

INTEGRATING SOCIAL CONSIDERATIONS INTO MANAGING WHITE-TAILED
DEER IN MINNESOTA

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Dedication

This dissertation is dedicated to my parents, Marie (deceased) and Fred Cornicelli, and my daughter Teresa. My mother passed away in September 2008 and as of this writing my father is dealing with health challenges that are far more important than my work. No matter how far I moved away from home, my mom and dad were always close. Their unwavering support for my endeavors helped shape who I am today and I hope to instill those same values in my daughter as she chooses her own path. Teresa, I know the past few years have been difficult and you're in the process of finding your place in this world. Even though I'm an adult, I really do understand. Just know that I'll always be there and it will turn out just fine.

Table of Contents

Acknowledgements	i
Dedication.....	ii
Table of Contents	iii
List of Tables	v
List of Figures.....	vii
CHAPTER 1	
Introduction and Overview.....	1
Introduction	2
Minnesota Deer Management History.....	3
Wildlife Agency & Deer Regulation Changes: Lessons from other States.....	5
Experimental Management.....	7
Study Purpose and Overview	9
Integration of Social Science and Biological Data.....	10
CHAPTER 2	
Implementing a stakeholder based process for determining deer population goals in Minnesota	14
Introduction	16
Literature Review	17
Carrying Capacity.....	17
The Evolution of Public Participation in Wildlife Decision-Making.....	19
Methods	23
Framework.....	23
Stakeholder Identification, Solicitation, Team membership, and Expectations.....	23
Meetings	25
First Meeting	25
Second Meeting	27
Public Participation	28
Web-based public input.....	28
Internal Evaluation	29
Results	30
Stakeholder Teams	30
Team versus Public Recommendations.....	31
DNR Management Direction.....	32
Discussion.....	32
Management Implications	34
CHAPTER 3	
Assessing support for deer harvest regulation changes in Minnesota.....	38
Introduction	41
Background.....	42
Hunting Satisfaction and Regulations	43

Measuring Support and Preferences for Regulations	45
Methods	47
Sampling and Data Collection.....	47
Survey Instrument	48
Support for Alternative Regulations.....	49
Scenarios and Choices	49
Data Entry and Analysis.....	52
Results	53
Response Rate	53
Demographics and Hunting Background	54
Support for Alternative Regulations.....	54
Early antlerless season.....	55
Antler-point restriction	55
Earn-A-Buck.....	56
Cross-Tagging	56
Adjusting season timing	57
Buck license lottery	57
Regulatory preferences among individuals who supported more antlered bucks.....	58
Ranked Choice Survey Data Analysis - Individual Scenarios	58
Scenario 1 – Deer population is within goal levels	58
Scenario 2 – Deer population is 25% above goal level	60
Scenario 3 – Deer population is 50% above goal level	61
Scenario 4 – Deer population at or below goal, high buck harvest rates, limited antlerless permits.....	62
Scenario 5 – Various antler point restriction regulations	64
Discussion.....	65
Management Implications	68

CHAPTER 4

Satisfaction and Participation Among Hunters Participating in Deer Hunts with Special Regulations	91
Introduction	93
Literature Review	95
Motivations.....	95
Satisfaction	96
Participation.....	98
Research Framework and Hypotheses.....	99
Methods	100
Mail Survey Methods	100
Data Collection Instrument.....	101
Variable Measurement and Model Development.....	102
Data Analysis.....	104
Results	106
Antler Point Restriction Hunters - Itasca State Park	106

Response Rate	106
Respondent Characteristics	106
Regulatory Support, Overall Satisfaction, Participatory Intent, and Descriptive Statistics	107
APR Index Model Scale Development.....	107
Path analysis	108
Early Antlerless Hunters.....	110
Response Rate	110
Respondent Characteristics	110
Regulatory Support, Overall Satisfaction, Participatory Intent, and Descriptive Statistics	111
EA Index Model Scale Development	112
Path analysis	113
Earn-A-Buck Hunters (St. Croix State Park)	115
Response Rate	115
Respondent Characteristics	115
Regulatory Support, Overall Satisfaction, Participatory Intent, and Descriptive Statistics	116
EAB Index Model Scale Development	116
Path analysis	117
Discussion and Implications.....	119
 CHAPTER 5	
Conclusions, Implications, and Future Research	149
Management Recommendations and Policy Implications.....	151
Attributes of a Successful Deer Program	152
Hunting Participation.....	152
Strive for Long-Term Satisfaction.....	153
Offer Consistent Hunting Opportunity	155
Obtain Regulation Support	156
Offer License and Season Flexibility	157
Research Limitations and Future Research	157
Conclusions	160
References	162
 Appendices	
Appendix A 2005 Regulatory Choice Survey	183
Appendix B Scenarios and Choices Presented to Hunters on the 2005 Regulatory Preference Survey.....	194
Appendix C Antler Point Restriction survey at Itasca State Park , 2005 – 2007	204
Appendix D Early Antlerless Survey , 2005 – 2007	216
Appendix E Earn-A-Buck Survey at St. Croix State Park, 2005 – 2007	228
Appendix F Minnesota Deer Hunter Control Survey, 2005 – 2007	240

List of Tables

Table 1.1 Location of alternative deer regulations in Minnesota.	12
Table 3.1 Percent support for regulations that would increase the number of mature bucks in local deer populations, Minnesota, 2005.	70
Table 3.2 Percent support for each regulatory alternative presented to Minnesota deer hunters, 2005.	71
Table 3.3 Percent support for alternative deer management regulations in Minnesota, by survey strata, 2005.	72
Table 3.4 Percent support among respondents indicating their relative support for regulations that promote more adult bucks in the deer population, by survey strata, Minnesota, 2005.	73
Table 3.5 Percent support for alternative deer regulations among people who supported more antlered bucks, Minnesota, 2005.	74
Table 4.1 Response rates for each survey.	123
Table 4.2 Comparison of satisfaction-related variables for Itasca State Park respondents in 2005, 2006, and 2007.	124
Table 4.3 Reliability, factor analysis of scales, and average variance extracted for variables used to measure Itasca State Park hunt participation.	126
Table 4.4 Harvest intentions and ultimate behavior of hunters that participated in the early antlerless deer hunts, 2005 - 2007.	129
Table 4.6 Reliability, factor analysis of scales, and average variance extracted for variables used to measure Early Antlerless hunt participation.	132
Table 4.7 Comparison of satisfaction-related variables for Earn-A-Buck respondents in 2005, 2006, and 2007.	134
Table 4.8 Reliability, factor analysis of scales, and average variance extracted for variables used to measure Earn-A-Buck hunt participation.	136

List of Figures

Figure 1.1 Hypothetical tradeoff curve between the effectiveness of deer harvest regulations as measured against regulatory support from hunters.	13
Figure 2.1 Schematic for developing a stakeholder-based process to establish deer population objectives.	36
Figure 2.2 Deer goal setting blocks evaluated during 2005 – 2007. Red lines are ecological classification boundaries.	37
Figure 3.1 2004 Minnesota Permit Areas with Choice Survey Regions.	75
Figure 3.2 Schematic used to distribute deer hunter choice scenarios using the randomized incomplete block design for 7 choices	76
Figure 3.3 Two-level nested structure for choice scenario 1.	77
Figure 3.4 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the nested-logit model fitted to the top ranked alternative for scenario 1	78
Figure 3.5 Two-level nested structure for choice scenarios 2 (25% reduction) and 3 (50% reduction).	79
Figure 3.6 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the nested-logit model fitted to the top ranked alternative for scenario 2	80
Figure 3.7 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the nested-logit model fitted to the top ranked alternative for scenario 3.	81
Figure 3.8 Two-level nested structure for choice scenario 4.	82
Figure 3.9 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the nested-logit model fitted to the top ranked alternative for scenario 4.	83
Figure 3.10 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the multinomial logit model fitted to the top ranked alternative for scenario 5.	84
Figure 4.1 Hypothesized structural equation model predicting intention to participate in future APR, EA, and EAB hunts.	139
Figure 4.2 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2005 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future antler point restriction hunts for best-fit model ($n = 336$).	140
Figure 4.3 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2006 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future antler point restriction hunts for best-fit model ($n = 296$).	141
Figure 4.4 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2007 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future antler point restriction hunts for best-fit model ($n = 274$).	142

Figure 4.5 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2005 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future early antlerless hunts for best-fit model (n = 363).	143
Figure 4.6 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2006 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future early antlerless hunts for best-fit model (n = 419).	145
Figure 4.7 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2007 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future early antlerless hunts for best-fit model (n =655).	145
Figure 4.8 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2005 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future earn-a-buck hunts for best-fit model (n =196).....	146
Figure 4.9 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2006 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future earn-a-buck hunts for best-fit model (n =197).....	147
Figure 4.10 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2007 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future earn-a-buck hunts for best-fit model (n =186).	148

CHAPTER 1

Introduction and Overview

Introduction

The recovery of white-tailed deer (*Odocoileus virginianus*) from near extirpation is one of the most successful stories of contemporary wildlife management. As a result of season closures, reintroduction programs, and conservative hunting, white-tailed deer populations in the United States have increased to record levels (Warren, 1997).

Traditionally, agencies have relied heavily on the opinions of deer hunters when setting harvest quotas and population objectives (Lauber & Brown, 2000) and recreational hunting has served as the primary management mechanism to regulate deer populations (Woolf & Roseberry, 1998). The direction and support received from hunters regarding increasing game abundance has been successful to the point that managers must now look at programs that reduce the abundance of some game species (Holsman, 2000). Indeed, Brown et al. (2000) provided a thorough review of the stepwise progression of deer management. They noted that management has progressed through several stages beginning with closed seasons designed to establish populations to more contemporary management where deer populations are managed to reduce or maintain population densities. The current study focuses on understanding what deer hunting regulations can be adopted by state wildlife agencies that would have broad public support and be effective at achieving desired population goals.

At the broad landscape level, a variety of factors (e.g., habitat quality, hunter density) can affect deer vulnerability and hunter effectiveness. One of the primary issues with managing overabundant deer populations is obtaining an adequate harvest to stabilize or reduce deer numbers (Brown et al., 2000). In a Canadian study, Giles and

Findlay (2004) found that manipulating antlerless harvest by dramatically increasing antlerless tags was not possible. Consequently, the ability to reduce deer numbers by markedly increasing antlerless harvests was unlikely because there were minimal increases in antlerless harvests after 40% of hunters had antlerless tags. Canadian authorities, however, did not alter its seasonal framework—it only manipulated the number of antlerless tags during their study, which is a similar deer management approach to the one currently used in Minnesota.

Minnesota Deer Management History

White-tailed deer are the most abundant big game species in Minnesota. As early as 1858, deer populations were managed through regulated hunting. In 1923, deer hunting seasons were closed in farmland area and remained closed until 1946 (Berner & Simon, 1993). During the same period, deer were more abundant in the north and seasons were not closed; thus, a more clearly defined deer hunting tradition developed in the northern forests than in other regions of Minnesota. The first statewide, any-deer season occurred in 1946 and since that time, deer populations have fluctuated throughout the state in response to changing habitat, patterns of winter severity, and hunting harvest. These factors contributed to forced season closures in the early 1940s and 1951. The statewide deer population ultimately declined enough in the late 1960s to warrant a deer season closure in 1971 (Berner & Simon, 1987).

During the 1970's, the Minnesota Department of Natural Resources (DNR) developed a management framework that allowed hunting to occur each year while concurrently increasing the statewide deer population. The new system heavily exploited bucks but limited antlerless deer harvest to people who had successfully obtained a

permit through a lottery system (Berner & Simon, 1987). While the hunting zones, season lengths, and opening dates have changed slightly over the years; the current seasonal framework generally reflects the system developed in the 1970's. Essentially, a hunter who purchased a license for a particular hunting zone could take a buck within the legal season for that zone or could take an antlerless deer by permit in a "lottery" permit area. The antlerless permit quota was determined based on the overall deer population relative to the population goal and hunter success rates. In most cases, demand for antlerless permits had typically exceeded supply in most permit areas. For this reason, a lottery preference system has been utilized since the early 1980s so that antlerless permits were equally distributed among hunters through time.

Beginning in the 1990s, DNR allowed for issuance of additional antlerless only permits to help reduce deer populations in permit areas that exceeded established goals. In 2003, the first major change since 1978 occurred when the previously described 'buck' license allowed for a hunter to take a deer of either-sex in any area that allowed for over-the-counter antlerless permits. In other words, in many parts of Minnesota hunters were no longer required to harvest a buck on their main license, which should have the effect of shifting harvest to antlerless deer (e.g., fewer regulatory restrictions).

Minnesota's deer program has been a success story based on hunter numbers and deer harvests. Minnesota firearms deer hunter numbers have grown tremendously over the century and so have deer harvests. Furthermore, the current framework has, for the most part, brought stability to deer population management relative to previous decades when liberal seasons were often followed by season closures. Population management through season structure and regulation beginning in the mid-1970s gradually increased

the proportion of adult female deer in Minnesota's deer population. These changes in sex ratios, along with winter weather patterns, have been the most significant factor in growing deer populations over time.

