TRENDS AND FACTORS INFLUENCING PARTICIPATION IN RECREATIONAL HUNTING IN CANADA: A DYNAMIC MODEL

Boxall, P.C.[1], DuWors, Elaine[2] and Filion, F.L.[2]

1 Alberta Fish and Wildlife Division, Edmonton, Alberta. Present address: Forestry Canada, 5320-122nd Street, Edmonton, Alberta, Canada T6H 3S5.

2 Canadian Wildlife Service, 351 St. Joseph Blvd., Hull, Quebec, Canada K1A 0H3.

ABSTRACT

Hunting participation declines in Canada appear to have begun in the late 1970s and early 1980s. A dynamic model is introduced in which this trend is explained as a result of changes in 1) social and economic factors, 2) the wildlife management regime, 3) the state of wildlife populations 4) the quality and amount of habitat, and 5) social, economic and psychological factors relating to the hunting experience. Each of these factors is explored and illustrated with examples from recent studies, as are ways in which these factors might be working in combination to influence participation. A subjective assessment of the direction of change in major factors is offered to demonstrate that there is likely no simple explanation of the decline in hunter numbers in Canada. Implications of this trend for wildlife management in Canada include 1) potential declines in license revenues and 2) increasing difficulty in using recreational hunting as a method to control animal numbers while at the same time providing recreational opportunities. Yet there is significant potential for affecting the direction of hunting trends, since interest in participating in recreational hunting has been increasing. Wildlife professionals could strive to involve themselves in identifying those groups of individuals interested in hunting and encourage them to actively participate.

1. INTRODUCTION

It is clear that participation in hunting in Canada is not increasing. What are the trends in hunting participation and what are the factors influencing these trends? What implications do changing patterns of participation have for the management of recreational hunting? The purpose of this paper is to provide management insights on these questions based on an examination of hunting trends in Canada since the 1960s and relevant recent studies which help us to understand these trends.

2. HUNTING AS A FORM OF RECREATION IN CANADA

Canada has a hunting heritage stemming from the early European settlers who colonized the land in the 17th and 18th Centuries. The early pioneer days necessitated hunting for subsistence, which was not difficult given the vast unspoiled wildlife resource. The patterns and rigours of colonization, and the history of the establishment of Canada as a nation, however, led to a somewhat unique system of wildlife and

wildland management. This system is unique in that wildlife resources are essentially publicly owned; or more formally, held and managed in trust for the people by the Crown or government of the day. This system of ownership is coupled with the fact much of Canada's land mass is publicly owned land.[1] Thus, enjoyment of the wildlife resource in Canada, whether for hunting or other uses, is facilitated by the lack of private ownership of the animals and much of the habitat in which they can be found.

Access to wildlife for recreational hunting is regulated by the government through the sale of permits or licenses and a set of associated regulations which limit harvest and access, establish seasons, and restrict the use of various weapons or equipment. It is important to note that the permit fee is set low such that an individual's income does not generally determine whether one can afford to hunt. In fact permits are not sold in economic markets so that the true value of recreational hunting is not realized. In some instances permits are allocated through a lottery because the demand for hunting is greater than the supply of animals. However, for many types of hunting the numbers of hunting permits sold is unrestricted.

This management system has led to participation by individuals from a number of socioeconomic groups found in Canadian society. However, there are some important differences between the socioeconomic profiles of hunters and the general population of Canada. These are: Canadian hunters are predominantly male; they come from all income groups; there is a greater representation of rural residents; and hunters in general seem to have less education than the general population (Filion et al. 1987). These findings parallel those found in similar studies in the United States (e.g. Porath et al. 1980).

It seems clear that actual participation in hunting in Canada is not increasing. The question arises as to whether hunting is stable or declining. This is a difficult question to answer due to the complexities of the types of hunting available, the fact that each of Canada's ten provinces has its own wildlife management regime, and a diversity of socioeconomic patterns throughout Canada that influence participation. Another important consideration is whether trends should be described using the numbers of hunting licenses sold or using answers to hunting participation questions from surveys of the general population.

We attempt to describe trends in participation in hunting various wildlife species groups in Canada using both survey and license sale data. The question of which of these two sources of participation data provide accurate estimates of hunting participation was raised by Boxall (1990). However, accurate estimates of participation are not required here since trends are of interest, and we will show that both survey and license sale information reveal similar trends in participation. Due to the limited availability of research studies, detailed information is provided on waterfowl hunting trends, and explanations of these trends will be discussed using data from some specific provinces of Canada.

