

# An economic assessment of forestry activities on whitetail deer and moose hunting in northwestern Saskatchewan

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## Introduction

Integrated resource management (IRM) describes a management philosophy that considers managing the forest for more than a fibre supply. IRM considers non-timber resources (i.e., wildlife habitat, forest biodiversity, recreational/tourism opportunities) simultaneously with the planning of the timber harvests and management (i.e., wood supply) in such a way to maximize public benefits. The Alberta government defines IRM as a means "to achieve maximum benefits for Albertans, now and in the future" (Alberta Energy and Natural Resources 1983). Many jurisdictions maintain a similar definition; but few actually examine benefits in IRM decisions. The role of economics in IRM is to evaluate the benefits of timber and non-timber goods and services in order to assess trade-offs and determine an optimal management strategy that maximizes economic benefits to society. The challenge facing economists is to measure the values of goods and services that are not traded in markets such that they can be directly compared to timber products. The latter values can be imputed through formal market transactions.

In Canada, most forest land is publicly owned, but is under the "stewardship" of the provincial governments. Timber harvesting rights are awarded to firms through tenure arrangements. Most of the non-timber benefits are non-market in nature, and are excluded from forest tenure arrangements. This has generally led to an under-valuation of non-timber resources and has

caused some economists to call for their inclusion into tenure agreements (eg Pearse 1988).

Wildlife and its use are highly valued by Canadians and hunting is an important use of forests. Historically the incorporation of wildlife values into forest management plans has been slow, in part because its value has not been well understood due to its non-market characteristics. Recreational hunting is a non-market good because the expenditures and licenses fees do not reflect the true market value of a hunting experience. The licence price is usually set arbitrarily by government authorities, and expenditures are difficult to tie directly to wildlife (Bishop 1987).

Hunting is an important recreational activity in Saskatchewan (Canadian Wildlife Service/Statistics Canada 1993). In that year, about 74,000 or 10.3% of the provincial population over the age of 15 hunted, while about 31% of the population reported they hunted wildlife at least once in their lives. The survey revealed that big game hunting generated about \$3,200,000 in expenditures by Saskatchewan residents and estimated the non-market value of the activity at \$145.74 per participant. This approximates the value of hunting if it were sold in a market and can be compared to market prices and revenues derived from timber products.

There are two limitations of the non-market value given in the *Importance of Wildlife to Canadians* (CWS/Statscan 1993)

survey: 1) it is a static value - it does not consider how the value of a hunting experience changes if, for example, forest industry activities affect the quality of a hunting experience; 2) it is a provincial value and cannot be tied to a specific area within the province or to a specific type of hunting, for example deer or moose. The purpose of our study was to examine how some of the non-timber resource benefits are affected by changes in forest structure resulting from timber harvesting in an area of Saskatchewan where the forest industry is expanding. In particular, our study estimated changes in the value of a recreational whitetail deer or moose hunting as one, or a combination of several, conditions of the forest environment faced by hunters are altered by timber harvesting.

## Methods

Millar Western Pulp Ltd. and NorSask Forest Products Inc. are partners in the harvesting of timber from a large tract of land in Northwestern Saskatchewan. The Forest Management Licence Agreement (FMLA) is managed by Mistik Management Ltd. in Meadow Lake. The FMLA area comprises 3.3 million ha of land. Deer and moose hunting is an important recreational activity in the area, with about 53,370 deer hunters and 9660 moose hunters using the FMLA during the 1992/93 season. Discussions with big game hunters identified that the harvesting of timber and associated activities may affect the quality of a recreational experience. The following characteristics were identified as important and under the influence of forestry activities: road quality, degree of access, congestion while hunting, and game populations. Our objective was to determine how the value of hunting is affected by changes in these variables that represent some of the indirect impacts of timber harvesting.

We developed two mail-back questionnaires, one for whitetail deer hunters and

one for moose hunters. We obtained separate samples of hunters living in northwestern Saskatchewan and of hunters living in other parts of the province. Mailing lists were derived from resident hunting licenses obtained from the Wildlife Branch.

Questionnaires were mailed immediately after the hunting season (November 30) to reduce recall bias, and one reminder and a second questionnaire were sent at about 10 and 40 days, respectively, after the first mailing. There was a response rate of 59.3% for deer hunters and 51.6% for moose hunters. Details on the questionnaire, survey administration and examination of non-response bias can be found in Morton et al. (1993).