Wildlife Agency & Deer Regulation Changes: Lessons from other States

Few states have conducted scientific studies to quantify the effects of alternative hunting regulations, and/or adjustments in seasonal framework, and different licensing systems have on antlerless harvests. Wisconsin created an October/December antlerless only season (Zone-T Season) and uses earn-a-buck (EAB) regulations during the deer season in attempts to maximize antlerless harvests. The Wisconsin Zone-T season occurs 4 days each in October (pre-general season) and December (post-general season) with the majority of harvest occurring during the October portion of the season. Conceivably, a portion of the antlerless deer would have been harvested during the general hunting season (e.g., compensatory numerical harvests) but no attempts have been made to quantify compensatory effects. In 2000, Wisconsin prescribed an EAB regulation where hunters had to first harvest and register an antlerless deer prior to harvesting a buck. Numerical antlerless harvests increased 48% over the antlerless harvest in 1999 when EAB regulations were not implemented. However, Wisconsin hunters do not support either early antlerless or EAB regulations (Dhuey, 2007).

Antler-based protection of male deer has been used by several states to reduce harvest pressure on yearling males (1.5-year-old) with the objective of recruiting more males into older age classes (Strickland et al., 2001). These selective harvest regulations, typically called antler point restrictions (APR) have been used in Arkansas, Colorado, Mississippi, Missouri, and Pennsylvania as part of their general deer management

programs. Arkansas implemented a three-points-to-a-side restriction in 1998 (Arkansas Game and Fish Commission, 1999); Colorado has attempted a variety of APR regulations for mule deer (*O. hemionus*) since 1985 (Carpenter & Gill, 1987) Mississippi began protecting males with less than one four-point antler in 1995 (Demarais, Strickland, & Castle, 2005); Missouri is currently testing a 4-point antler restriction that began in 2004 (L. Hansen, Personal communication); and Pennsylvania adopted a statewide 3- and 4-points-to-a-side restriction (3-point in forests, 4-point in farmlands) in 2002 (M. D. Grund, personal communication).

All states except Colorado offered liberal opportunities for hunters to harvest antlerless deer while testing APR regulations and Arkansas, Mississippi, and Pennsylvania estimated 15 - 25% increases in annual numerical antlerless harvests under APR regulations (M. D. Grund, personal communication). Interestingly, the concept of protecting the yearling cohort may not recruit more mature males in population; in fact, in some cases it may have the opposite effect. In Mississippi, researchers noted a decline in average antler size for bucks on a variety of different soil types (Demarais et al., 2005). In Northwest Florida, Shea and Vanderhoof (1999) observed a decline in mean antler size of 2.5-year males because larger 1.5-year old males were removed and smaller antler males were protected. The premise being that an APR regulation may have the effect protecting the smaller segment of the yearling buck population, while harvesting the bigger yearlings. Strickland et al. (2001) reported that APRs may have a negative effect on long-term antler characteristics and should only be viewed as a temporary solution to chronic age-structure problems.

Preliminary results from Pennsylvania suggest: (1) hunters rarely mistake protected bucks for legal bucks, (2) yearling buck harvest mortality reduced from >~80% to about 50%, (3) harvest mortality is very high on legal bucks—almost 100% harvest mortality on legal bucks in fragmented, farmland landscapes, (4) statewide antlerless harvests increased by about 20%, and (5) hunter satisfaction in hunting regulations and the deer program increased over a 3-year period after APR regulations were initiated (M. D. Grund, personal communication). To date, there have been no peer-reviewed publications regarding Pennsylvania's APR regulations; however, Frye (2006) has deftly summarized the trials and tribulations associated with enacting those regulations.

Experimental Management

As Minnesota moves from a more conservative deer management program towards a more liberal framework based on harvesting antlerless deer, there is an increased need to gather accurate hunter survey information. Regulations that impose restrictions by requiring antlerless harvest (e.g., earn-a-buck) or protect a segment of the antlered male population (e.g., antler point restriction) likely cannot be implemented without broad public support and a thorough examination of the policy trade-offs. For example, in 2001, Minnesota deer hunters were surveyed to ascertain knowledge and support of regulations. In general, hunters were unfamiliar with DNR management programs, knew very little about quality deer management, and generally believed there were adequate: (1) numbers of deer, (2) season length and timing, and (3) hunter numbers (Duda, 2002). Fulton, Bruskotter, and Cornicelli (2004) surveyed hunters in northwest Minnesota and found similar results to the 2001 deer hunter survey. In general, hunters wanted to manage for more mature bucks in the deer population (60%)

but no single regulation achieved more than 49% support. These findings underscored the need for a more comprehensive instrument to collect information concerning both hunter satisfaction and preferred choices for what appear to be unpopular regulatory alternatives. This structured consideration of advantages, disadvantages, and trade-offs may contribute to more effective policy outcomes (Steelman & Ascher, 1997).

Walters and Green (1997 p. 988) cogently described management by saying, "None would argue that natural resources management is an adaptive learning process, where effects of each management action are complex and uncertain so that experience with the practice of management is necessary to discover better ways of doing it." Given the wicked nature of natural resources management problems (Nie, 2004; Rittel & Webber, 1973), our research may be partially confounded because we cannot fully identify the unknowns. For example, Kilgore, Snyder, Schertz, and Taff (2008) noted a high financial cost associated with acquiring private land access for deer hunting. The access issue is difficult to quantify as there may be a net reduction in regulatory effectiveness if the goal is to reduce populations and access is restricted.

Walters and Holling (1990) suggested that policy is politics and acceptance of a management policy occurs when solutions and problems are sufficiently credible. While we made professional assessments of suitable regulatory alternatives based on our experience and the literature (Chapter 3), we were unable to evaluate the entire combination of regulatory alternatives, thus the possibility exists that we may have omitted a possibly effective regulation. Our intent was to create a research project that examined numerous facets related to the human dimensions of deer management and the integration of biologically-relevant alternatives. Patton and Sawicki (1993 p. 3)

identified 6 steps to the problem-solving process: (1) define the problem, (2) determine evaluation criteria, (3) identify alternative policies, (4) evaluate alternative policies, (5) select preferred policy, and (6) implement preferred policy. Chapter 2 addresses problem definition by establishing deer population objectives. Chapter 3 determines both the evaluation criteria and identifies alternative policies, while Chapter 4 evaluates the alternative policies (regulations). It is anticipated that DNR leadership will use the information generated in this dissertation to (5) select and (6) implement regulations based on population objectives and hunter acceptance; thus, this dissertation should be viewed as a statewide analysis of deer management policy.

Study Purpose and Overview

The present research is part of a larger study to examine the effects of experimental deer regulations on both deer populations and hunters. This larger study was segregated into 2 components: (1) biological evaluation of regulations, and (2) determination of deer population objectives and the social implications of proposed and implemented regulations. In 2005, regulations on 7 state parks and 8 deer permit areas were modified on an experimental basis to test APR, earn-a-buck (EAB), and early antlerless deer hunting regulations (Table 1.1).

Despite the volume of research that has been conducted on topics related to deer and deer management, there is no published research project that examined deer management at the statewide level, starting with the establishment of population objectives and ending with evaluating regulations that were ultimately implemented. The specific goals of the study were to:

1. Develop a public participation process that established deer population objectives throughout Minnesota's deer permit areas,
2. Describe Minnesota deer hunter attitudes and their support for regulatory alternatives. Our goal was to develop a process and supporting methodology for designing deer hunting regulations that are effective at achieving management objectives while being broadly supported by the hunting public,
3. Over a 3-year period, describe satisfaction, regulatory support, intentions to participate in future years, and make comparisons between hunters participating in hunts with experimental regulations.

Data for chapter 2 were collected through a self-administered mail-back survey of Minnesota deer hunters. Data for chapter 3 were collected over a 3-year period from hunters participating in APR, EAB, and early antlerless regulations using self-administered mail-back surveys. Each year, an additional questionnaire was distributed to a control group and was used as a comparison to the treatment groups. In total, 12 surveys were used in the chapter 3 data analysis. While the following 3 chapters had independent options, collectively they contribute to the overall goal of the research, which was to develop statewide deer population objectives and make recommendations on harvest strategies to achieve those objectives.

Integration of Social Science and Biological Data

This research will enable the DNR to develop a decision-making model that integrates the social science research with the biological implications of deer harvest regulations. Rather than independently using the established multiple satisfaction approach (social) and population trends (biological), we envision an adaptive

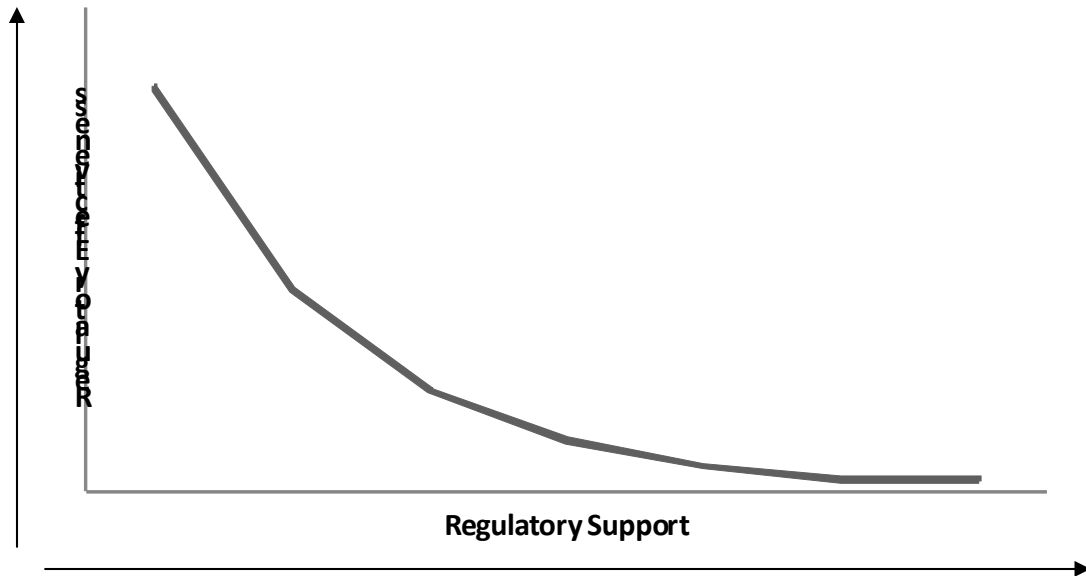
management strategy, similar to the one used in waterfowl harvest management (Williams & Johnson, 1995). Such a system would use the DNR goal-setting process to define socially acceptable deer densities on the landscape. Concurrently, management strategies would be developed that achieve those population objectives (e.g., increase, lower, stabilize) by employing harvest regulations that are both effective and have public support. Figure 1.1*a* represents a theoretical curve where less effective regulations may be more acceptable than a more effective regulation. Conversely, Figure 1.1*b* might represent a “desired” situation where regulations that are the most biologically effective might have the least support and that there is a near linear tradeoff between effectiveness and support. The “desired” situation may be one where public support increases as the effectiveness of regulations to achieve desired outcomes increases.

As policy decisions have wide-scale political ramifications, the DNR would be ill-served to use harvest regulations that may achieve population objectives but have low public support. Regulations constructed in that fashion are vulnerable to legislative scrutiny and laws may be enacted that effectively remove tools from the manager’s toolbox. For example, the Wisconsin DNR recently lost the ability to use EAB as management strategy to control deer populations across most of the state even though the regulation was proving effective. Conversely, traditional management strategies that rely on limited antlerless harvest or increasing permit quotas have not been effective in managing over abundant deer populations in Minnesota and it is widely recognized that new harvest strategies must be developed.

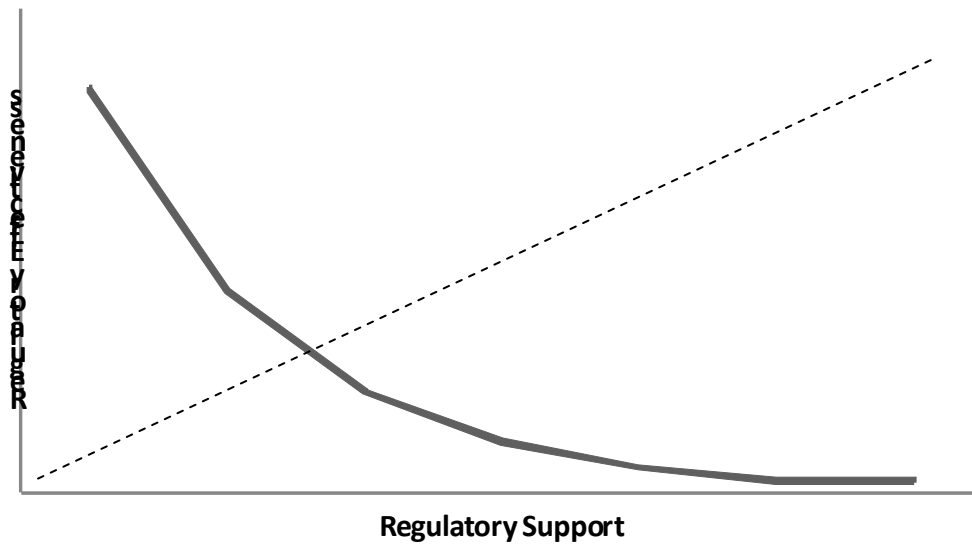
Table 1.1 Location of alternative deer regulations in Minnesota.

Regulation	Location
Earn-A-Buck	St. Croix, Great River Bluffs, Maplewood, and Wild River State Parks
Antler Point Restrictions	Itasca, Savanna-Portage, and Forestville State Parks
Early Antlerless Season	Deer permit areas 209, 210, 225, 227, 236, 252, 256, 257

Figure 1.1 Hypothetical tradeoff curves between the effectiveness of deer harvest regulations as measured against regulatory support from hunters.



