet future timber demands. The reasons for these doubtful beliefs were observed slow forest regeneration, poor soil productivity, environmental degradation, and ever-advancing technology – irrespective of increasing non-industrial demands on the same landbase. The burgeoning number of definitions for "sustainability" was not broached but rather left to the participants' intuition.[6]

Choice Experiment Qualitative Results

Synopsis of Group Comments

All three groups were afforded plenty of time, writing space, and opportunity to provide comments. The researchers were readily available[7] throughout the process and telephone conversations were used to keep the participants involved and interested between PIWs. In each survey used in this research, there were both direct open-ended questions probing the concerns of the participants in addition to space provided for any other comments and concerns. GP1 members clearly had more input opportunities than those in GP2 and GP3 (which had the least). Albeit, all individuals from all three groups were invited to submit any comments or concerns (as an addendum to the survey, or mailed in separately after some reflection) that they felt were not captured in the survey questions and format. Below some of the comments from each group are summarized in an effort to reflect the tenor of the discussion at meetings and the concerns of the members of each of the three groups.

For GP1 participants, there were many comments relating to all aspects of the PIW process and survey. Some comments made note that the survey exercise was hypothetical and therefore the "real" choices and trade-offs may be different. A need to find "balance" in Saskatchewan's forest management was a common theme. The PIWs were rated as good,

[6] The responses indicated the predominant interpretation of sustainability was connected with "sustainable timber supply." This was perceived as not sustainable, let alone the wider definition of sustainable development that includes economic, ecologic, and social aspects.

[7] Contact information for the researchers was included in all mailed information and along with an invitation to call throughout the process with any questions or concerns.

informative, educational, and as an effective means for increasing awareness. The workshops were thought necessary or very helpful in explaining and understanding the survey, and that a single workshop may be adequate. A prevailing thought held by GP1 participants is that industrial interests usually always prevail over environmental concerns.

The comments emanating from GP2 participants were somewhat similar to those of GP1. There was concern over sustainability due to the rapid progress in harvesting technology, and yet some of the members who work directly in the forest industry observed poor forest regeneration. The profit motive was also seen as jeopardizing the forest and environment. The boreal forest was named as a very important source of peace and tranquillity, spiritual revival, and employment. Concern was also stated for future generations and the role of forests in climate regulation and global warming. Finally, there was distress that the results of this research would likely never be reflected in the logging practices of the company in the local area.

The written comments of GP3 respondents suggested the same concerns regarding sustainability, regeneration, recent forestry expansion initiatives, labour losses to equipment and nebulous environmental values being subjugated by economic and political interests. Many sentimental values were expressed for such things as wildlife, aesthetics, sacred places, future generations and the forest itself.

In general, the authors of this study noted that the participants exhibited disillusionment with forest management practices in Saskatchewan, and with the many forms of public involvement they experienced. There appeared to be lack of trust on the part of many participants in any of the three groups, and the feeling that industrial interests would prevail over environmental interests regardless of the feelings of the local populace. If these feelings are truly held by the participants, they should strongly appear among the preferences for combinations of the various attributes examined in the choice experiment. Further, these preferences could be tempered by consideration of the costs of realizing priority for environmental preservation over industrial benefits through increased taxes and changes in levels of local employment. To examine these trade-offs we now turn to the results from the choice experiments.

Model Estimation Results

The choice experiment involved the multiple presentation of three management scenarios. Different levels in the five attributes identified in Table 2 characterized each scenario.

In every trinary combination, one of the scenarios represented the "current situation" which reflected the actual current levels of each of the five attributes. These are identified by the bold text in Table 2. Each respondent to the choice experiment faced 16 different trinary combinations of attributes. In each of the 16 combinations, experimental design procedures were implemented to capture in a statistically efficient manner the contribution of each attribute to the choice decision. Statistical choice models (called conditional logit models) were estimated to identify the "weights" the group members attributed to each of the attributes in the scenarios. These models were estimated for each of the three groups, which allowed comparisons between groups. Joint models were also estimated on various combinations of pooling the groups' responses. This allows identification of the variation in the aggregate preferences of the various groups.