The dotted lines in Figure 1 depict the pattern of hunting participation in Canada in 1961, 1981 and 1987 using survey data. During the period 1961-1981 hunting in general as well as hunting different

[1] As an example, about 90% of inventoried productive forest lands in Canada is under public ownership (see Federal Forests in Canada 1990, Forestry Canada, Ottawa).

species groups registered increased participation. The number of individuals hunting in 1981 was twice as high as in 1961. However, since the late 1970's and early 1980's the number of hunters has declined. Yet patterns can be discerned in participation rates in specific types of hunting. For example, the number of people hunting big game animals increased by about 10%, while numbers of waterfowl hunters declined by about 25%. This decline in waterfowl hunting is explored in detail in Figure 1. The solid line represents the number of Federal Migratory Game Bird permits sold from 1961 to 1989. Between 1966 and 1978 sales of licenses increased by 38%, with the year 1978 representing a peak in the number of waterfowl hunters. Since 1978, however, permit sales declined 66%. This decline is not restricted to any one area in Canada and is generally widespread.

These data on hunting in general, and waterfowl hunting in particular, identify a declining trend in participation in this activity in Canada. This decline appears to have begun in the late 1970's and early 1980's.

Participation in hunting grew at a faster rate than Canada's population during the period 1961 to 1987. The number of hunters more than doubled (112.9%) while the Canadian population increased by two thirds (63%) during this period. From 1961 to 1987 all age groups in the Canadian population grew in numbers with the exception of the age cohort 15-24 years (Figure 2). The numbers of individuals in this age group grew each year until 1980, after which they declined. This age group is of interest because numerous studies have shown that long term recruitment to the hunting population occurs with individuals of this age being exposed to hunting activity by older family members (Applegate 1977). In Canada, about 7% of individuals in this age cohort hunted in 1961. This grew to 13% in 1981 and fell to 11% in 1987. Decreases in hunting participation in recent years have been the highest among these younger Canadians, and reflect not only the impact of an aging population, but likely a decrease in the popularity of hunting among these younger individuals.

4. A MODEL FOR PREDICTING HUNTING PARTICIPATION

The trends in hunting participation described above, in concert with the history of recreational hunting in Canada, suggest that a complex dynamic model explains changes in participation in this activity. In Figure 3, we propose such a model. This model consists of a number of elements essentially arranged in two submodels: one showing wildlife and recreational hunting relationships; and another outlining some linkages between hunting and social, economic and political variables. There are four elements in the wildlife recreation participation submodel: wildlife populations, wildlife habitat, the operational wildlife management regime managed by governments, and recreational hunters. The other submodel depicts more broader societal considerations in two elements: a sociopolitical one and a social/economic one. The linkages indicated between these elements influence the number of recreational hunters participating at any given time. For example in Canada, the sociopolitical regime determines the amounts and uses of public land and also the direction and budgets of wildlife management programs. These parameters, along with various socioeconomic parameters (e.g. age, sex, income etc.), influence the number of individuals who

hunt, and the amounts and conditions of wildlife habitat and populations.

4.1 Social and Economic Factors

In Table 1 we provide a list of variables that could be significant factors influencing participation in hunting activities in Canada. In most cases these variables can be measured or are known to management agencies concerned with hunting participation levels. The first group (Table 1) represents a collection of social and economic variables. These include the demographic characteristics of the population from which hunters come, economic variables that influence costs associated with hunting, and a number of attitudinal or cultural variables.

An example of using some of these variables to estimate participation levels in hunting is shown in Table 2 with a logit model.Logit models are commonly used for estimating the influence of variables in binary participation decisions (i.e. yes/no decisions), and have been used by a number of researchers in studies of wildlife-related recreation (e.g. see Walsh et al. 1989; Ribaudo and Piper 1991). We estimated our model using data from the Canadian province of Alberta to measure the significance of some of the sociodemographic variables described above in influencing the probability of participation in hunting in a given year (Table 2). This modelling exercise is preliminary because we need to consider a number of supply and price variables in the model for which information is not available at present. The model we tested was statistically significant and correctly predicted over 86% of the individual's actual participation in our sample. The results suggest that the sex, level of education, and residence (whether rural or urban) of an individual were statistically significant variables influencing the probability of hunting. This information provides useful predictions of hunting participation levels as these variables change: for sex, an increase in the ratio of males to females in the provincial population would have a positive effect on participation levels; for education, the fewer the years of formal schooling, the higher the probability of participation; and if the ratio of urban to rural people in the population increased, one would expect fewer hunters. The partial derivatives reported in Table 2 indicate the magnitude of the change in the probability of participation as an individual variable shifts while others remain constant. Although this model is preliminary in that information on a number of variables was not available, it indicates to wildlife management professionals a technique that could be useful in interpreting the effects of sociodemographic trends on participation in hunting.