A) Situation in which effectiveness decreases as a function of increased support.



B) Situation (dashed line) where support increases as effectiveness of the regulation increases.

CHAPTER 2

Implementing a stakeholder based process for determining deer population goals in
Minnesota

Integrating biological population objectives with social carrying capacity is a problem for biologists who have historically managed deer populations primarily for hunting interests. As all states manage deer populations through recreational hunting, there are other opinions that should be considered prior to setting population objectives. This article describes a method to establish deer population objectives at the statewide level using minimal staff time and a repeatable template. We grouped deer permit areas by general habitat types and over a 3-year period convened stakeholder teams to facilitate developing deer population goals for the Minnesota DNR. We also solicited public input using a web-based, close-ended survey and received nearly 4,000 responses statewide, which were considered along with the stakeholder recommendations. Our results suggest that deer population objectives can be determined using an inclusive public participation process. In addition, agency personnel can make more defensible harvest objectives if the population level was set collaboratively.

Key words: natural resources decision-making, population goal setting, public participation, white-tailed deer

Introduction

In the United States, wildlife is held in the public trust and non-migratory game species management is generally entrusted to the state wildlife agency. White-tailed deer (*Odocoileus virginianus*) are the most studied large mammal in North America and much information has been published about the biology of this species. Although it is broadly accepted that today's deer population is a wildlife success story (Woolf & Roseberry, 1998) and that hunting is the primary tool used to manage deer populations (Stedman, Bhandari, Luloff, Diefenbach, & Finley, 2008), there is considerable discussion as to whether or not hunters can control deer populations over the long-term (e.g., Brown et al., 2000; Decker & Connelly, 1989; Riley et al., 2003). Consideration has been given to the integration of both biological and human dimensions information to better manage populations (e.g., Decker & Chase, 1997; Stedman et al., 2008), yet wildlife decision-making has traditionally relied on biological knowledge and expert authority (Riley et al., 2002).

In Minnesota, deer management falls under the jurisdiction of the Department of Natural Resources (DNR), Division of Fish and Wildlife, Section of Wildlife. Since the turn of the 20th century, Minnesota deer populations have undergone the same cycles that were observed nationally from near extirpation to historic highs (Woolf & Roseberry, 1998). Throughout much of Minnesota, deer seasons were closed or alternated every other year (Berner & Simon, 1993). This pattern continued through the early 1970's when the deer management system was changed to allow for population expansion and annual hunting opportunities (Berner & Simon, 1987). Currently, Minnesota deer populations range from historically high in many regions (>15 deer/km²) to

comparatively low in the highly agricultural southern portions of the state (< 2 deer/km²). Annually, the Minnesota DNR makes adjustments in harvest strategy; however, there has not been a formal assessment of the appropriate size of the statewide deer population.

This paper describes a case study that established deer population goals throughout Minnesota through a collaborative public participation process that involved both key stakeholder groups and the broader Minnesota public. We developed both a standardized, stakeholder-based, facilitated process and a public participation planning that is adapted to both local situations and public desires for inclusion. Recognizing that natural resource management issues have no defined solutions (Nie, 2003; Rittel & Webber, 1973), we developed a process that incorporated sociological considerations into what has traditionally been a biological process (e.g., professional staff determine optimum deer density). Our aim was to draw upon previous research (e.g., Lafon, McMullin, Steffen, & Schulman, 2004; Nelson, 1992) to implement a statewide process that was manageable and could be repeated by other agencies. In essence, we are hopeful this paper serves as the “how to” guide that Gigliotti, Decker, and Carpenter (2000) described should be completed.

Literature Review

Carrying Capacity

Historically, wildlife managers manipulated game species based on biological carrying capacity (BCC), which is defined the maximum number of animals that can be supported by the landscape (McCullough, 1992). In their review of BCC concepts, Carpenter, Decker, and Lipscomb (2000) provided an overview of the sigmoid growth curve, which is indicative of white-tailed deer population growth and they also defined

the standard terminology regarding modeling deer populations (e.g., "*K=Biological Carry Capacity*", "*I=Inflection Point*"). Most classically trained wildlife biologists understand BCC and how it is applied to population management and manipulation. However, few, if any wildlife professionals manage white-tailed deer populations at BCC, yet contemporary deer management strives for population objectives that align with the greater needs of the public. Agricultural and forest damage, deer-vehicle collisions, and residential tolerance are all important considerations regarding deer population size. Understanding these concerns provides a foundation for communication between the agency and public (Loker, Decker, & Schwager, 1999).

The concept of social carrying capacity (SCC) originated in the recreation field as a method of determining how recreational users impact the experiences of all users (Graefe, Kuss, & Vaske, 1990). Decker and Purdy (1988) subsequently adapted SCC to a concept termed wildlife acceptance capacity (WAC), which they defined as the “maximum wildlife population level in an area that people can support”. Unfortunately, WAC acceptance thresholds are determined for individual groups of stakeholders, and different stakeholders’ perceptions of wildlife populations can differ dramatically. Managing agencies are still required to determine the upper and lower limits of the populations, which may serve to disenfranchise one or more stakeholder groups.

Within the context of urban deer management, Ellingwood and Spignesi (1985) coined the term cultural carrying capacity (CCC); the maximum number of deer that can coexist compatibly with local human populations. This concept was subsequently advanced by Minnis and Peyton (1995) who advocated a system that considers preferences of multiple stakeholders. This approach does not weight individuals or

recommend maximum levels; rather, it incorporates a variety of attitudes and constructs a range or “latitude of acceptance” for the population. Functionally, the latitude of acceptance in the CCC model is the actual balance managers strive to achieve in managing deer populations and are likely not related to BCC (e.g, the range of “acceptable” deer population size is lower than what the habitat can theoretically support).

In an era when deer management should be considered a societal exercise (e.g., populations are not managed at BCC), the attitudes and beliefs from a range of stakeholders are important. Different demands among stakeholders, however, create an inherent tension in the management environment in that one primary stakeholder group (hunters) often desires to have more deer than other stakeholders. Given the current system of managing deer populations through hunting, and the dependence of state agencies on funding from deer license sales, balancing the desires of stakeholders is politically challenging. Our research attempted to determine CCC in a management environment with multiple stakeholders some of whom have conflicted interests.

The Evolution of Public Participation in Wildlife Decision-Making

Beierle and Cayford (2002) describe 3 historical models for environmental decision making by government agencies. The managerial model typified the period from the late 1800’s to 1950’s when agencies were entrusted to identify and pursue the common good, establishing policies that produced the Pinchot-ian ideal of the greatest benefit for the largest number of interests for the longest time. Agencies shifted to a pluralism model in the mid-twentieth century when administrators served as arbiters for competing public interests and public policy was established through debate and

negotiation. Historically, wildlife populations were managed by professionals who treated their constituents like “clients” and principally managed harvested species to the benefit of that clientele (Decker, Krueger, Baer, Knuth, & Richmond, 1996). In the late 20th century, agencies began using a popular democracy model in which public participation was used to identify the common good and public policy was based on shared community goals. This transactional management model empowers stakeholders to engage each other and negotiate a solution (see Decker & Chase, 1997, pp. 791-792). This evolution has been predicated by the fact that stakeholders (whoever they may be) have demanded a larger role in managing wildlife populations (Chase, Schulser, & Decker, 2000). Although little research has been conducted on wildlife-related value shift, Manfredi, Teel, and Bright (2003) postulated that several societal factors such as affluence, mobility, urbanization have contributed to generational shifts in wildlife-related values. Inglehart and Baker (2000) suggested that in industrialized societies, there has been a shift in Materialist (e.g., safety, economy)/Post-Materialist (e.g., quality of life, environmental) values, which may have contributed to the elevated level of interest. The social context of wildlife management has changed, making it critical that agencies and policies adapt to reflect societal norms and values (Jacobson & Decker, 2006).

Citizen participation can be beneficial when a polarized issue requires citizen mandate for resolution and the issue of extreme interest to stakeholders may result in a “crisis” if the issue is not addressed (Irvin & Stansbury, 2004). Identifying socially acceptable deer population goals represents such an issue. Diverse stakeholder interests that include hunting, ecosystem health and sustainability, recreational wildlife viewing, tourism, agriculture, landscaping, public safety, and risk management do not currently

agree on optimum deer population levels. Failure to reach agreement and subsequent management action could lead to severe financial consequences for some stakeholders as well as denigrated ecological conditions.

Identifying the level and type of public involvement needed through an examination of situational objectives for the public and the locus of decision control is critical to a successful public participation processes (Chase, Siemer, & Decker, 2002). A continuum for public participation objectives range from improving the management climate (authoritative approach), providing public input (passive-receptive and inquisitive approaches), utilizing the public to help make decisions (transactional approach), to utilizing the public to implement decisions (co-managerial approach) (Decker & Chase, 1997). The locus of control can vary from being solely held by the agency, shared between the agency and stakeholders, to solely held by the public (Reich, 1990).

As the public seeks more involvement in natural resource policy making, participants and practitioners have identified 5 factors that contribute to a “good” participation process including: (1) a legitimate process that is open and transparent, (2) a process promoting the search for common values and using respectful dialogue, (3) a fair and equitable process, (4) a process promoting equal power among participants, and (5) a responsible and respectful process where decision makers understand and consider interests (Webler, Tuler, & Krueger, 2001). In settings where goals are ambiguous and there is a lack of scientific agreement on cause-effect relationships, McCool and Guthrie (2001) suggest that writing and implementing a plan, learning, interest representation, relationship building, creating responsibility, and gaining social and political acceptability are characteristics of successful public participation. Perceptions of justice

in public participation and decision making is an important factor cited by public participants suggesting that fair decision making processes may be more important than the actual techniques utilized (Smith & McDonough, 2001). A well-managed and structured public participation process can result in high quality environmental decisions (Beierle, 2002; Gregory, 2000; Reed, 2008).

Potential barriers to effective public involvement in natural resource decision-making exist for both the public and managing agencies. Agencies frequently cite two barriers of public involvement including a lack of public understanding of mandated or self-assigned agency decision-making processes and concern from staff that the agency will not control natural resource decision-making (Lord & Cheng, 2006). These potential barriers need to be accommodated when designing and implementing public participation processes to achieve successful outcomes for both stakeholders and the agency.

Agencies are challenged to identify optimal levels of public involvement in policy making to have successful processes from both the citizen and agency perspectives. Issues appropriate for a high level of social consultation and collaboration are those for which the manager has insufficient information to make a decision, public acceptance is critical to effective implementation, public acceptance is not assured if the manager chooses a resolution alone, relevant stakeholders are willing to engage in problem solving, and the quality of future public input and relations would be improved if learning occurs among diverse stakeholders (Lawrence & Deagen, 2001). As there are competing interests surrounding deer populations, the determination of carrying capacity (either social or biological) meets these criteria for public involvement in the decision-making process.

Methods

Framework

We developed a collaborative method of establishing statewide deer population goals by management unit for minimal financial expense and staff time. Our desire was to develop a process that could be implemented statewide yet with manageable “costs” (e.g., staff time, finances). Consequently, the study was conducted throughout the entire state over a three-year time period using the schematic summarized in Figure 1. The Minnesota DNR manages deer in distinct management units called deer permit areas (DPA). Although there were 129 DPAs across the state, assembling teams for all the areas would have been both time and cost prohibitive. Thus, DPAs were pooled by habitat types as defined by the Minnesota Ecological Classification System (ECOMAP, 1993). Based on geographic proximity and ecological patterns a total of 15 deer goal setting blocks were evaluated from 2005 to 2007 (Figure 2). By reducing the area of evaluation to consolidated blocks, we were able to evaluate numerous DPAs concurrently using one stakeholder team per block. In total, 125 DPAs were evaluated using this process. Four DPA's were not evaluated because 3 were in the Twin Cities metropolitan area and deer populations are managed for low levels. One additional DPA encompassed Red Lake Indian Reservation, which is not under DNR's management jurisdiction.

Stakeholder Identification, Solicitation, Team membership, and Expectations

To construct a list of possible team members we followed the procedure described by Riley et al. (2003b). We identified both organizations (governmental and non-governmental) and individuals who were not affiliated with any particular interest group. Annually, the Minnesota DNR hosts a roundtable meeting of stakeholder groups to

discuss current management issues and develop topics for future discussions (Nelson, Wingate, Skrypek, & Holmes, 1993). Groups that would likely have an interest in deer management were identified for possible team participation. Groups included (but were not limited to) business, hunting, environmental, and agricultural organizations. In total, slightly more than 30 stakeholder groups were identified using the roundtable mailing list.

To identify interested individuals, DNR area wildlife managers were asked to provide contact information for people who were both familiar with the local area and might be interested in participating. Staff was specifically asked to identify individuals who had an interest in deer but were not necessarily just deer hunters. Individuals who were specifically solicited included (but were not limited to) county commissioners, land managers, farmers, sportsmen club representatives, and automobile insurance agents.

Prior to official announcement of the project, an email was sent to identified individuals and group representatives notifying them that a letter and application would arrive in the mail shortly. The initial email was intended to make them aware of the process and also determine if they were the correct person who should receive the correspondence. A packet of information was then mailed to group representatives and individuals. The letter came from the Division of Fish and Wildlife Director and included an application with contact information and the application deadline.