The models presented below represent choice models that estimate the probability that a participant in a group chose a particular scenario. The model parameters reflect the importance of each attribute in this choice process. Thus, a positive parameter identifies that more of this attribute has a positive effect on choice, while a negative parameter signifies that more of the attribute reduces the chance of a scenario being chosen. These parameters represent "weights" associated with the importance of each attribute and thus when compared with each other, represent information on an individual participants preferences for those attributes.

Table 8 displays parameter estimates for attributes for choice models estimated by group. In these models, it was assumed that each attribute affected a consumer's utility or happiness in a linear fashion (i.e. the indirect utility function is linear in its arguments). The first parameter in the model represents an alternative specific constant (or dummy variable) for the scenario that represents the current situation. This scenario exhibits a positive and statistically significant effect for the current situation (or the *status quo*) in all three groups. This can be considered a form of *status quo* bias or endowment effect and is usually a feature of presenting new situations to individuals. In other words, people are generally reluctant to experience changes from the current situation. This is a typical finding in these types of choice experiments (e.g. Adamowicz et al. 1998) and its explanation involves mistrust of administration, or dubiousness of the ability to bring proposed new situations to fruition. Another possible reason is that people chose the current situation more frequently that the other two scenarios offered as a form of protest or an "easy way out" because the choice task was too complex and the trade-offs among the attributes in the scenarios were unfamiliar.

Table 8. Parameters (Asymptotic *t* Statistic) or Weights Associated with the Attributes for the Linear Form of the Choice Model

Variable	**GP1**	**GP2**	**GP3**
Current Situation	0.7936**	1.3790**	0.770**
	(2.55)	(3.72)	(3.06)
Moose population	0.1063**	0.0212	0.1181**
(1000s animals)	(4.10)	(0.76)	(5.38)
Caribou population	0.4701**	0.4888**	0.6071**
(1000s animals)	(2.32)	(2.21)	(3.53)
Forest age	0.0537*	0.1180**	0.0572**
(% old)	(1.66)	(3.34)	(2.14)
Recreation[1]	0.0941	-0.6293**	-0.0638
Level 1	(0.48)	(-2.75)	(-0.39)
Recreation	0.0314	-0.1672	-0.1535
Level 2	(0.16)	(-0.78)	(-0.91)
Recreation	-0.3378	0.3527*	0.3424**
Level 3	(-1.57)	(1.69)	(2.11)
Recreation	0.2123	0.4438	-0.1252
Level 4			
Protected areas	0.1978*	0.2127*	0.1951**
	(1.72)	(1.78)	(2.09)
Employment	0.2122*	-0.0632	0.2300**
(No. jobs in 100s)	(1.93)	(-0.55)	(2.48)
Household	-0.2705	-0.3921*	-0.3228**
Taxes ($100)	(-1.39)	(-1.88)	(-1.98)
Log-Likelihood	-203.074	-174.45	-292.5
ρ^2	0.1113	0.09984	0.1155

[1] Recreation levels were effects coded so the Level 4 parameter is the negative sum of the other three parameters.
* Signifies parameter is significant at the 5% level or better, ** significant at the 10% level.

The MOOSE and CARIBOU population attributes, however, are positive and significant for all three groups, except for GP2 where the MOOSE parameter was *not* significant. This suggests that holding all of the other attributes constant, the utility or happiness of group members would increase with increases in either moose (except in GP2) or caribou numbers. Thus, scenarios in which population levels of these species were increased, increases the probability of choosing them. The parameter on the FOREST AGE attribute is positive and significant in both GP2 and GP3 at the 5 % level and significant in GP1 at the 10 % level. Therefore, all three groups would enjoy an increased level of utility with greater provision of old age-class forests.