4.2 Wildlife Management Factors

The second group of factors reported in Table 1 are related to the wildlife management regime in which wildlife management professionals operate. In a number of cases participation may be related to aspects of the hunting regulations established by the management agency. Although in a number of cases these are goal-oriented, and are generally related to the size and biological "quality" of wildlife populations, a number of specific regulations can potentially influence participation in recreational hunting. In many cases some of these variables could be or actually are used to limit or increase hunter numbers (e.g. license

prices: Anderson et al. 1985; Boxall 1989). However, in Canada hunting regulations are enacted with little consideration paid, at least formally, to their impact on the participation levels of hunters.

A number of Canadian studies have investigated some aspects of hunting regulations in relation to their impact on hunting participation. Boxall (1989), using time series analyses, showed that the price of a license, previous waterfowl harvest success, weather, and an index of breeding habitat quality, affected the number of migratory game bird hunting licenses sold. He argued that arbitrary increases in the price of hunting licenses may affect participation levels to such an extent, that the revenue derived from their sale may in fact drop (see also Anderson et al. 1985). Filion and Parker (1984) found that insufficient enforcement of hunting regulations was a concern among some migratory game bird hunters. However, this concern was not a major factor influencing dissatisfaction with their hunting experience. In this case one could argue that inadequate enforcement may not be a major concern affecting migratory game bird hunter participation.

We believe that studies of the effect of various wildlife management variables on participation levels should be an important part of wildlife management decisions in Canada. Hunting regulations in Canada are dynamic, and are frequently set with the condition of the wildlife populations a primary input in the decisions made by game biologists.

However, in Canada political support for wildlife management programs involves some support by hunters. This is identified in the model with two-way arrows linking these components. This linkage, coupled with the fact that hunters directly fund a number of management programs in Canada, argues for the importance of studying the relationships between participation rates, regulations and other management variables.

4.3 Wildlife Population and Habitat Factors

The next two groups of factors in the model relate to wildlife populations and their habitat (Table 1). A number of these factors are in fact what wildlife or game biologists study frequently in their daily activities, and thus a number of these are measurable. Habitat factors, however, are complex and are beginning to receive much attention in Canada at the present time. Patterns of land use that conflict with wildlife interests including agriculture, forestry, and industrial pollution, combine to affect the amounts and quality of land suitable for wildlife populations.

4.4 Personal and Psychological Factors

Finally, there are a diversity of variables that affect an individual hunter directly to influence the probability that he/she will participate in any given year. Some of these are displayed in Table 1. A number of these are beyond the control of the wildlife management agency (e.g. leisure time) and are difficult to assess in terms of modelling exercises. However, our research efforts in Canada have revealed that the majority of hunters participate in many other wildlife-related activities such as fishing and bird-watching. These activities may have a positive effect on the probability of participation in hunting

and argue for the strong influence of outdoor recreation and interest in wildlife as major motivating factors behind participation in hunting. If hunting is declining, a salient question becomes the identification of factors that are preventing these particular individuals from becoming involved in hunting.

Table 1. A List of Potential Factors Influencing Participation of Canadians in Recreational Hunting

Social and Economic Factors

Age of the Population
Male-Female Ratio
Urbanization
Amounts and Content of Education
Levels of Personal Income
Costs of Hunting Equipment
Costs of Travelling to Hunting Sites
Degree and Visibility of Anti-Hunting Sentiments
The Number and Types of Substitute Recreational Activities

Wildlife Management Factors

Complexity of Regulations (e.g. Seasons and Bag limits)
Stability of Regulations
Severity of Regulation
The Price of Licenses or Permits Charged by the Agency
Availability and Quality of Education and Information Materials
Levels of Enforcement of Regulations
Stocking Rates and Locations of Harvestable Game

Wildlife Population Factors

Population Levels of Game Animals
Species Diversity
Sex and Age Structures of Game Populations
Breeding Success
Diseases and Predation

Wildlife Habitat Factors

Habitat Quality
Amounts of Habitat

Factors Relating to Hunters

Amount of Leisure Time
Harvest Success Levels
Amounts of Time Required to Harvest Animals
Average Daily Expenditures while Hunting
Availability of Hunting Sites
Distance between Residence and Hunting Sites
Satisfaction with Regulations
Quality of Hunting Experiences
Availability of Suitable Hunting Companions

Table 2. A Probability of Participation in Hunting Equation Estimated Using a Logit Model with Alberta Data from the 1987 Survey on the Importance of Wildlife to Canadians (N=6387).