Selection of each team was completed by local DNR staff with consultation from me. A conscious effort was made to balance stakeholder interests in deer population goals in the team composition. Functionally, we selected teams from a broad range of disciplines and interests so no single interest could be over-represented. Ultimately,

teams were comprised of 12 – 20 people representing those interests. We assigned each team the responsibility of making recommendations for their block on deer population levels (increase, decrease, stabilize), but not on how to manage deer populations (harvest strategies). Once the teams were selected, individuals were mailed an information packet with a standardized document that outlined the history of Minnesota deer management. Team members were also sent harvest and population trend data for their respective blocks from 1993 to the evaluation year. By having the majority of historical information standardized statewide, we were able to disseminate a large amount of information consistently across all blocks. By including only local harvest and population information, we provided the team information they would need to make a recommendation while at the same time providing them with a statewide, historical perspective of deer populations and management. To evaluate the goal-setting process, we distributed a survey during 2006 and 2007 to determine if our process met the needs of the team, was fair, and achieved useful results.

Meetings

First Meeting. Two facilitated meetings for each team were organized 3 to 6 weeks post notification. The meetings were designed to ascertain direction from the stakeholder team. At the beginning of the first meeting, team members were asked to speak for a few minutes on their background, interests, and reasons for wanting to help set deer population objectives. Following the introductions, a brief presentation reviewing the history of deer management, team expectations, and desired procedural outcomes was given by me or 1 of the local area wildlife managers. Staff from the Section of Wildlife and DNR, Division of Forestry was invited to participate in the

process as advisors and respond to questions from the team or clarifying discussion points as requested by the facilitator.

We administered 2 preference surveys to gauge opinions about current deer population levels and desires for future deer populations. The first survey asked if the individual team member believed the deer population in each DPA was “too high”, “too low”, or “about right”. The second survey asked if the deer population in each DPA should “increase 50%”, “increase 25%”, “remain the same”, “decrease 25%”, or “decrease 50%”. We defined coarse units of measurement (e.g., 25% or 50%) rather than finer degrees (e.g., 10%) because a 10% change in population was likely indiscernible from “the same” from both the hunter and resource manager perspectives. The confidence interval surrounding a 10% change in population would likely not differ from the null hypothesis of no change; whereas a 25% change in population would likely not be detectable either visually (in the field) and mathematically (modeled estimate).

The concept of deer density (actual deer per square mile) was specifically omitted from the discussion because discussing and debating deer numbers complicated the process and not advance discussion. We asked team members to focus on deer harvest trends as the determinant of future management direction rather than DNR’s estimate of deer density for each DPA. We articulated that deer populations are variable and the modeled estimate is likely not the true population size; thus, an individual’s perception of deer density is likely not congruent with agency-derived numbers. Deer are not uniformly distributed on the landscape so densities within a DPA are variable and dependent on a multitude of factors. We used harvest as the index of deer population

trends because buck licenses are unlimited and hunters must legally present the deer at a registration station within 24 hours after the close of the season.

After discussing the results of the preference surveys and prior to adjourning, team members were asked to go back into the local community to solicit input from people throughout their block. Members were asked specifically to talk to a variety of people and interest groups not necessarily from either their immediate locality (e.g., town or hunting camp) or interest group. Emphasis was placed not on attempting to validate one's personal opinion; rather, to seek opinions from those who may not be in agreement with the team members' perceptions. By asking members to solicit differing opinions, participants had an understanding of local deer populations across a broad area from a variety of sources.

Second Meeting. Team members were again asked to reiterate their representation and spend a few minutes talking about what they learned in the time between the first and second meetings. Team members were encouraged to ask questions of other individuals regarding what they had learned over the last month. Discussions were probing and team members seemed genuinely interested in both sharing their knowledge and hearing from others. Following the discussion, individuals were again administered the second future conditions survey from the first meeting (increase 25% or 50%, stay the same, decrease 25% or 50%). Once the results were tallied, the facilitator went through each DPA individually to interpret the results. Team members were then asked if they agreed or disagreed with both the recommendation and the facilitator's interpretation. We attempted to reach a consensus for each DPA and where there was disagreement, the DPA was discussed until a consensus was reached. Staff advisors were asked to respond

to the feasibility of the recommendations. Following the second meeting, another letter was sent to team members summarizing the discussion and agreed trends. All tables and graphs were included in the mailing and team members were urged to me if they noted a discrepancy in the interpretation.

Public Participation

Although we attempted to obtain a cross-section of people who could represent the evaluation blocks and those individuals spoke with many people, we recognized there was a need to collect additional public input to gauge representativeness of the team recommendations. In 2005, we held roundtable-style meetings in which DNR staff was available to introduce the topic and to receive comments, answer questions, and survey participants to gauge their opinions.

Despite attempts to publicize the meetings, attendance was low (range 3 – 20 people) and indicative of the problems outlined by Putnam (2000) who described a steady decline in public engagement and involvement. For 2006 and 2007, we developed an alternative web-based information gathering process that did not require participants to attend a public meeting. As our goal was to maximize public input and involvement in this process, we believed the change of input-gathering method would facilitate collection of more data than previous methods.

Web-based public input

Our web-based process was developed as a public participation tool to gauge public input on the topic. It was not designed as a random survey of individuals to accurately measure the beliefs and attitudes of the deer hunter population in Minnesota; rather, it should be viewed as the opinions of people who were interested in the topic and

responded to our solicitations for input. While these individuals may not be representative of the public-at-large, we believed this was a valid approach because the internet was used as a surrogate for the traditional round-table meeting and we solicited comments identically (e.g., printed media, radio interviews) between 2005 (roundtable) and 2006-2007 (web-based).

To introduce the goal setting project, we designed a webpage that briefly explained the process. After going to the main page, participants navigated to a map where they selected one of the deer goal setting blocks under examination. Once selected, a new page with a standardized presentation opened that was very similar to the one administered to the teams in that it presented historical deer management information and customized deer harvest data for that block. The additional information was the inclusion of the team recommendations. Following the presentation, there was an option to complete an online survey that was comprised of 11 closed-ended questions, included respondent demographics, familiarity with individual DPA's within the block, deer population perceptions and desires, and opinions/satisfaction related to the deer goal setting process. For the 2006 and 2007 data, a chi-square test using SPSS 15 for Windows (2005) was used to test differences between team and public input data. Differences were considered significant at $P < 0.05$.

Internal Evaluation

Deer harvest, population information, and trend preferences from both the teams and public input were summarized by DPA in spreadsheet format. DNR managers then reviewed the data and offered their recommendations regarding deer population direction

for each DPA. Agency staff recommendations were added to the spreadsheet and a final recommendation was generated and presented to DNR leadership for consideration.

Results

Stakeholder Teams

From 2005 – 2007, a total of 30 facilitated meetings were conducted for 15 teams across Minnesota. In all cases, teams were able to provide consensus recommendations for deer population direction in each DPA. In some cases, the opinions were clear; in others, the facilitators took additional comments and gave their interpretation of the data. Team members were then asked if they agreed with the interpretation. When asked, staff advisors provided their perspectives and any disagreements were discussed until consensus could be reached. Upon conclusion of each meeting, letters were sent to team members reiterating the discussion and recommendations. Team members were urged to contact the senior author immediately if they read something different from what they heard. No team members indicated the written interpretation had deviated from the discussion. Therefore, we concluded consensus had been reached in all DPAs in all blocks evaluated.

In 2006 and 2007, we distributed a brief survey to team members after the second meeting to gauge their opinions of the process. Team members were asked to rank from 1 (poor) to 10 (great) how satisfied they were with the process. Overall, means were 7.7 (range 7.2 – 8.3) in 2006 and 7.9 (range 7.1 – 8.9) in 2007. Most of the comments received centered on being appreciative of being asked to participate, the openness of the discussions, and the fact that DNR did not try to steer the discussion one way or the other. Methods to improve the process included allowing more time between meetings, a

more detailed analysis of the data and further discussion of estimated population size, and a smaller scale choice of population options (e.g., 10%).

Team versus Public Recommendations

To evaluate the web-based public input process, we asked respondents 3 questions regarding their experience. Specifically: (1) if their views were changed as a result of viewing the presentation, (2) whether or not their deer population desires were in agreement with the team recommendations, and (3) their degree of satisfaction with the process. Overall, a low percentage of individuals (11%) believed their views were changed as a result of the presentation and there were no differences between survey blocks ($n = 2,651$; $\chi^2 = 15.4$, $P = 0.17$). Given the presentation was designed to inform and educate participants on deer populations and the goal setting process and not change opinions, we were not surprised that opinions had not been changed.

We were also interested in learning to what degree there was congruence between hand-selected team members who represented a broad spectrum of interested citizens and the individuals who completed a web survey. There were concerns for web participation in that only people with strong opinions might reply or that organized groups would collaborate to give a shared opinion one person at a time (“stuffing the ballot box”). Although there were statistical differences between blocks as to the degree of agreement ($n = 2,635$; $\chi^2 = 50.3$, $P < .001$), a majority of respondents in all 15 blocks agreed with the team recommendations. Overall, 63% of survey respondents believed their opinions were similar to the team recommendations. When they differed, web-based respondents tended to recommend higher deer populations than team members in DPA's where

increases were recommended. In areas where deer population reductions were recommended, team members recommended steeper reductions.

Although there was an area on the webpage to submit comments, there was no opportunity to express an opinion in a face-to-face forum. For this reason, we were concerned that a web-based process would lead to low satisfaction levels because it removed the interaction between agency professionals and the public. Overall, an average of 58% (range = 49% - 63%) of respondents expressed satisfaction with the goal setting process. Although there were statistical differences between blocks ($n = 2,525$; $\chi^2 = 62.7$, $P < .001$), only one block had a mean satisfaction level below 50% (Southwest block = 49%).

DNR Management Direction

In total, DNR accepted 90% of the team/public input recommendations ($n = 113$). For the areas where DNR opted to manage outside the team recommendations, 11/12 were DPAs where the wildlife manager provided information indicating the population should be lower than the composite recommendations. For the other DPA, the DNR wildlife manager believed populations could be higher than recommended. DNR leadership ultimately accepted the recommendations as presented and DPA management strategies were adapted to move deer populations towards these new population goals.

Discussion

Previous research has demonstrated that involving stakeholders has a multitude of benefits including improved relationships with managers, a better understanding of conflicting views, and improved knowledge of the issue (Lafon et al., 2004). The concept of using a stakeholder-based participatory process to evaluate deer populations is

not unique to certain aspects of white-tailed deer management. Within the arena of urban and suburban deer management, citizen committees and task forces are routinely used to co-manage populations in those highly controversial situations (e.g., Lund, 1997; Raik, Decker, & Siemer, 2003). The New York State Department of Environmental Conservation (NYSDEC) uses a citizen task force approach to set deer population goals in their 85 wildlife management units and we drew heavily on their experiences. In designing our process, there were several elements that differed from the methods employed by the NYSDEC. We were interested in incorporating a significant public-input component that went beyond a stakeholder team. Our preference was also to create a template that could be repeated on an as needed basis without re-creating stakeholder teams every few years.

Developing a standardized process to determine deer population goals throughout an ecologically diverse state proved challenging. The logistics of identifying team members and making selections so the teams were diverse, scheduling meetings and facilitators, and organizing DNR staff were time consuming tasks. Our intent was to stagger the within-team meetings so they occurred about 3 weeks apart. Logistically, we were able to hold 3 meetings per week; consequently, the project required completing all the meetings within a 3-5 week period. Concurrent with development of the process were discussions with DNR staff relative to their roles and in some cases, allaying their fears of 'losing control' of deer management. Similar to Nelson (1992), DNR staff felt they were the experts and using a citizen panel would only compromise their ability to do their job. We continually emphasized that if the process were managed appropriately, the outcomes would be beneficial to all involved and transactional deer management would

allow the manager to defend their populations levels because the process was inclusive. Ultimately, DNR managers at all levels were satisfied with both the process and outcomes.

Management Implications

Process management is an important component of a project of this scale. Selection of enthusiastic and open-minded stakeholders, designing a repeatable template for meetings and data, and providing a quick and easy method for gathering public input are also important components. By managing the process, the outcomes will be better understood and management direction more defensible. The opinions of local managers will always be important but if the process is fair and open, we found that the outcomes nearly always aligned with manager expectations.

We do not believe an online solicitation for information should be the primary tool for implementing biological recommendations; however, the internet could be used to complement an agency's existing public input process. For analytical data acquisition, information should continue to be generated using random surveys. A self-administered survey from a random sample of participants was not used because the online survey portion of the project was a surrogate for a round-table style public meeting. We fully acknowledge our public input was a biased sample because we solicited input from interested individuals. Because of the lack of randomness, our results may not represent the overall public opinion (e.g., Johnson, Johnson, Edwards, & Wheaton, 1993). Although many people do not own a computer, public access to the internet (e.g., libraries) has limited the ability of people to use that as a reason to not participate. We believe that if properly designed and implemented, the outcomes are defensible and a

larger audience has an opportunity to participate. Ultimately, setting deer population goals through a comprehensive public process has a positive net gain for both the interested public and the wildlife manager.

Figure 2.1 Schematic for developing a stakeholder-based process to establish deer population objectives.