The attributes on RECREATION LEVELS were effects coded and thus for this attribute three parameters are estimated and the final parameter on the last level is calculated as the negative sum of the other three.[8] This attribute did not generally exhibit statistically significant effects on choice across the groups. Only three levels showed significant effects: level 1 is negative (the two wheel drive access lowers utility) and level 3 is positive (ATV access is desired) for GP2 and GP3. This suggests for these groups that a member's overall utility would increase with greater restrictions on access up to the point of ATV access.

Of the final three attributes, the PROTECTED AREAS parameter is positive and significant for all three groups. The EMPLOYMENT parameter in GP1 and GP3 is positive and significant, indicating desires for higher employment levels. However, the parameter on TAXES is negative as expected (increased taxes decrease utility with all of the other attributes held constant), but only significant in the GP2 and GP3 models.

The same choice model specifications were also estimated using a quadratic form for some of the attributes in the conditional utility function. The quadratic functional form includes variables that represent a linear term for each continuous attribute and a squared term for those same attributes. This form is useful in determining whether the effect of an attribute exhibits a "threshold" effect (i.e. increases in MOOSE affect choice up to a point).

The parameter estimates for each group are generally similar in effect to the linear models (Table 9). Of all the continuous attributes, only MOOSE and CARIBOU had squared terms that were statistically significant. However, in the quadratic models a positive and significant effect for the current situation is only found for GP2. As before, the MOOSE linear parameter is positive and significant for GP1 and GP3. The MOOSE squared parameter is negative and significant, suggesting decreasing marginal utility as the population size of moose increases. Similar results and interpretation apply to the CARIBOU coefficients in all three groups. Moose and caribou demonstrate a "threshold" phenomenon in which the number of animals markedly and linearly increases utility to a "threshold" number at which time the utility

[8] Using effects codes means the first three levels are estimated and the fourth is the negative sum (calculated) of the previous three levels (in this case). The advantage of using effects codes is that they remove the impact of the factor from the constant and thus make interpretation easier. They are however, statistically identical to dummy variables.

curve begins to plateau and slowly decrease, hence the negative parameter on the squared terms. No other attributes manifest this threshold effect in estimation. This result had previously been found by Adamowicz et al. (1998b).

Table 9. Parameters (Asymptotic *t* Statistic) or Weights Associated with the Attributes for the Quadratic Form of the Choice Model

Variable	**GP1**	**GP2**	**GP3**
Current Situation	0.0607	1.0660**	0.0698
	(0.17)	(2.64)	(0.25)
Moose population	0.5335**	0.0867	0.5495**
(1000s animals)	(3.69)	(0.70)	(4.76)
Moose population	-0.0242**	-0.0041	-0.0249**
Squared	(-3.03)	(-0.57)	(-3.89)
Caribou population	5.291**	4.1398**	6.1110**
(1000s animals)	(4.92)	(3.99)	(6.46)
Caribou population squared	-2.6096**	-2.024**	-0.2973**
	(-4.67)	(-3.67)	(-6.05)
Forest Age	0.0496	0.1137**	0.05082*
(% Old)	(1.48)	(3.10)	(1.79)
Recreation	0.1778	-0.6347**	-0.0433
Level 1[1]	(0.84)	(-2.71)	(-0.25)
Recreation	0.0005	-0.1988	-0.1697
Level 2	(0.00)	(-0.90)	(-0.95)
Recreation	-0.4478*	0.3534**	0.3150**
Level 3	(-1.97)	(1.67)	(1.81)
Recreation	0.2695	0.4802	0.1020
Level 4			
Protected Areas	0.1809	0.2176*	0.2006**
	(1.47)	(1.732)	(1.97)
Employment	0.1623	-0.0721	0.1815*
(No. jobs in 100s)	(1.41)	(-0.61)	(1.86)
Household Taxes	-0.4694**	-0.5167**	-0.5515**
($100)	(-2.10)	(-2.26)	(-2.92)
Log-Likelihood	-185.63	-166.54	-263.01
ρ^2	0.188	0.139	0.2047

[1] Recreation levels were effects coded so the Level 4 parameter is the negative sum of the other three parameters.
* Signifies parameter is significant at the 5% level or better, ** significant at the 10% level.