Independent Variables[1]	Coefficients	Mean Values	Partial derivatives[2]
Intercept	-2.0470*		
Sex	2.2690*	0.4889	0.14661
Age	-0.0007	39.0795	-0.00005
Age Squared	-0.0004	1773.50	-0.00003
Education	-0.2160*	2.6721	-0.0139
Personal Income	0.000002	16870.0	0.0000001
% Correct Predictions	81.3		
Log Likelihood	3732.83		
Chi Square	916.511 (6 df)		

* Signifies statistical significance at the 5% level.

1 The variables age and income used were midpoints of categories from an ordinal scale variable. Education is an ordinal scale variable. All others are nominal scale variables with values coded as one of two choices: for sex, male=1 and female=0; for residence, urban=1 and rural=0.

2 The partial derivative for variable x_i is $\partial p/\partial x_i = p(1-p)\beta_i$, where p=0.692 and is the probability of participation estimated using the logit model evaluated at the means, and β_i is the appropriate coefficient.

4.5 Potential Influences on Behavior

Economists commonly investigate the importance of specific variables in some participation decisions. They routinely include variables such as: distance between home and hunting grounds, expenditures, and harvest success in econometric models explaining the frequency of participation in recreational activities, including hunting. These efforts have identified that distance, for example, is consistently significant in describing the frequency of participation in hunting and/or aspects of the importance of hunting to an individual's welfare (see Sorg and Loomis 1984; Donnelly et al. 1985; and many others). Current efforts are now being directed to assessing perceptions of the quality of particular hunting sites, how quality relates to the value of a hunting trip, and how aspects of quality can be controlled by wildlife managers. An example of this work is Coyne and Adamowicz (1992) who showed that the density of animals, hunter congestion, and the price of travelling between home and hunting sites, affected the probability of bighorn sheep hunters selecting particular sites. These variables, in concert with information on access, hunting regulations, and amounts of wilderness, were used to construct a model that explained the participation and activity of sheep hunters at ten sites in Alberta.

Perception of the quality of past and present hunting experiences are thought by many researchers to be a major factor in future hunting participation decisions. Wildlife managers commonly use hunting days and harvest success as indicators of the activity and benefit of a hunting experience. However, a number of studies in the United States have identified factors such as companionship, nature, and urban escapism as important features of the satisfaction of hunting experience (see Gilbert

1977 for examples). Similar studies in Canada are uncommon. The most notable is Filion and Parker (1984) who studied migratory game bird hunters. These studies identified that gaining access to hunting sites, congestion at available sites, costs, and distances travelled, were more important factors influencing satisfaction than availability of birds or harvest success.

Table 3. Summary of the Direction of Change for Some Types of Hunting in Canada with Some Explanatory Factors

Hunting Activity	**Direction of Change**
Participation in Recreational Hunting of Waterfowl	↓
Participation in Big Game Hunting	stable
Participation in Small Game Hunting	↓
Factors that Influence Participation	**Direction of Change**
SOCIAL/ECONOMIC FACTORS	
Age of the Population	↑
Urbanization	↑
Education	↑
Personal Income	↑
Costs of Hunting	↑
Recreational Substitutes for Hunting	↑
WILDLIFE, HABITAT AND MANAGEMENT FACTORS	
Complexity and Severity of Regulations	↑
Prices of Hunting Licenses	↑
Amounts and Quality of Habitat	↓
Population Levels of Game Animals	?
FACTORS RELATING TO HUNTERS	
Leisure Time	↓
Proximity and Numbers of Hunting Sites	↓
Quality of Hunting Experiences	?
Satisfaction with Regulations	?

In summary, we have identified a variety of factors that in concert, identify a complex model explaining participation rates of Canadians in recreational hunting. These factors are changing over time, and there is likely no simple explanation of the declining trend in hunter numbers in Canada at the present time. In Table 3 we attempt to summarize the trends in participation in hunting in Canada and changes in a number of elements that we feel are contributing to these trends. We also reveal some factors that are important, but that sufficient information is not available to determine a direction of change. There

are a number of factors identified in Table 3 where wildlife managers can play a key role. These include the severity and stability of regulations, license prices, and information and educational materials and programs offered to actual or potential hunters.