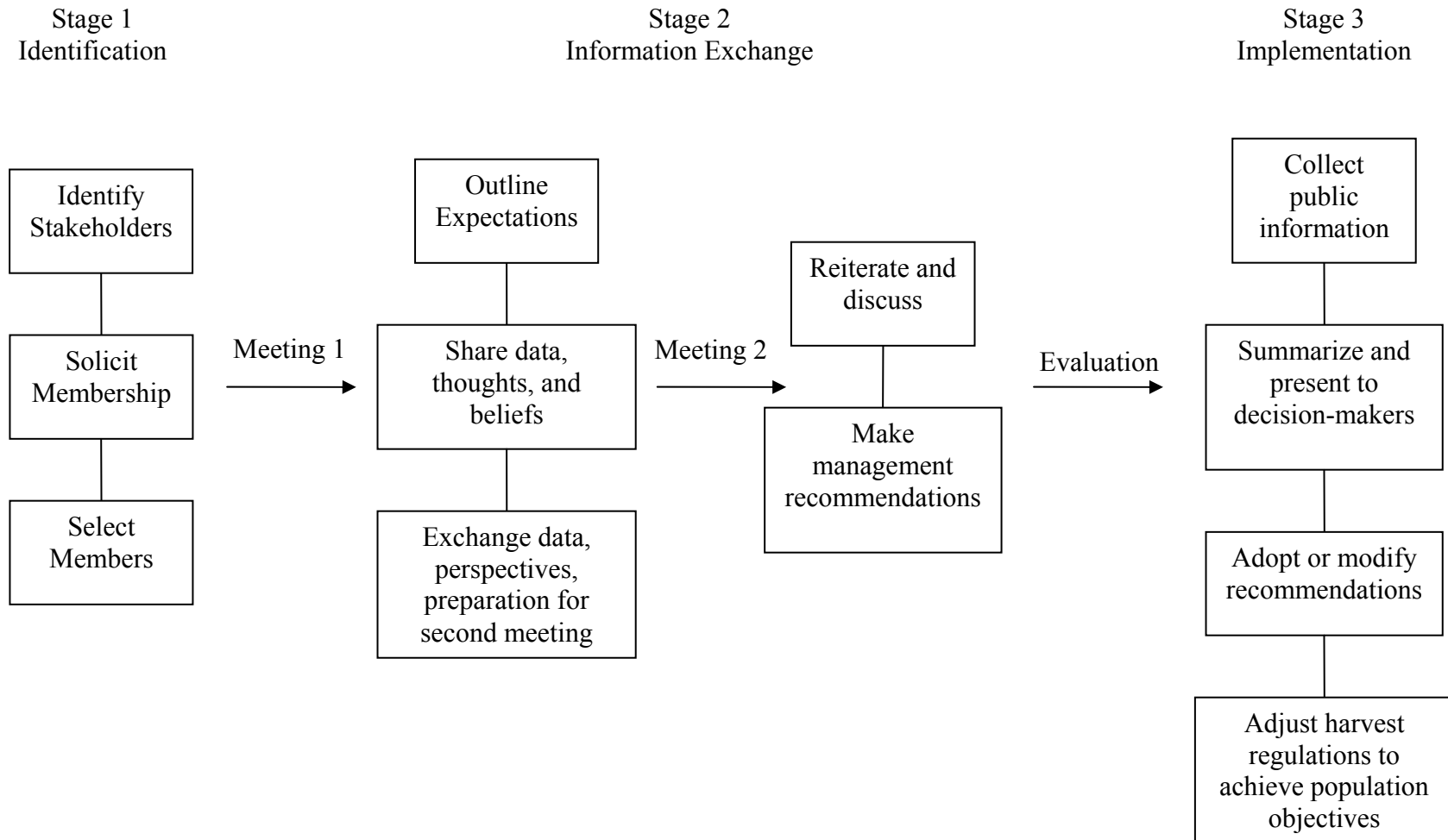
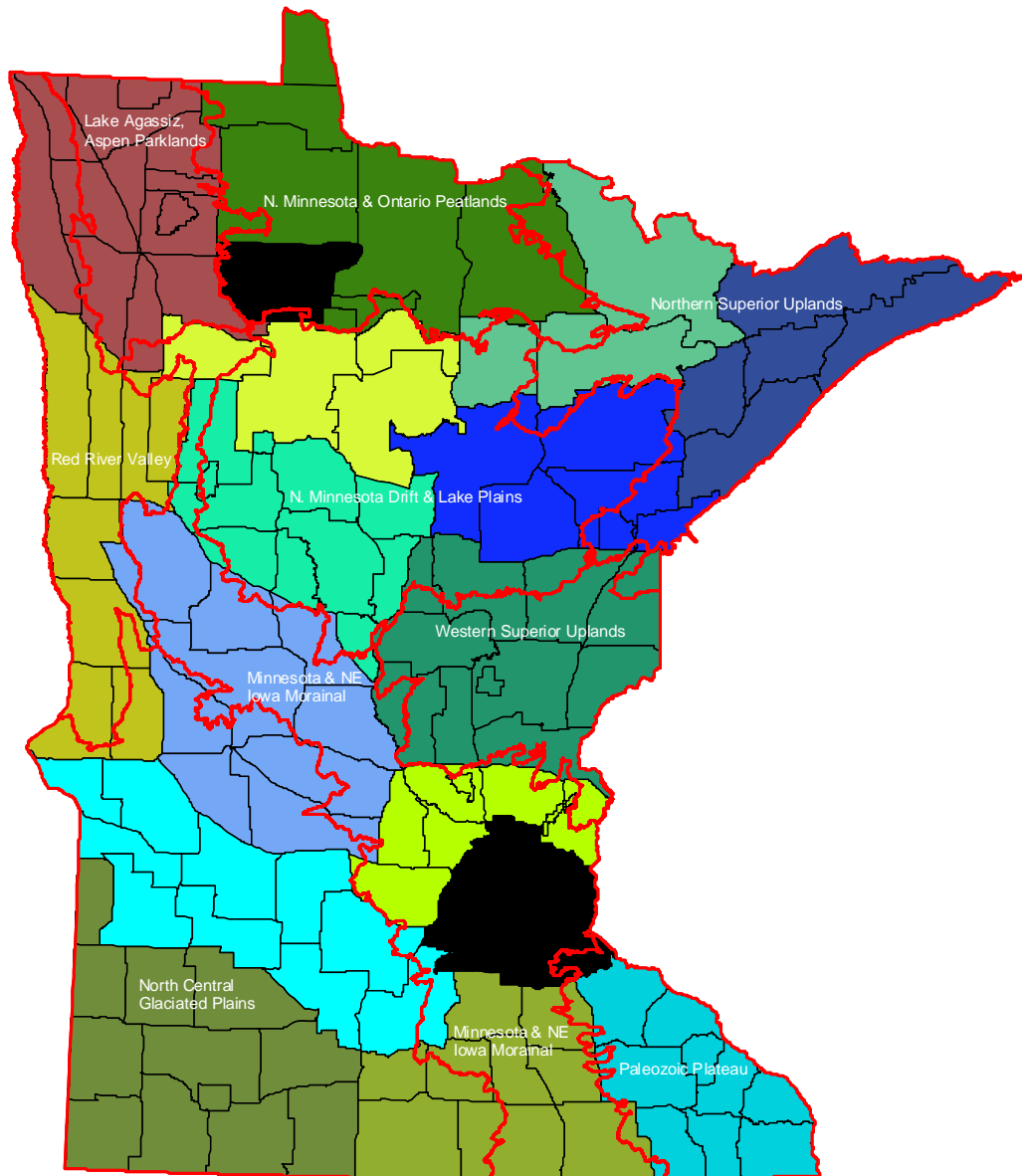


Figure 2.2 Deer goal setting blocks evaluated during 2005 – 2007. Red lines are ecological classification boundaries.



CHAPTER 3

Assessing support for deer harvest regulation changes in Minnesota

Recreational hunting is the primary tool managers used to manage white-tailed deer (*Odocoileus virginianus*) populations. Historically, populations in Minnesota were manipulated by altering permit numbers or increasing the bag limit. In some areas of Minnesota, the number of antlerless deer harvested by hunters under the current seasonal framework has not been adequate to reduce deer densities toward population goals as most hunters (75%) only harvest 1 deer; thus, increasing the bag limit has not had the effect of lowering deer populations towards established goals. Concurrent with implementing experimental harvest regulations, we also surveyed deer hunters to determine their attitudes towards deer hunting and different regulatory alternatives. We mailed a survey to a random sample of Minnesota firearm deer hunters and asked questions regarding deer populations, regulations, and their opinions regarding deer management. While a majority of respondents (66%) supported regulations that increase the proportion of mature bucks, no regulatory option received majority (>50%) support. Antler point restrictions (47%), elimination of buck party hunting (46%), earn-a-buck (37%), and limiting buck licenses (29%) were not supported by a majority of deer hunters. These types of results, while important, do not provide guidance as managers must ultimately select a regulatory package from a suite of unpopular options. Consequently, within the survey we used a modified incomplete block design utilizing 7 survey versions to present hunters with 5 real-world management scenarios. Within each scenario, there were 7 possible regulatory options of which hunters were randomly presented with 3 that they were asked to rank order. The option to ‘do nothing’ was not 1 of the choices in any of the scenarios. Results indicate that hunters preferred different

regulations depending on the management scenario but would generally prefer antler point restrictions and would generally not prefer limiting buck licenses through a lottery. The results from this study will ultimately be used to help wildlife managers design deer harvest regulations that lower populations and are acceptable to deer hunters.

Keywords: attitude survey, choice survey, deer management, discrete choice model, human dimensions, nested logit model, stated preference survey

Introduction

White-tailed deer (*Odocoileus virginianus*) managers in the United States are faced with the management challenge of trying to reduce deer populations through the primary management tool of public hunting (Brown et al., 2000). Given the national decline in hunter numbers (U.S. Department of Interior, 2007), the impacts of large deer populations are not trivial. Events in several states demonstrate that management actions that are biologically effective are also unpopular with hunters (Dhuey, 2007; Frye, 2006).

During the past century, wildlife agencies' priorities for white-tailed deer management have evolved through 3 distinct phases. During much of the 20th century deer populations were low compared to historic populations and management actions focused on encouraging population growth through reintroductions and regulations that limited harvest, especially of females (Halls, 1984). During this phase, conservation organizations and public wildlife agencies also encouraged an ethic of conservation stewardship defined by a management and hunting ethic focused on limited harvest of adult bucks, protection of breeding females from harvest and financial support of public management through license fees. By 1970, robust populations of deer and recognition that hunting provided multiple benefits to hunters led to a focus on increasing the diversity of deer hunting experiences and harvest opportunities through special seasons, management areas, and harvest of antlerless deer. This second phase of deer management was marked by agencies focusing on deer hunting as a recreational opportunity and trying to optimize hunter satisfaction with hunting experiences and opportunities (e.g., Driver, 1985; Hendee, 1974). By the close of the 20th century, most areas within the United States had entered into a third phase of deer management in which agency priorities have shifted away from encouraging population growth to

strategies of reducing deer populations while ensuring hunter satisfaction with recreational experiences (Brown et al., 2000; Holsman, 2000).

A large number of studies helped deer managers understand what motivates deer hunters and what factors lead to satisfying hunting experiences (e.g., Decker, Brown, and Gutiérrez, 1980; Hammitt et al, 1990; Hendee, 1974; Manfredo, Fix, Teel, Smeltzer, & Kahn, 2004). Previous research had provided meaningful direction for development of recreational hunting programs that match the diverse experiences desired by deer hunters. Most of the studies; however, were conducted in an era where management strategies were directed at maintaining or increasing deer populations. For this reason, they do not provide direction for the current management question of how to alter hunter behavior to reduce deer numbers without negatively affecting hunter satisfaction or participation.

The primary objectives of this chapter are to: (1) describe the preferences of Minnesota deer hunters for regulatory options that would reduce deer populations, (2) introduce a discrete choice survey methodology that examines preferences for regulatory change when the option of "doing nothing" is not presented, (3) answer the question of how do managers select a regulatory option when action must be taken to lower deer densities. The focus of this chapter is to describe a theoretical choice model to assess regulatory support when “no change” is not an option.

Background

Currently, the traditional method of managing deer populations has been to increase season length and bag limits; yet this strategy is not generally effective because most people hunt only a few days and harvest only 1 deer (MNDNR electronic harvest data). Therefore, total deer harvest may not differ significantly when the deer bag limit is 2 versus 10. Within the realm of developing a harvest strategy that lowers deer

populations, there are limited policy options available to managers that address overabundant deer populations yet do not require hunters to alter their hunting/harvest patterns.

Previous research has reported a link between regulatory acceptance, hunt satisfaction, and participation (Fulton & Manfredo, 2004). When managers design new regulations, many are concerned that regulations may achieve population objectives but have low overall support and thus impact participation. Additionally, the public has become more active in wildlife management issues and have an increasing interest in being part of the process (see Chapter 2). Adding to the increased interest is a growing propensity for individuals and groups to approach their local legislature to adopt statutory changes that may be in conflict with the agencies need to manage populations (Nie, 2004). In essence, managers must be concerned that dissatisfied hunters may convince their legislator to change laws, effectively removing a tool from the manager's toolbox.