FOREST AGE was positive and significant for GP2 and GP3. The RECREATION LEVEL attribute showed limited significance. GP1 level 3 and GP2 level 1 are both negative and significant. The calculated value for level 4, in all cases, is positive. The PROTECTED AREAS coefficient is positive and significant in GP2 and GP3. EMPLOYMENT is positive and significant for GP3 in this model. The TAXES parameters are again predictably negatives in all three groups, and unlike the linear cases, are statistically significant for each group.

The quadratic models exhibit a better fit for the choice data than the linear models since the values of the log-likelihood functions and the ρ^2 statistics (which assess the proportion of explained variance) are larger in each of the quadratic models.

Having selected the quadratic form of the utility function as superior, what remains is to test whether the aggregate preferences for the groups are similar. This proceeds through pooling the data for various combinations of the groups and estimating the parameters jointly including a new parameter called a scale parameter. This approach examines the question if aggregate preferences are statistically significantly different between GP1 and GP2 (for example). In assessing statistical significance one should consider that the samples may also have different variances (or "scales").

The results of estimating joint scaled models are shown in Table 10. The MOOSE, CARIBOU, and FOREST AGE coefficients are all positive and significant. As before the MOOSE and CARIBOU squared coefficients are negative and significant demonstrating diminishing marginal utility as the number of moose or caribou cross a "threshold" number. The RECREATION attributes remain largely insignificant. The third level in GP 2+3 shows a positive and significant coefficient but the trend in coefficients does show a negative coefficient for the first two levels with the third and fourth becoming positive. Other statistically significant results in the four pooled group models are the positive PROTECTED AREAS parameters and the negative TAXES parameters. The only significant EMPLOYMENT coefficients are the positive ones for the GP1+GP3 and GP1+GP2+GP3 pooled models.

Statistical tests of the differences between the individual group models involve Likelihood Ratio tests. This involves computing the difference between the sum of the relevant likelihood values at convergence (Table 9) and the relevant joint scaled model likelihood in Table 10. Multiplying the results by 2 yields a χ^2 statistic with the degrees of freedom equal to the number of parameter restrictions.

The first test involves comparison of all the three group models. The relevant χ^2 statistic is 37.85, which compared to the critical value of 36.42 at 24 degrees of freedom is significant at the 5% level. This means that the parameters from all three models are significantly different. The likelihood ratio statistics for other comparisons are: GP1 versus GP2 (χ^2 =29.02), GP2 versus GP3 (are χ^2 =32.90), and GP1 versus GP3 (χ^2 =9.76). The 5% critical χ^2 value for 12 df is 21.03. Thus, only the parameters for GP1 and GP3, when scaled are statistically similar.

Table 10. Parameters (Asymptotic *t* Statistic) or Weights Associated with the Attributes for the Quadratic Form of the Choice Model Estimated on Information Pooled Among Combinations of the Three Groups