Changes in hunting values related to forestry activities were determined using a series of contingent behaviour questions. This method allows the evaluation of multiple quality changes and assesses the trade-offs between the attributes of the forest (road access, game populations, congestion) by presenting a respondent with a series of levels of attributes and asking them if their behaviour would change if they faced changes in these attributes. Each survey contained two dichotomous choice contingent behaviour questions where respondents were asked if they would be willing to visit a new hunting site with has an implicit price associated for travel costs. Each question gave two forest hunting scenarios. The first scenario involved a base case that was the same for both questions on all versions of the survey. The second scenario altered the levels of access, game populations, or congestion of hunters and a randomly generated travel cost factor. Each question asked respondents at which of the two sites (hence dichotomous) they would prefer to hunt. There were three versions of the deer and moose hunter questions for a total of six different scenarios. The varying scenarios and associated travel costs provided an estimate of how much a hunter is willing to pay for a set of changed conditions at hypothetical

sites with which they were presented (Morton et al. 1993).

Analysis of the contingent behaviour questions involved the binary logit modelling techniques (Greene 1991). This consists of estimating the probability of visiting the altered site based on a set of independent variables that include the changed forest conditions, travel costs, and other variables. Economic values for the forest conditions were estimated using the methods of Cooper and Loomis (1992). Further details on the theory and modelling results can be found in Morton et al. (in prep.).

## Results

Table 1 provides mean and median economic values on a trip basis for the six scenarios offered to deer and moose hunters. These six scenarios are changes to the base case represented by limited access, low game populations, and low levels of hunter congestion. The set of variables that improved access, increased game populations, and maintained low access levels provided the greatest mean value to both deer and moose hunters (\$58.22 and \$136.69 per trip respectively). The lowest values were associated with a combination of: improved

access, lower game populations and increased congestion levels. The ranking of the alternate scenarios was similar by all hunters with the exception that moose hunters ranked scenario 1 higher than the deer hunters. In general, the mean values for any of the scenarios derived from moose hunters were valued higher than for the deer hunters. The median values illustrated the range of values of individual hunters. Median values for scenarios 1, 2, and 3 for deer and moose hunters were negative suggesting that over half of these individuals would not be willing to incur the extra costs to visit these sites. However, in the overall population of hunters the gain in values for some outweigh the loss for others, as illustrated by the large positive mean values.

In order to illustrate the usefulness of these results we present a simulation of forestry impacts on big game hunting in the Millar Western-Norsask FMLA. The objective was to determine the economic effects of changes in the hunting environment in one specific area of the FMLA (Management Zone 69). Discussions with the woodland managers suggested that timber harvesting will increase access and have a positive impact on deer and moose populations. The impact of these changes can be calculated by

**Table 1. Estimated impacts (per trip) of some forest environment changes on the economic values of Saskatchewan big game hunting trips.**

Attribute	Scenario					
	1	2	3	4	5	6
Access	Limited	Improved	Improved	Improved	Limited	Improved
Game Populations	Increased	Low	Low	Increased	Increased	Increased
Congestion	Increased	Increased	Low	Increased	Low	Low
<b>Whitetail Deer Hunting Trips</b>						
Mean Value	\$ 31.96	\$ 17.79	\$ 32.03	\$ 35.75	\$ 53.01	\$ 58.22
Median Value	\$ -8.53	\$ -46.63	\$ -8.38	\$ -0.60	\$ 29.73	\$ 37.66
Standard Deviation <sup>1</sup>	\$ 5.51	\$ 3.21	\$ 5.71	\$ 6.42	\$ 9.35	\$ 10.60
<b>Moose Hunting Trips</b>						
Mean Value	\$ 69.84	\$ 29.91	\$ 55.02	\$ 85.68	\$ 115.24	\$ 136.69
Median Value	\$ -19.32	\$ -137.47	\$ -54.60	\$ 12.82	\$ 63.56	\$ 95.69
Standard Deviation <sup>1</sup>	\$ 81.19	\$ 53.21	\$ 71.70	\$ 93.17	\$ 109.53	\$ 121.86

<sup>1</sup> These were derived from Monte Carlo simulations

multiplying the estimated number of trips to zone 69 by the mean per-trip economic values in Table 1. In order to do this a number of assumptions must be made:

- 1) The number of trips taken by hunters to the zone must be determined. The hunting trip information from the surveys was used to expand the trips by survey participants to the provincial population: when expanded provincially, the 2 trips reported by the provincial sample of deer hunters and 4 trips by the moose hunters to zone 69 represent 326 deer hunting trips and 142 trips taken by moose hunters.
- 2) The post-timber harvesting environmental quality changes do not influence the overall number of hunting trips to zone 69; meaning that the environmental quality changes being suggested are not enough to provoke hunters currently using the area to hunt more, do not encourage hunters hunting in other areas of the province to hunt there, and do not induce non-hunters to take up hunting. Without this assumption, a more complex model, involving substitution of hunters over zones, would be needed to estimate the changes in the number of trips to zone 69. However, substitution effects that increase congestion faced by the hunters currently active in the zone can be examined using our results.
- 3) The quality of hunting in terms of access, congestion, and game populations in

adjoining zones in the FMLA remains constant.

#### Simulation results - Whitetail deer hunters

With improved access, increased game populations and no increase in congestion, the estimated increase in welfare for all Saskatchewan resident whitetail deer hunters can be valued at \$18,979/yr (Table 2). This benefit decreases if congestion in the region increases; the estimated decrease ranges from approximately \$7243 to \$11,654/yr. This decrease in benefits due to increased congestion demonstrates the importance of privacy (low congestion) to hunters. With unimproved access, increased game populations and no increase in congestion, the estimated increase in welfare is about \$17,281/yr. Not surprisingly, the benefits to hunters from timber harvesting without improving access are lower than the scenarios that improve access. These benefits also decrease if congestion in the zone increases.

#### Simulation results - Moose hunters

With improved access, increased game populations and no increase in congestion, the estimated increase in benefits is \$19,409/yr (Table 2). Increases in congestion reduces these benefits by \$7243 to about \$12,200/yr. With unimproved access, increased game populations and no increase in congestion, the estimated increase is \$16,364 annually. The benefits to hunters from timber harvesting without improving access are lower than

**Table 2. Annual impacts of forest environmental changes on the economic values of big game hunting in zone 69, northwestern Saskatchewan**

Attribute	Scenario					
	1	2	3	4	5	6
Access	Limited	Improved	Improved	Improved	Limited	Improved
Game Populations	Increased	Low	Low	Increased	Increased	Increased
Congestion	Increased	Increased	Low	Increased	Low	Low
Mean Values for Deer Hunters	\$ 10,419	\$ 5,800	\$ 10,442	\$ 11,655	\$ 17,281	\$ 18,980
Mean Values for Moose Hunters	\$ 9917	\$ 4247	\$ 7812	\$ 12,167	\$ 16,364	\$ 19,410

the scenarios that improve access. Increased congestion similarly reduces these benefits.

## Discussion

This study identifies a framework and method for incorporating some non-timber values in integrated forest resource management decisions. Timber harvest activities have an impact on some non-timber values that are positive and negative. We chose to examine hunting because it is relatively easy to identify individuals who use forest areas being managed for timber. Similar analyses could be conducted for other forest users as long as some idea of the impacts can be identified as attributes that affect a forest recreation experience. In the case of hunting, our research suggests that timber harvesting has indirect impacts on the hunting experience through changes in access and congestion as a result of the construction of logging roads, and game populations resulting from habitat alteration. Estimating the values of various combinations of changes in these conditions allows a ranking of management alternatives and provides insights into how timber harvesting can proceed that enhances, or at least minimizes impacts, on important uses of the forest. They also suggest hunting management options (e.g. limited entry hunts) that might be used to mitigate timber harvest effects (e.g. congestion). We provide estimates of the benefits of some of these changes for hunters and argue that forest managers should be considering these in planning activities.

Canadians are becoming more informed about environmental matters and are demanding responsible management of the environment. The use of focus groups, surveys, and other social science research methods are tools that can be used to incorporate public concerns in the management of forests and other natural resources in a structured way. Structured public involvement mechanisms, such as the survey

described in this paper, allow managers to better understand what society wants without confrontation at public meetings. They also allow input from a more representative sample of society. Continued improvements in economic methods such as the contingent behaviour method will facilitate the formal incorporation of economic benefits and the impacts of environmental changes into resource decision-making processes. The results of such surveys as the Saskatchewan hunting surveys can be used to actually examine and perhaps rank IRM approaches in terms of maximizing benefits.

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