5. IMPLICATIONS OF POTENTIAL DECLINES IN HUNTING IN CANADA

At the present time, implications of declines in recreational hunting relate to the effectiveness of wildlife management in Canada. Currently, there are a number of wildlife programs that are funded from revenues generated through the sale of recreational hunting licenses[2]. Declines in hunter numbers will seriously impact the revenues used by these wildlife programs and could be perceived by decision makers as a decline in public support for hunting. This will in turn impact the effectiveness of the activities of wildlife professionals who use or depend on these programs. The growing importance of license revenues in supporting wildlife management activities in Canada should point to more careful scrutiny in the setting of fees and in considering the needs of the clientele who pay them (i.e. hunters); something very few wildlife agencies are doing in Canada.

Recreational hunting has also been an effective and relatively inexpensive method to control animal numbers while at the same time providing a diversity of recreational benefits to individuals interested in the outdoors. As participation declines, hunting as a management tool may be disappearing as an option in the control of problem wildlife species. If management agencies were to regulate animal numbers directly, more funds and manpower would have to be diverted from other sources.

The information summarized in this paper does not paint an optimistic future for recreational hunters to enjoy the primary role they once had in influencing the direction and significance of wildlife management in Canada. Yet there is potential for things to be quite different. Wildlife-related recreation is undergoing change: participation in nonconsumptive activities such as viewing or studying wildlife is growing faster than Canada's population, while participation in hunting is falling behind (Filion et al. in press). Despite this falling participation, however, interest in hunting participation has been increasing. In 1981, 3.5 million Canadians declared they were interested in participating in hunting. In 1987, this interest had grown to 3.7 million. That's more than twice as high as the actual hunting participation of 1.7 million in 1987.

Although most factors identified in Table 3 that can explain hunting participation are beyond the control of the wildlife management regime, some others (e.g. license prices) are established directly or indirectly by wildlife management professionals. Given the current state of wildlife management in Canada and known public interest in this activity, wildlife professionals should be concerned with the levels of participation in hunting, and could strive to involve themselves in

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[2] An example of such a program in Canada is the funding of the activities of Wildlife Habitat Canada through sales of the Migratory Game Bird Hunting Permit across the country. In Alberta, hunting license revenue in 1991 will be used to directly fund: The Buck for Wildlife Program, Report a Poacher Program, Fisheries Enhancement Fund, North American Waterfowl Management Program, and several others.

areas which can allow people interested in hunting to participate directly.