Variable	GP1+GP2	GP1+GP3	GP2+GP3	GP1+GP2+GP3
Current Situation	0.5332** (1.76)	0.0646 (0.29)	0.1575 (0.98)	0.2329 (1.15)
Moose population (1000s animals)	0.3744* (2.98)	0.5030* (4.96)	0.2540* (3.73)	0.4440* (4.68)
Moose population Squared	-0.0168* (-2.47)	-0.0228* (-4.30)	-0.0108* (-2.98)	-0.0201* (-4.05)
Caribou population (1000s animals)	5.4380* (5.46)	5.3413* (6.01)	3.5097* (4.40)	5.4287* (6.18)
Caribou population Squared	-2.6680* (-5.20)	-2.6110* (-5.80)	-1.7020* (-4.26)	-2.6510* (-5.98)
Forest Age (% Old)	0.0792* (2.79)	0.0470* (2.27)	0.0412* (2.22)	0.0583* (2.88)
Recreation Level 1[1]	-0.1609 (-0.87)	0.0309 (0.26)	-0.1261 (-1.25)	-0.0785 (-0.65)
Recreation Level 2	-0.0762 (-0.44)	-0.1022 (-0.87)	-0.1280 (-1.29)	-0.1211 (-0.99)
Recreation Level 3	-0.1333 (-0.69)	0.0351 (0.29)	0.1986* (2.01)	-0.0942 (0.75)
Recreation Level 4	0.3704	0.0362	0.0555	0.1054
Protected Areas	0.2227* (2.17)	0.1769* (2.30)	0.1295* (2.24)	0.1898* (2.67)
Employment (No. jobs in 100s)	0.0802 (0.82)	0.1601* (2.25)	0.0676 (1.30)	0.1253** (1.88)
Household Taxes ($100)	-0.5592* (-2.97)	-0.4855* (-3.39)	-0.3676* (-2.98)	-0.5204* (-3.78)
Scale GP1	1.0000	1.0000	NA	1.0000
Scale GP2	0.6470 (-1.53)	NA	1.0000	0.5925* (-1.97)
Scale GP3	NA	1.1100 (0.59)	1.7407* (2.35)	0.141 (0.72)
Log-Likelihood	-366.68	-453.52	-413.099	-634.107
ρ^2	0.131	0.189	0.212	0.157

[1] Recreation levels were effects coded so the Level 4 parameter is the negative sum of the other three parameters.
* Signifies parameter is significant at the 5% level or better, ** significant at the 10% level.

Economic Welfare Considerations

A virtue of using the choice experiment method to examine preferences for passive uses is that the parameters can be used to assess the economic value of changes in the amounts of passive use values. This involves calculating the amount of income a respondent would be willing to trade for increases in, for example, caribou numbers or protected areas. The income

changes can be assessed through increases in household taxes a respondent would be willing to pay.

In considering the welfare implications of some of the attributes in the above models a movement from the current situation to a plausible future state (specifically a 5 % increase from the status quo level of the attribute while holding all other attributes constant) was considered. The results are shown in Table 11. In considering moose, an increase in their population from the current population estimate used in the survey of 7500 by 5 % to 7875 would have the average person willing to pay $10.26. A decrease in the attribute numbers above would require a payment to the individuals in order to maintain the original utility level. The order of importance of the attribute changes in terms of economic values is increases in forest age, protected areas, caribou populations, moose populations and employment levels. The ordering is the same for each of the three groups and in the joint model. However, one can see that the magnitudes of the actual values for GP1 and GP3 are similar, and that those for GP2 are different than the other two groups. The joint model captures the "average" values among the three groups. It is noteworthy that these participants rated employment lower than environmental values.

Table 11. Estimates of the Economic Values Associated with 5% Increases from Current Levels in Various Environmental Attributes and Employment Levels Using the Quadratic Models in Tables 9 and 10

Attribute	**$ (Canadian) per person**			
	GP1	**GP2**	**GP3**	**GP1+GP2+GP3**
Moose population	13.64	1.96	14.01	10.26
Caribou population	13.64	10.73	25.02	12.70
Forest Age	52.85	121.11	54.13	56.05
Protected Area	38.54	46.36	42.72	36.47
Employment	10.37	-4.61	11.60	7.22

Conclusions

The conclusions from this research can be broken down into two related parts. The first involves the general findings of the discussions we had with participants in all three groups. This content is important because it represents the opinions and feelings of 43 local citizens

impacted by resource development in the NorSask FMLA. General findings from the group discussions and written comments suggest:

- Environmental benefits and global ecosystem function are deemed priorities above the economic wealth and jobs or even recreation.
- Total harvesting volume, logging practices, and areas allocated to the forest industry (amount) are seen as the most important long-term threats to forest ecosystem integrity.
- The present and future existence of forest is very important (statements suggesting both existence and bequest values).
- Unease with the amount of forest management control over forest resources in the province. This includes concern over environmental degradation and the lack of citizen input into forest management.
- A lack of faith in the sustainable nature of present forest management.