Hunting Satisfaction and Regulations

How are regulations and satisfaction related? Wildlife professionals can manage hunting opportunity by manipulating timing and length of the season, legal hunting hours, age/sex of legal harvest, bag limits, legal hunting weapons, hunter numbers, and deer density (Heberlein & Kuentzel, 2002; Strickland et al., 1996). However, hunting regulations that influence such factors as success rates, days afield, and total harvest also have an effect on hunter satisfaction levels (Enck & Decker, 1995). Brown et al. (2000) noted that in order to achieve population control, regulations needed to be constructed such that hunters were (1) motivated to comply, (2) willing to participate, and (3) willing to harvest antlerless deer. They argued that the ability of hunters to control deer

populations may be diminishing because deer populations are increasing, hunter numbers are decreasing, and obtaining permission to hunt on private land is becoming more difficult.

In a study of Alaska moose hunters, Fulton and Hundertmark (2004) extended the multiple-satisfaction approach by using cognitive hierarchy theories in social psychology to describe respondents attitudes based on the strengths of their positive and negative beliefs towards a selective harvest system. The authors found that beliefs regarding the biological and social consequences largely shaped their attitudes as to whether or not they supported the regulation. They also found that hunting satisfaction was influenced as much by support for the regulation as by harvest success.

Given the national decline in hunter numbers, achieving hunter support for regulation changes is critical; however, due to lack of knowledge about deer populations and population dynamics, hunters might evaluate regulations designed to control deer populations negatively (Lauber & Brown, 2000). This lack of public support for management programs can work counter to the need to retard deer population growth. For example, regulations designed to protect bucks may discourage hunters from participating, thereby negating the ability to manage deer populations. Barro and Manfredo (1996) also noted that perceptions regarding the impacts of regulations may constrain participation and lower satisfaction. In an assessment of hunter satisfaction related to a shortened buck hunting season, Fulton and Manfredo (2004) found both increasing negative reactions to the regulation changes and decreasing satisfaction over time.

Fix, Pierce, and Manfredo (2001) examined mule deer (*O. hemionus*) hunter preferences for 3 different management options. Using a panel survey design, participants were asked to identify which type of hunting opportunity would be most preferable. Essentially, hunters were asked if they wanted (1) maximum hunting opportunity, (2) maximized opportunity to harvest a trophy deer, or (3) statewide management for trophy deer. Overall, hunters were unwilling to give up hunting every year and tended not to choose the option of statewide trophy management (17%). The most popular options included maximum trophy opportunity (40%) or the option of maximum hunting opportunity (34%), which indicated hunters wanted some additional opportunity to harvest a trophy deer but were unwilling to forgo the annual hunting trip to accomplish the goal. Manfredo, Fix, Teel, Smeltzer, and Kahn (2004) used the same survey instrument to evaluate elk (*Cervus elaphus*) hunter preferences. The authors noted a similar pattern among hunters in that they tended to select a hunt that allowed annual participation. Such hunts generally provide for a smaller bull and have a higher hunter density but allowed people to hunt somewhere every year. Consequently, managing for hunter opportunity (including both buck and antlerless opportunity) and managing for trophy potential may be conflicting strategies in that limiting the ability of individuals to hunt every year will likely reduce the opportunity to harvest enough antlerless deer to manage total populations, thereby creating another management dilemma.

Measuring Support and Preferences for Regulations

Within the field of human dimensions of wildlife, most studies that have examined support for hunting regulations have typically used a measurement models developed for measuring attitudes (Eagly & Chaiken, 1993) incorporating either Likert (1932) or semantic differential (Osgood, Suci, & Tannenbaum, 1957) scaling approaches. While such approaches are effective at determining the relative degree of favor or disfavor that respondents might have for different regulatory alternatives, they are not sufficient to elucidate relative preference among options.

Recent studies within recreation and natural resource management have begun to use a discrete, stated choice approach to help clarify preferences among alternatives and the importance of different attributes of alternatives to choice preference. Discrete, stated choice (DC) designs have been used extensively in marketing, psychological, economics and transportation research for >30 years (Louviere, Hensher, & Swait, 2000). Within the recreation community, DC has been used to measure recreational tradeoffs (e.g., Lawson & Manning, 2002), crowding (e.g., Shelby, Vaske, & Harris, 1988), and wilderness (e.g., Roggenbuck, Williams, & Watson, 1993). Choice designs are different than traditional surveys in that individuals are asked to choose alternatives from a list of attributes, rather than making ratings (Adamowicz, Boxall, Williams, & Louviere, 1998). While there appears to be an application in wildlife attitude assessment, this approach has largely been untested in the wildlife-related human dimensions research. Boxall, Adamowicz, Swait, Williams, & Louviere (1996) outlined various attributes of moose hunting in Alberta and used a choice experiment model to examine moose hunter participation. In Scotland, Bullock, Elston, and Chalmers (1998) used a choice experiment to model red stag hunting and landscape change. Respondents were asked to

select a preferred type of hunting trip from 3 alternatives and the authors were able to elucidate hunter preference. The survey instrument employed by Manfredo et al. (2004) was based on the multiple-satisfaction approach; however, the instrument was consistent with a DC design.

As agencies in many states have an increasing need to lower white-tailed deer densities, relieving harvest pressure from males and shifting it to females could conceivably accomplish 2 goals: (1) deer herd reduction, and (2) more mature bucks in the overall deer population. However, no clear direction on how to accomplish either goal has been identified because hunters are currently not forced to definitively choose a management prescription. Attitude surveys consistently measure support for alternative actions (Phillips, Johnson, & Maddala, 2002), whereby respondents are asked to indicate support or opposition to regulations; thus, there is no "cost" associated with choosing either "option A" or "option B". In Minnesota, hunter preferences toward deer population objectives conflict with biologically viable regulatory alternatives [e.g., 60% support for bigger bucks but < 50% support for regulatory options (*in* Fulton, Bruskotter, & Cornicelli, 2004)]. For this project, we developed a ranked choice design that can be analyzed using discrete choice analysis (Fieberg, et al., in press). This approach may allow managers to design a harvest strategy that achieves population objectives based on a suite of alternatives.

Methods

Sampling and Data Collection

Our study sample was divided into 4 strata: Northwest, Transition Zone, East Central, and South East (Figure 3.1). These areas represented the locations where

alternative harvest strategies may be necessary to control and manage deer population growth. The samples were drawn using stratified random sampling of 2004 licensed deer hunters aged 18 years or older in the DNR Electronic Licensing System (ELS) database. At the time of license purchase, deer hunters were asked to indicate which permit area they hunt most often. Deer harvest data indicate 90% of successful hunters harvest a deer in the area they said they hunt most often (L. Cornicelli, Minnesota Department of Natural Resources, unpublished data). For this reason, we used the hunters' responses to the question of which deer permit area (DPA) they hunt most often as the basis for stratification of the sample. The target completed sample size for firearm deer hunters who hunt in each region was 700 ($n = 2,800$ statewide). An initial stratified random sample of 6,000 individuals (1,500 in each region) was drawn from the ELS. Dillman's (2000) tailored design method was used to distribute the survey. In total, 3 complete mailings of the questionnaire with cover letter were sent, along with a non-response check. Data were collected through May, 2006. Data were weighted to reflect the proportion of hunters sampled within each region and the proportion of regional respondents. For total estimates, data were weighted based on these proportions.

Survey Instrument

The survey contained 4 sections (Appendix A). The first section evaluated recent hunter experiences and general perceptions about hunting deer in Minnesota. The second section included questions to quantify hunter support for alternative deer hunting regulations, and the third section focused on past deer hunting experience. The fourth section assessed ranked preferences for deer season and regulatory changes using a

choice survey design. This chapter describes results from sections 2 and 4. The results for sections 1 and 3 were previously reported by Fulton, Cornicelli, and Grund (2006).

Support for Alternative Regulations

This section of the survey focused on hunter opinion related to management strategies that should increase antlerless harvests and support for specific regulations to achieve that objective. A potential byproduct of increasing antlerless harvests would be an increase in the proportion of males in the population. Participants were first asked if they supported the concept of more antlered bucks and then presented several regulatory packages so as to elucidate the individual level of support for each option.

Study participants were presented baseline information explaining each regulatory alternative and asked to rate their support as: strongly support, moderately support, neither, moderately oppose, or strongly oppose. Finally, hunters were asked several questions regarding factors they consider important relative to setting deer regulations. Respondents were given several factors to consider and asked if they agreed or disagreed with the importance on a rating of: 1 – Strongly agree, 2 – Slightly agree, 3 – Neutral, 4 – Slightly disagree, and 5 – Strongly disagree.

The seven regulatory alternatives presented to respondents in order to gauge level of support for each alternative were: 1 – Antler point restrictions, 2 – Earn-A-Buck (where the hunter must take an antlerless deer before they can take an antlered buck), 3 – Early antlerless season, 4 – Prohibit cross-tagging for all deer, 5 – Prohibit cross-tagging for bucks only, 6 – Buck license lottery, and 7 – Move the deer season out of the rut.

Scenarios and Choices

We provided hunters with different population management scenarios and queried them about what changes in deer hunting regulations were most preferable.

Hunters were presented with 5 scenarios related to Minnesota deer management:

1. The deer population is stable and within population goals. It is currently being managed so that either-sex licenses are available over the counter and hunters can also buy additional antlerless permits. Based on requests from some hunters, this area will be managed in the future for more mature bucks.
2. The deer population is currently 25% above the management goal. The current strategy of allowing 5 deer per hunter has not been effective in lowering the deer population. A new strategy needs to be developed that lowers the deer population to goal levels within 3 to 5 years.
3. The deer population is currently 50% above the management goal. The current strategy of allocating 5 deer per hunter has not been effective in lowering the deer population. A new strategy needs to be developed that lowers the deer population to goal levels within 3 to 5 years.
4. The deer population is stable or below the population goal and the harvest rate on 1½ year-old bucks is high. Consequently, a low percentage of the buck population lives beyond 1½ years. Currently, buck licenses are available over the counter, either-sex permits are available through the lottery, and hunters can only kill one deer. Based on requests from hunters, this area may be managed in the future to protect young bucks and allow them to get to the next age class.
5. Antler point restriction regulations are currently being used by several states to encourage antlerless harvest and protect 1½-year-old bucks. The number of

hunters and sporting organizations interested in antler-point restriction regulations seems to be increasing in Minnesota. While the harvest rate of bucks varies in Minnesota, the majority of the bucks killed during the firearm season are 1½ years old. Typically, 50 to 75% of the 1½ year-old buck population is harvested during the firearm season.

The entire suite of choices along with corresponding scenarios is presented in Appendix B. In total, there were 7 choices within each management scenario, but each hunter was presented only 3 choices in which they were asked to rank preferentially in descending order (1, 2, 3). We assigned the alternatives given to each recipient using a randomized incomplete block design (Kuehl, 1994), which allowed for the same number of choices to be represented in all 6,000 surveys (Figure 3.2).

Choices were designed so they would be representative of regulations that might be adopted for that scenario. For example, earn-a-buck regulations have the potential to decrease deer populations; therefore, earn-a-buck was not a choice in the scenarios where the deer population was stable and/or within goal range. Also, the choice of moving the deer season out of the rut was not presented in the scenarios where the deer population was 25% or 50% above goal density because that regulation likely would not lower deer populations. Conversely, moving the season was presented as a choice when the scenario suggested the deer population was within goal levels and the desire was to manage for more mature bucks. This portion of the survey was not designed to gauge hunter support on an issue; rather, it was designed to elucidate a rank-ordered preference for management alternatives in response to a specific scenario. Consequently, the option of

‘doing nothing’ was not a choice under any scenario but the options of ‘not hunting’ or ‘moving to another area’ were offered as choices on some scenarios.

Data Entry and Analysis

The data entry template was designed using the Questionnaire Programming Language version 5 (<http://qpl.gao.gov>), which allowed for online data entry at any computer with internet access. We used a double entry method in which 1 person would enter data and another would proof data entered from the same survey. This method assured 2 people reviewed each survey, which decreased data entry errors.

We analyzed descriptive statistics and compared strata results using chi-square tests, analysis of variance (ANOVA), and cross-tabulations using the Statistical Program for the Social Sciences (SPSS 15). Choice scenarios 1 through 4 were analyzed in program STATA (10) using a nested logit model (NL) as described in Fieberg, Cornicelli, Fulton, and Grund (in press)¹. Scenario 5 was analyzed using a multinomial logit (MNL) model because the choices were independent and could not be nested. Both the MNL and NL models provide a method to estimate perceived utility for options not presented to respondents (Louviere et al., 2000). While the MNL is the most commonly used, both of these models have their basis in random utility theory, whereby individuals are assumed to make choices (among available options) so as to maximize the utility or satisfaction gained from their choice (see Cooper & Millsbaugh, 1999 for a description of utility related to the MNL model). The utility of each choice is assumed to have both deterministic and stochastic (e.g., random) components.

¹~~The choice survey methods described here are an abbreviated version. The full methods as published are included as an endnote at the end of this chapter.~~

The deterministic components may be modeled using a set of dummy variables for each choice (as in Fieberg et al., in press), or using a set of lower level attributes that reflect costs or perceived benefits associated with each choice (e.g., costs of implementing a regulation or the impact of the regulation on the number of mature bucks) as well as interactions between individual-level characteristics (e.g., income, gender) and other deterministic components. The NL model is more flexible than the MNL model in that the stochastic components of individual choice specific utilities are assumed to be positively correlated for options residing in the same nest (but utilities associated with choices in different nests are assumed to be independent). Effectively, the NL model allows for more realistic substitution patterns (e.g., changes in the estimated probability of choosing each option, following the removal of one or more other options) when choices are likely to share unmodeled characteristics (Train, 2003; Fieberg et al., in press). For each scenario, we modeled the probability of selecting the top-ranked choice from the set of 3 options presented to the survey respondent.