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FIGURE 1

HUNTING TRENDS IN CANADA

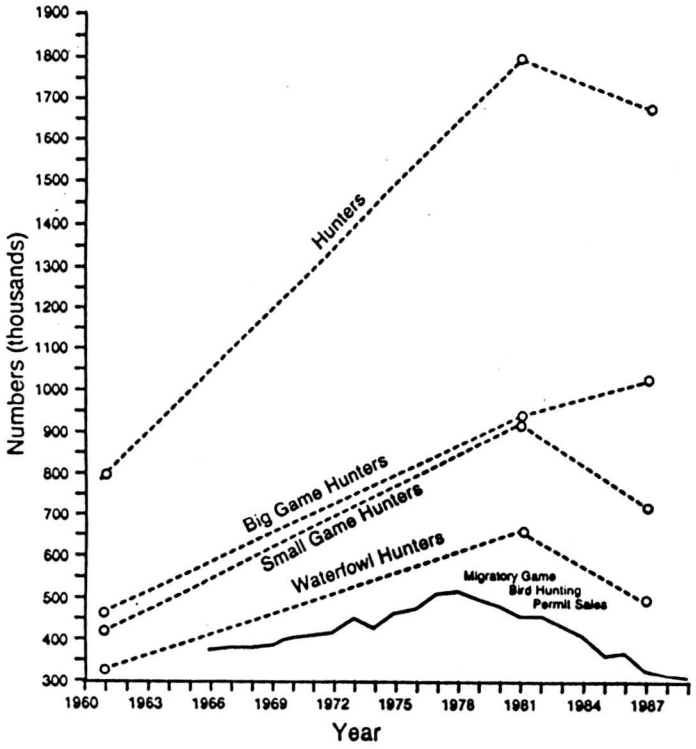


FIGURE 2

GROWTH OF CANADA'S POPULATION 15 YEARS OF AGE AND OVER

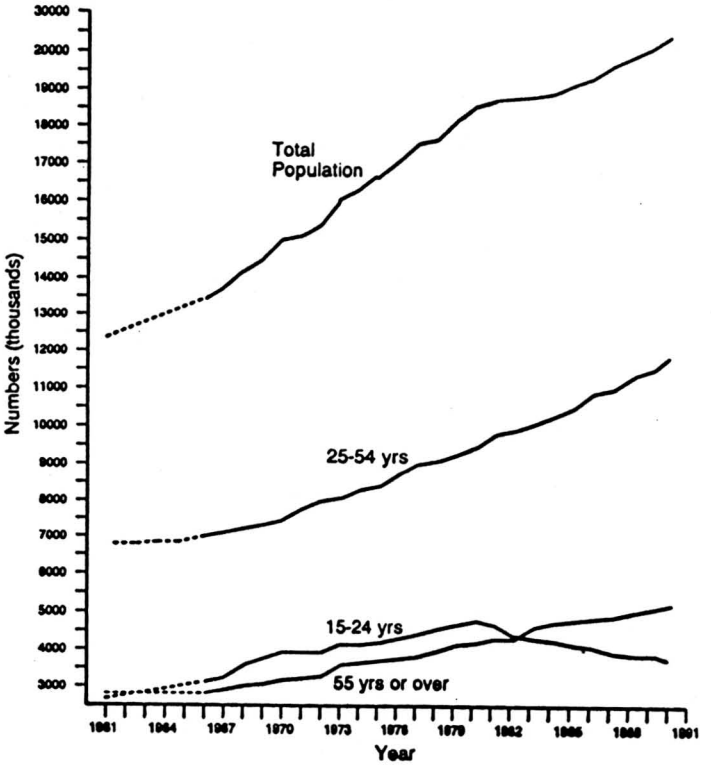
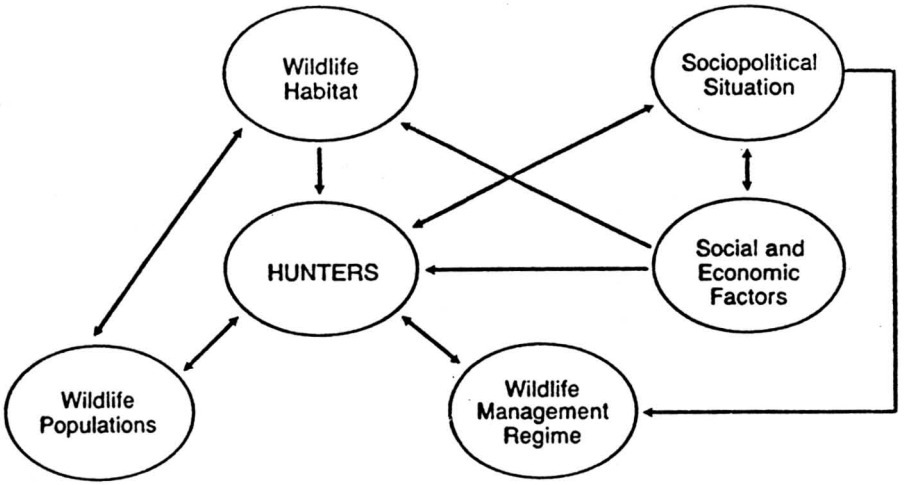


FIGURE 3

A MODEL OF RECREATIONAL HUNTING PARTICIPATION IN CANADA



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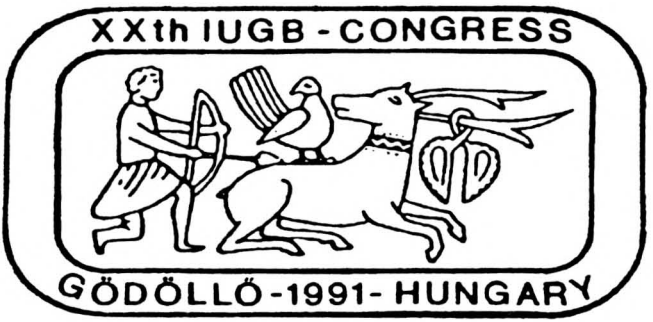

Part 2

Edited by

Sándor Csányi

and

József Ernhaft

University of Agricultural Sciences

Gödöllő, Hungary

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