These opinions were consistent across participants in the three groups. However, collectively, members' opinions were indeed different and this may be attributed to both recruitment factors and a small group phenomenon. Members of group 1 were the least critical of present forest management (including a higher percentage of folks feeling present forestry is sustainable), while those in group 3 were second in terms of level of criticism. Participants in group 2 were the most critical.

Expressing opinions on resource management is one thing, but making personal sacrifices to realize change is another. Thus, the choice experiment method was used to assess the degree and direction of trade-offs the participants would make to change the way resource and the environment is managed. We examined the possibility of trade-offs of jobs and taxes for increases or maintenance of various passive use values in the NorSask forest.

A preference construction approach was used to determine if different preference constructing experiences prior to completing a choice experiment would affect the results. It was hypothesized that for different groups a different group variance may be found. The PIW results do show a higher percentage of participants from GP1 having more certainty in their choices versus GP2. However, these findings were not apparent in the choice experiment results. In fact, counter to what was hypothesized, the preferences of the GP1 participants were similar to

those from gathered through a mail administration of the instrument to a separate sample of individuals (i.e. GP3).

General findings from the choice experiment were:

- An affinity to choose the status quo in the face of uncertainty (a well-known phenomenon associated with such studies).
- A relatively high value for moose as an important meat source and game hunting species. Indigenous peoples rely heavily on moose for food while the local outfitters rely on moose as an important sport hunting species.
- Caribou (the special species proxy for biodiversity) was of high marginal value albeit subject to a "threshold" where the marginal value decreases once population security is attained (caveat – these decisions are based on the best science available which may be inaccurate).
- An increased utility from retaining more old age-class forest. This attribute had the highest marginal value for each percent increase.
- Protected-areas were another attribute highly valued above the current amount.
- As expected, there were increases in utility associated with increased levels of local employment and a decrease in utility with increased household taxes.
- The estimated economic values for the increases in passive use attributes identify an order of importance. This is forest age, protected areas, caribou, moose, and finally jobs.

Policy and Management Implications

The different values held by a society are not absolute. Economic values are derived from and are one expression of larger cultural values. Additionally, these values are based on many different sources of information and thus are dynamic and continually refined via new scientific understanding, technology, and intergenerational progression.

When considering non-timber passive-use values we enter a realm of many different possibilities. The capacity of present technology to alter the landscape requires us to ponder the sort of world we will create and ultimately leave future generations; including the type of perturbations and scale of disturbances we wish to place on the landscape. Current forestry policy has the dual objective of targeting older timber stands before they either decay or burn while at the same time promising employment. This research suggests that the local public may want a very different set of benefits wrought from their forest including more older age-class

forest, more protected areas, and more biodiversity and *not* the dominant policy push for industry expansion and jobs. It would seem that the public is more risk averse than the present management course and therefore desire greater protected areas and "benchmark" areas to temper the scale of the impact on the forest landbase.

It must be highlighted that the surveyed public in this research was local to the forest dependent community (although many surrounding areas, especially to the south, do support agriculture as well). Some may find the preferences and concern for preservation over local employment by these local people surprising. Wider sampling throughout the province of Saskatchewan (including urban areas), other regions in Canada, and international populations would likely produce different (and likely larger) passive use values more in support of these findings.[9]

The comments surrounding employment and the lack of statistical significance of the employment attribute in many of the single group models (Tables 9 and 10) suggest that employment is not the main driver in the local public's mind. The stable economic climate in which this research was conducted may have had some effect on perceptions. Politicians and the media often proclaim employment as a paramount issue that may very well be a tautological establishment. This may rather be an urge by government to expand an industry and reduce unemployment, promote economic growth (a standard economic mantra internalized throughout most of mainstream western leadership), prolong their mandate via a "successful" record, increase revenues to maintain social programs, and an industrial bias due to lobbying and other rent-seeking behavior.[10] In this case, northern Saskatchewan has a rapidly growing First Nations population that experiences a paucity of employment which may motivate the provincial government to expand forestry.