For scenario 5 (various antler point restriction choices), we opted to use the MNL model (Cooper & Millspaugh, 1999) because the choices did not lend themselves well to nesting. We also compared the MNL results from scenario 5 with the empirical proportion of selecting a choice individually from each set of choices.

Results

Response Rate

In total, 426 surveys were undeliverable and 3,293 were completed and returned, which resulted in a 59% response rate. We assessed non-response using a brief 10 question demographic survey (n = 393 returned). We failed to detect significant

differences between respondents and non-respondents ($P > 0.05$). Regional response rates ranged from 56% to 63%.

Demographics and Hunting Background

Median age of respondents was 39 years and they had an average of 24 years of deer hunting experience and nearly 99% indicated they hunted deer during the 2004 Minnesota deer season. Respondents were also asked if they hunted: new areas every year, new areas every 1 to 2 years, new areas every 3-5 years, or the same area every year. A large majority of hunters (90%) indicated they hunted the same area every year, and there was little difference in those rates by region. Hunters in the northwest stayed in their traditional areas most often (93%), while hunters in southeast Minnesota were least likely to stay in the same location every year (89%).

We examined the land ownership of property hunted had on the willingness of hunters to change hunting locations, and we did identify some noticeable trends. For example, hunters who did not own land tended to move more frequently than hunters who owned property. In addition, people who indicated they did ‘some’ or ‘most’ of their hunting on public land tended to change locations every 1 to 2, or 3 to 5 years.

Support for Alternative Regulations

Overall, 66% of respondents were supportive of a regulation that would increase the proportion of antlered bucks in local deer populations. Across the study regions, there were no significant differences ($P > 0.05$) in the proportion of hunters who would support regulations that promoted proportionately more bucks in deer populations (Table 3.1). Specific regulatory alternatives are presented below and summarized in Tables 3.2 and 3.3.

Early antlerless season. This regulation would establish an antlerless-only season before the general firearm opener. The concept is that a hunter who takes a deer early, may be more selective with filling their buck license and be less inclined to harvest a younger buck. Further, since the early deer season would be antlerless-only, this may shift harvest ratios toward females, thereby lowering deer densities.

In our study, nearly 50% of respondents indicated support, 16% neither supported nor opposed, and 32% opposed an early antlerless season. Support for an early antlerless season was the highest observed for any regulatory option. Although there were no regional differences ($\chi^2=23.0$, $P = 0.083$), support ranged from 48% in the transition area to 51% in the southeast. Interestingly, while <50% of all respondents indicated support for the hunt, nearly 57% said they would participate if it were offered in their area. This difference might be attributable to the 16% of respondents who had no opinion (neither supported nor opposed).

Antler point restriction. Antler-point restriction regulations are designed to protect yearling (1½ year old) bucks by only allowing the harvest of bucks that have a minimum number of antler points on at least 1 side of its antlers. Typically, the regulation protects at least 50% of the yearling buck population, which roughly translates into a 3-point regulation in the northern part of the state and a 4-point regulation in the south. Overall, almost 47% of respondents either strongly (25%) or moderately (22%) supported an antler-point restriction regulation. However, opposition was nearly as strong with 43% either moderately (13%) or strongly (30%) opposing the regulation. Regionally, we detected minor differences with southeast hunters more inclined to support (51%) and northwest hunters least likely to support (43%; $\chi^2 = 25.5$, $P = 0.043$).

Overall, support exceeded opposition in all other areas except for northwest hunters who opposed the regulation more often than support it (43% support vs. 45% oppose).

Earn-A-Buck. Earn-a-buck is a regulation that requires a hunter to harvest an antlerless deer before they can legally harvest an antlered buck. During the 2005 Minnesota deer hunting season, 72% of successful hunters killed only 1 deer so the regulation may have the effect of increasing pressure on antlerless deer because a buck cannot be immediately harvested. Once the antlerless deer is taken, a hunter may or may not have an opportunity to harvest a buck, and they may be more inclined to pass on smaller bucks because they have already procured venison.

Overall, only 37% of respondents either strongly (14%) or moderately (22%) supported an earn-a-buck regulation. Conversely, the regulation was opposed by 48% of respondents (18% moderately, 30% strongly). We detected no statistical differences in levels of support for this regulation among survey regions ($\chi^2 = 14.9$, $P = 0.455$) and in all areas respondents were much more likely to strongly oppose than strongly support the regulation.

Cross-Tagging. In Minnesota, cross-tagging specifically means that while hunting as a group, individuals can shoot and tag deer for each other. For this survey, the question was specifically worded to indicate the intent was not to break up the family and friend-hunting units (e.g., party); rather it was to only allow hunters to shoot and tag their own deer. Overall, only 28% indicated any type of support, while 62% opposed the regulation. Specifically, 46% of respondents strongly opposed eliminating cross-tagging. Regionally, there were no differences among our survey areas for all cross-tagging ($\chi^2 = 17.3$, $P = 0.302$). As the cross-tagging question had been asked on previous surveys

conducted on Minnesota deer hunters and achieved very low support (e.g., Fulton et al. 2004), we opted to ask another question that would only address cross-tagging of bucks. In other words, hunters would only be able to shoot and tag antlerless deer for each other. By preserving the option of cross-tagging antlerless deer, we observed an increase in support, albeit it was still below 50%. In total, 46% of respondents indicated they would support that regulation, while 42% indicated opposition. Similar to the results obtained in the previous question, we did not detect any regional differences for buck-only cross-tagging ($\chi^2 = 19.3$, $P = 0.201$).

Adjusting season timing. In total, only 28% of respondents either strongly (13%) or moderately (15%) supported the concept of moving the deer season out of the rut. Conversely, 55% of respondents opposed the regulation with 36% of those people strongly opposing. Regionally, northwest (59%) and transition (57%) hunters were most likely to oppose the regulation, while southeast hunters were most likely to indicate support (34%; $\chi^2 = 42.6$, $P < 0.001$).

Buck license lottery. In our study, this regulation received the lowest overall support of any of the options presented. In total, only 29% of respondents supported this regulatory option. In contrast, 59% opposed the regulation with 44% of those indicating strong opposition. Regionally, we detected no differences of opinion as most hunters were equally opposed to the regulation ($\chi^2 = 24.5$, $P = 0.057$). We also asked hunters if they would pursue antlerless deer if the regulation was adopted and they failed to obtain a buck license. Overall, most hunters (84%) indicated they would still hunt antlerless deer, although there was significant regional variation ($\chi^2=39.3$, $P < 0.001$). Hunters in southeastern Minnesota, while no more opposed to the regulation in general, were much

more likely to indicate they would not hunt at all if they were not successful in obtaining a buck license (23%).

Regulatory preferences among individuals who supported more antlered bucks.

For the 66% of respondents who were supportive of a regulation to increase the number of antlered bucks, we examined which regulatory alternative was most supported. There is an underlying presumption that respondents who supported antlered buck regulations would 'get behind' at least one of the regulatory alternatives (as indicated by high support). However, that was not the case as we observed only moderate increases in support for the regulatory alternatives among those who supported said regulations (Table 3.4).

In total, antler-point restrictions (61%), eliminating buck cross-tagging (55%), and an early antlerless season (53%) were supported by >50% of this sub-group. Earn-a-buck (42%), buck license lottery (36%), moving the deer season out of the rut (33%), and eliminating all party hunting (32%) were supported by less than <50% of the sub-group. Regionally, southeast respondents had the highest support for antler point restrictions (65%), an early antlerless season (56%), moving the season out of the rut (41%), and eliminating all cross-tagging (35%). Conversely, northwest hunters were most supportive of earn-a-buck (54%) and least supportive of eliminating all cross-tagging (29%; Table 3.5).

Ranked Choice Survey Data Analysis - Individual Scenarios

Scenario 1 – *Deer population is within goal levels and antlerless permits are available over the counter.* This scenario exists in many Minnesota DPAs, most notably in the northern and central parts of the state. Management in these areas typically allow

the taking of either-sex deer with a regular license and additional antlerless deer by over-the-counter permit. Briefly, the choices presented in this scenario were as follows,

1. Buck license lottery that allows cross-tagging (BL1).
2. Buck license lottery that does not allow cross-tagging (BL2).
3. Antler point restriction that protects some bucks (APR1).
4. Antler point restriction that protects more bucks (APR2).
5. Antler point restriction that protects the most bucks (APR3).
6. Delay the start of the deer season by one week.
7. Would not hunt the area if the regulations were changed.

For this scenario, we applied a 2-level nesting structure to the buck lottery (BL1, BL2) and the antler point restriction (APR1, APR2, APR3) choices (Figure 3.3). Overall, estimates of choosing each of the 7 options (assuming all are available in the choice set) were delay the season (0.24), followed by APR1 (0.17), APR2 (0.16), BL1 (0.15), BL2 and APR3 (0.11 each), and finally not hunt (0.07) (Figure 3.4a). At the nest level, we found the antler point restriction was most preferred (0.44), followed by the buck lottery (0.26), delaying the deer season (0.24), and not hunting (0.07) (Figure 3.4b). We inferred from this data that 44% of hunters would choose one of the antler point restriction regulations and within that regulation, the most supported options were also the least restrictive (APR1 - 0.17; APR2 = 0.16).

Delaying the deer season was the least intrusive regulatory option and thus most often selected. Among antler point restriction regulations, the least restrictive (protect 50% of the yearling buck population) was selected most often, whereas the 2 most restrictive regulations (BL2, APR3) were selected least often. Finally, the option of not

hunting if regulations were enacted ranked consistently the lowest; thus, hunters would likely choose any regulation (even apply for buck hunting opportunity) before they moved to a new location as a result of regulatory change.

Scenario 2 – Deer population is 25% above goal level and needs to be reduced within 5 years.. This scenario is probably the most common current condition in northwestern, central, east-central, and the southeastern corner of Minnesota. Deer areas in these locations are typically managed as intensive, where hunters can take up to 5 deer of which only 1 can be antlered. Since the inception of antlerless-only permits in the mid 1990's, multiple permits have been available to individual hunters and deer populations have continued to rise. The choices presented in this scenario were as follows,

1. Buck license lottery that allows cross-tagging (BL1).
2. Buck license lottery that does not allow cross-tagging (BL2).
3. Antler point restriction that protects some bucks (APR1).
4. Antler point restriction that protects more bucks (APR2).
5. Earn-a-buck (EAB).
6. Early Antlerless only (EA).
7. Would not hunt the area if the regulations were changed.

For this scenario, the 2-level nesting structure was applied to the buck lottery (BL1, BL2) and the antler point restriction (APR1, APR2) choices (Figure 3.5). Similar to our observations in scenario 1, the estimates of choosing among the 7 options ranged from the least restrictive (EA = 0.31) to the most restrictive (BL1=0.06, BL2 = 0.06), although the choice of not hunting (0.04) was comparable to both BL options (Figure 3.6a). At the nest level, we found the antler point restriction (0.33) was nearly identical

to the early antlerless (0.31), followed by earn-a-buck (0.19), the buck lottery (0.13), and not hunting (0.04) (Figure 3.4b). Results from this scenario indicate that an early antlerless season would likely be most preferred, followed by either some type of antler point restriction or perhaps earn-a-buck. Given both buck lottery options ranked only slightly higher than not hunting, we believe respondents would prefer to take a certain type of buck (antler point restriction) or take a doe first (earn-a-buck), did not want to give up annual buck hunting opportunity.

Scenario 3 – Deer population is 50% above goal level and needs to be reduced within 5 years. This scenario rarely exists in Minnesota and would most likely be associated with DPAs containing large urban areas, disease management scenarios, some state parks, and other lightly hunted refuges. While presumed to be rare, the scenario was added because there is a chance the deer population goal setting project (Chapter 2) would identify some local areas that would require this level of deer reduction. As the management options would be similar to scenario 2, we opted to use the same choice set,

1. Buck license lottery that allows cross-tagging (BL1).
2. Buck license lottery that does not allow cross-tagging (BL2).
3. Antler point restriction that protects some bucks (APR1).
4. Antler point restriction that protects more bucks (APR2).
5. Earn-a-buck (EAB).
6. Early Antlerless only (EA).
7. Would not hunt the area if the regulations were changed.

As the choices were identical to scenario 2, so was the nesting structure (Figure 3.5). Overall, respondents were most likely to choose the early antlerless option (0.30)

and least likely to choose either buck lottery option (BL1 = 0.09, BL2=0.09); however, they were more inclined to choose the regulatory packages that might lead to more dramatic deer population reductions as compared to scenario 2. For example, in scenario 2, the APR regulations and EAB were nearly identical. In scenario 3, EAB was chosen more often than either APR option (Figure 3.7a). Within the APR choices, we found the most restrictive antler point regulation (APR2) was selected more often than APR1 (0.17 vs. 0.11). Once again, the option of not hunting was chosen least often (0.03).

At the next level, we found the early antlerless option (0.30) was chosen most often (and nearly identical to the percentage observed in scenario 2), followed by antler point restrictions (0.27), earn-a-buck (0.21), the buck lottery (0.18), and not hunting (0.03) (Figure 3.7b).