In this research the majority of the surveyed individuals were gainfully employed.[11] Many felt that the promise of new jobs in forestry was over-rated and linked to ecosystem damage and environmental degradation. The suspicion was in the short-term nature of some jobs

[9] Certification prices and donations to NGO's to protect forests are an international expression of these PUVs. Many donations and inflated prices are in support of protecting parts of the rainforest throughout the world.
[10] Governments also have objectives which may result in inefficient outcomes i.e. Government failure.
[11] Although comments from those unemployed or under-employed were more in favour of an intact forest that allowed more traditional means for subsistence. Others felt an intact the forest provided future options.

(e.g. seasonal, term contracts, construction) and the substitution of capital for labour. A forest left intact gave many participants the comfort of options for the future and subsistence activities in the meantime. Other participants felt that too much of the wealth generated by forest products was leaking out of the region (to the "south" in the province) and the country (to the United States) thus raising distribution issues.

Considering access and recreation, the choice experiment models do not produce many statistically significant results. However, examining the quantitative results in concert with the comments and previous ranking and rating exercises it may be stated that easy access was deemed a serious concern. There was a strong consensus in the various groups that too much access was undesirable; on balance the first two levels of access (two and four wheel drive) caused disutility whereas the final two levels of access (ATV and foot) were generally positive. Level three (ATV access) was positive and significant in many cases, which is consistent with the group comments and Mistik Management's approach; those accessing areas via ATV's are considered legitimate users.

The Public Involvement Process

Involvement in a public process has many aspects in which the individual participant may find interest and gratification. Participants may be motivated and rewarded by the process itself or they may be more interested in the end results of their input. For many in industry, government, and the public, the public involvement *process* itself is enough in that it provides the public with an opportunity to exchange information between themselves and industry, social learning, exercising democracy (empowerment), community vigilance and engagement. Therefore, beyond the results, a public involvement process has a very important social function and role in community well being. A perusal of PIW group comments (Appendix A) is convincing of this point and it is clear that beyond any quantitative results the process itself had tremendous social value. The PIW process unequivocally engendered: trust, education, interest, and successfully interfaced with the public while allowing a legitimate format to raise concerns.

In this research the qualitative results were fairly similar from all three groups and the initial working hypothesis of reducing group variance in choices was not realized. This may be explained in a number of ways. First, the initial group may have been very successful in assisting with survey design: clarifying terms, descriptions, concepts and presentation. This careful

design phase may have greatly reduced or even eliminated the inadvertent obfuscation, nuance, special knowledge and experience sometimes necessary to successfully complete a survey. In other words, the construction exercise obviated the need for preference construction. Assuming this result, the promise for successfully aligning the participants' true preferences in the survey may have been realized.

Second, the recruitment of individuals motivated enough to participate in a PIW and those referred for the mail survey were predominantly individuals that held stable and well-defined preferences prior to the study. This argument holds credence in that some individuals stated they have had similar conversations in the past, which would have helped to delineate their position and understanding of the more complex issues raised through facing the choice experiment tasks. This may represent a sampling problem and a more random technique devoid of the self-selection or referral component may have produced different results. Therefore, the notion of demonstrating variance differences between groups may have been hampered, but the information gleaned from the individuals during this research (versus more cursory and disengaged processes) will likely have been superior due to the profundity of their inquiry. The small sample phenomena may have resulted in certain groups being peculiar. For example, participants in GP2 were different than the other two groups in many ways (Table 3). GP2 was the smallest group, had a slightly different demographic (more women, lowest income and highest natural resource dependence), provided the highest response rate of all groups and had very different choice model parameters (Table 9 and 10) and welfare measures (Table 11).

Despite the results, it is argued that the PIW process used is superior to the usual perfunctory mechanisms (e.g. open houses) or public advisory groups (which often undergo a secondary socialization which renders them unrepresentative of the public) representative of public involvement approaches typically employed by the forest industry. This PIW format truly engages the public in meaningful discussion that challenges them to understand and comment on complex issues. As postulated at the outset, those individuals not involved in a PIW, GP3 participants, did manifest greater protest (by higher numbers of status quo choice and non-response to the mail survey).

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APPENDIX

Final Group Comments on the PIW Process

Group One

The comments suggested the workshops helped with defining terms and increasing understanding of the survey and the concept of trade-offs. The majority of the respondents did not find the survey difficult to complete and felt the information they received in the workshops was enough, unbiased, adequate to be reasonably certain of their choices. A few individuals, however, pointed out the hypothetical nature of the survey and this made their choices more uncertain. A review of the PIW process by GP 1 suggested the series of PIWs was appropriate, interesting, and worthwhile. See Appendix A for full comments.

Group Two

Group 2 comments suggested the single PIW was enough for this group and a single intense meeting provided enough information, instruction, and time for discussion to be fruitful. There was grave concern over forestry expansion based on technology, old and inadequate inventories. The majority did not find the survey difficult to understand or complete, and felt it had been explained very well before proceeding to its completion. As with GP 1 the information supplied was considered enough to complete the survey. The trade-offs and "forced choices" did leave a few somewhat uncertain with their choices. With respect to bias, a few individuals felt the assumption that a forest can be managed by technology and the species or attributes we choose showed some bias. The review of the PIW process by GP 2 was positive but there were some cynical perspectives when it came to how the results from the process might actually improve land management practices.

Group 3 did not attend any PIWs and thus no comments on this process are available.

Table 1. Demographic Characteristics for Saskatchewan and the NW Region of the Province

Characteristic	**Sask.**	**Meadow Lake**	**Green Lake**	**Beauval**	**La Loche**
Aboriginal population (%)	11.2	33.3	94.2	93.6	93.8
Population change (%)*	0.1	11.5	4.5	9.5	16.3
Average age of population	35.7	31.7	29.0	24.4	21.1
% Population > 15 yr. of age	76.9	71.8	65.7	59.2	55.2
% Population (> 25 yr.) with < grade 9 education	15.4	17.4	37.0	25.7	56.2
1996 unemployment rate	7.2	11.1	22.2	15.1	32.2
Average income	22,541	22,536	13,827	16,555	11,367

* Census data for time period of 1991 to 1996.

Table 2. Group Responses to Forest Sustainability Question

Group Number	***Number of respondents***	***Answered 'No', do not believe sustainable***	***Answered 'Yes', do believe sustainable***	***Unsure***	***No answer***
1	16*	6 (38%)	2 (12.5%)	2 (12.5%)	6 (38%)
2	10*	7 (70%)	1 (10%)	1 (10%)	1 (10%)
3	19	9 (47%)	3 (16%)	6 (32%)	1 (5%)
Totals	45	22 (49 %)	6 (13%)	9 (20%)	8 (18%)

* NOTE: Not all the survey respondents answered the questions. For comments refer to Appendix A.

Table 3. Group Response Rates

Number	**Group 1**	**Group 2**	**Group 3**
Individuals invited to meeting(s)	25	20	NA
Individuals *confirmed* at meeting	17 (68%)	12 (60%)	NA
Individuals mailed the final survey	17	NA*	40
Surveys returned	14 (82%) Mail-out	12 (100 %)	25 (63%)
Returned surveys containing usable results	13 (93%)	11 (92%)	19 (76%)

* NA – Not Applicable