Scenario 4 – Deer population at or below goal, high buck harvest rates, limited antlerless permits. This scenario exists throughout the farmland region of Minnesota and is most typified by DPAs where people can hunt bucks with over-the-counter licenses but must apply for a limited number of either-sex permits. Specific locations are the southwest farmland areas and major wildlife management areas where hunting pressure is high. Briefly, the choices were as follows,

1. All licenses through a lottery, buck cross-tagging allowed (AL1)
2. All licenses through a lottery, buck cross-tagging not allowed (AL2)
3. Antler point restriction that protects some bucks, youth must abide, no cross-tagging (APR1).
4. Antler point restriction that protects more bucks, youth must abide, cross-tagging allowed (APR2).

5. Antler point restriction that protects more bucks, youth can take any deer, cross-tagging allowed (APR3).
6. Delay the start of the deer season by one week.
7. Would not hunt the area if the regulations were changed.

For this scenario, we applied a 2-level nesting structure to the all lottery (AL1, AL2) and the antler point restriction (APR1, APR2, APR3) choices (Figure 3.8). Once again, hunters were most likely to select the least intrusive regulation (delay season - 0.26). The second most often selected regulatory alternatives were the 3 APR variants with APR2 chosen most often (0.19), followed by APR3 (0.17), and APR1 (0.12). The lottery choices, which by definition would limit annual hunting license purchase, ranked lower than the choices that provided for annual hunting (AL2 - 0.10; AL1 = 0.09). Interestingly, 8% of hunters indicated they would not hunt if these regulations were implemented, which was only slightly lower than the lottery selections (Figure 3.9a). Within the APR choices, it is important to note the two highest ranked choices also protected the highest percentage of yearling bucks. Within those two, hunters slightly preferred a regulation that also limited youth hunting opportunity.

At the next level, we found the antler point restriction was most preferred (0.48), followed delaying the deer season (0.26), participating in a license lottery (0.18), and not hunting (0.08) (Figure 3.9b). We inferred from this data that 48% of hunters would choose one of the antler point restriction regulations and within that regulation, the most supported options protected the most bucks and required all hunters to comply (APR2 = 0.19).

Scenario 5 – Various antler point restriction regulations. In Minnesota, antler point restriction regulations are currently being tested on 3 Minnesota state parks in order to test the biological effect of the regulation. Concurrently, the sociological effect will be assessed by surveying hunt participants (Chapter 4). To that end, this scenario attempted to address which variants of antler point restriction regulations would be most acceptable if they were adopted in a DPA and compare those choice against not hunting. Briefly, the choices were as follows,

1. Protect some bucks, youth must abide, no cross-tagging (APR1).
2. Protect more bucks, youth must abide, cross-tagging allowed (APR2).
3. Protect some bucks, youth can take any deer, no cross-tagging (APR3).
4. Protect more bucks, youth can take any deer, cross-tagging allowed (APR4).
5. Protect more bucks, youth must abide, no cross-tagging (APR5).
6. Generally opposed to any APR restrictions, but would hunt anyway (APR6).
7. Would not hunt the area if the APR regulations were enacted (APR7).

The MNL indicated that respondents were most likely to select APR4 (0.22), followed by APR2 and APR3 (0.17 each), APR6 (dislike but would hunt - 0.15), APR1 (0.14), APR5 (0.11), and finally APR7 (not hunt - 0.05) (Figure 3.10). The preference of APR4 makes intuitive sense because while it does protect a high percentage of yearling bucks, it still offers a youth incentive and allows people to continue to cross-tag bucks. Of all the regulatory alternatives, this is likely the least restrictive (even though it protects most yearling males). Conversely, the most restrictive regulation (APR5) also ranked the lowest.

Comparing the MNL results with a direct comparison of the empirical proportions of selecting each choice from the 7 sets yielded similar results (Figure 3.11). While the results were not fully consistent across choice sets, APR4 does appear to be a clear “winner” in that it ranked first among options in each of the choice sets in which it appears. Conversely, option 7 (not hunting) is the clear “loser” in that it consistently ranked lowest in its choice set.

Discussion

Appropriate management of natural resources often requires at least one trade-off (Steelman & Ascher, 1997). Within the realm of deer management, that trade-off can be expressed as reduced buck hunting opportunity to increase the proportion of mature males or limiting antlerless deer harvest to achieve a desired population goal. When placed in the context of 500,000 hunters, balancing trade-offs with a desire to accomplish deer management objectives can prove challenging. Our study demonstrated that hunters are traditional (90% return to the same location) and rely heavily on private land (85%) for hunting access. Thus, our finding suggests that the wildlife agency may find significant challenges in attempting shift hunters away from their traditional deer management areas to areas where increased hunter numbers are desirable to increase the antlerless harvest. To that end, as private lands are already hunted, it may prove challenging to increase hunter densities on private lands if that strategy is warranted. Conversely, negative trade-offs may be realized if the regulation is so disfavored that a significant proportion of hunters quit or move to a new location if regulations are changed.

In traditional attitude surveys, there are minimal assumptions of the underlying theory so respondents can rate all attributes equally and there is effectively no cost to assigning low rankings (Phillips, Johnson, & Maddala, 2002). As noted in our results, 66% of respondents favored mature buck regulations yet no alternative garnered >50% support, which was surprising given some of the regulatory alternatives presented to had low negative trade-offs. For example, the firearm deer season in Minnesota is established through administrative rule and opens the Saturday closest to 6 November. Data collected from 1983 to 1987 in northern Minnesota estimated that peak conception ranged from November 10 to 14 (Fuller, 1990). Consequently, the firearm deer season is timed before the peak of deer breeding and there is a belief among hunters that a 'rut opener' may increase buck harvest rates because bucks are most vulnerable in early November. However, no studies have been published to support or reject this theory and likely if the deer season were formerly established in mid-November, there may very well be resistance to moving it earlier in the season (from peak- to pre-rut).

By contrast, the current study used a ranked choice stated preference approach to have respondents rank alternative choices constructed from lower-level attributes that explicitly define the costs and benefits associated with each option. When faced with the choice of hunting under less than desirable regulations or not hunting in their traditional areas, Minnesota deer hunters chose to hunt. Our results indicated a high fidelity to traditional hunting locations and unwillingness to move, even if they disagreed with the regulations. Which regulations they chose; however, depended on the scenario and an individual's perception of its effectiveness. For example, when given scenarios that called for either a 25% or 50% reduction in the deer populations, respondents were more

likely to choose more liberal regulations under the 50% scenario. Using the 50% reduction scenario as an example, we also found that within the APR choices, the most restrictive antler point regulation (APR2) was selected more often than APR1 (0.17 vs. 0.11), which indicated hunters may have recognized that protecting more bucks may put more harvest pressure on antlerless deer as compared to a less restrictive APR regulation. Results from this scenario also indicated that an early antlerless season would again be most preferred; however, an EAB regulation would also be a feasible alternative. This scenario, along with the others also demonstrated that hunters would likely accept any regulation (including buck lottery) over not hunting if new regulations are implemented.

There were 2 additional issues that stood out in this survey. First, moving the deer season out of the rut has been noted by individuals as an acceptable and ‘easy’ change that would lead to more mature bucks. However, in the choice portion of this study, it was clear that respondents believed moving the deer season was less attractive than antler point restrictions. In the attitude portion of the survey, when asked if they supported or opposed moving the season, the regulation garnered less support (28%) than a buck license lottery (29%), which ranked lowest in all the choice scenarios.

Finally, respondents clearly wanted an opportunity to hunt bucks every year. In all cases, the buck license lottery choice ranked lower than all other regulatory alternatives. The only choice that ranked lower than a buck license lottery was moving to another hunting location if the regulations were implemented. Certainly, if a buck license lottery were implemented, DNR would experience at best dissension among a majority of hunters and at worst, a movement of hunters to other areas of the state.

Management Implications

Increasingly, wildlife managers have considered collaborative decision-making processes involving the general public, rather than being entrusted to employ more traditional expert-authority decision approaches. Attitude surveys (e.g., support or oppose) have relevance to management and will continue to be important, but often provide inadequate support for unpopular actions that may be required when traditional management tools are ineffective (e.g., bag limits and season lengths have already been exhausted). In addition, hunters are often conflicted in their response in that they have clear preferences (e.g., more bucks) but are unwilling to express trade-offs (e.g., regulatory change). Also, the myriad of stakeholders may want more or fewer deer at the same place at the same time (Woolf & Roseberry, 1998). Thus, once decisions are made as to which direction to go with deer populations, agencies are left with no clear direction on which regulatory package to choose.

The forced choice survey, as illustrated in the context of deer management, offers a viable approach to gathering public input in these situations. When presented with different real-world scenarios, hunters were able to rank (and thus presumably accept) suitable alternatives rather than choose to move to a new hunting location. Thus, these results suggest hunters would continue to hunt in the location despite regulatory change. This information is a powerful tool managers can use to demonstrate that while regulations may not have majority support, they can still be implemented without significant impacts on hunter numbers.

Specific to the choices presented to respondents, DNR should consider early antlerless seasons as a first step in DPAs where current management strategies are not effective at lowering populations. Progressing beyond early antlerless seasons, DNR has several options available that may also decrease densities. In all cases, APR and

EAB regulations could be considered if biologically they prove more effective than early antlerless season alone (see Grund, 2008). Finally, moving the deer season and a lottery for buck deer licenses were not supported and should not be considered an acceptable or viable management regulation for Minnesota white-tailed deer.

Table 3.1 Percent support for regulations that would increase the number of mature bucks in local deer populations, Minnesota, 2005.

Region	<i>N</i>	Strong Support	Moderate Support	Neither	Moderate Oppose	Strong Oppose	Don't Know
East Central	765	31.6	34.9	19.9	5.8	5.2	2.6
Northwest	805	34.8	28.4	19.1	7.7	7.7	2.2
Southeast	814	38.0	30.8	18.1	5.8	5.3	2.1
Transition	866	33.0	31.3	19.7	6.5	7.9	1.6
Total	3,250	34.4	31.3	19.2	6.4	6.6	2.1

$\chi^2=24.4, P = 0.058$

Table 3.2 Percent support for each regulatory alternative presented to Minnesota deer hunters, 2005.

Regulation	<i>n</i>	Strongly Support	Moderate Support	Neither	Moderate Oppose	Strongly Oppose	Don't Know
Early antlerless season	3,247	23.5	26.4	16.0	10.7	21.3	2.2
Antler Point Restriction	3,230	24.8	22.0	9.5	13.0	29.5	1.2
Prohibit buck cross-tagging	3,251	25.3	20.3	10.7	12.4	29.9	1.3
Earn-A-Buck	3,248	14.3	22.4	14.4	17.9	30.0	1.0
Buck lottery	3,228	12.0	17.3	10.4	15.8	43.5	1.1
Move season out of the rut	3,235	13.3	15.2	15.6	18.3	36.2	1.5
Prohibit all cross-tagging	3,247	17.4	10.4	9.8	15.7	45.4	1.2

Table 3.3 Percent support for alternative deer management regulations in Minnesota, by survey strata, 2005.

Regulation	<i>n</i>	Region				Total	χ^2	<i>P</i>
		East Central	Northwest	Southeast	Transition			
Early antlerless season	3,247	51.2	50.2	50.6	47.6	49.9	23.039	0.083
Antler point restriction	3,230	46.9	43.4	51.4	45.5	46.8	25.525	0.043
Prohibit buck cross-tagging	3,251	45.4	43.2	48.0	46.0	45.6	19.267	0.201
Earn-A-Buck	3,248	35.9	39.9	36.1	35.1	36.7	14.952	0.455
Buck lottery	3,228	26.9	30.3	28.1	31.2	29.2	24.481	0.057
Move season out of the rut	3,235	28.9	25.2	34.2	25.7	28.4	42.641	<0.001
Prohibit all cross-tagging	3,247	26.6	26.0	30.5	28.3	27.9	17.28	0.302

Table 3.4 Percent support among respondents indicating their relative support for regulations that promote more adult bucks in the deer population, by survey strata, Minnesota, 2005.

Regulation		Support for regulations that increase mature bucks			χ^2	<i>P</i>
		Support	Neither	Oppose		
Early antlerless season	Support	52.8	50.4	41.0	34.3	<0.001
	Neither	15.0	18.7	13.5		
	Oppose	32.3	31.0	45.6		
Antler point restriction	Support	60.7	22.3	17.7	510.3	<0.001
	Neither	7.3	18.4	4.8		
	Oppose	31.9	59.3	77.5		
Prohibit buck cross-tagging	Support	55.1	28.9	28.2	239.9	<0.001
	Neither	9.6	18.2	5.8		
	Oppose	35.3	52.9	66.0		
Earn-A-Buck	Support	42.4	26.2	21.8	131.6	<0.001
	Neither	13.9	19.9	9.1		
	Oppose	43.7	53.9	69.1		
Buck lottery	Support	36.3	15.2	16.1	225.1	<0.001
	Neither	9.3	20.5	2.6		
	Oppose	54.4	64.3	81.3		
Move season out of the rut	Support	32.7	18.7	22.3	86.6	<0.001
	Neither	14.7	23.9	10.2		
	Oppose	52.6	57.5	67.5		
Prohibit all cross-tagging	Support	32.0	19.8	21.8	87.6	<0.001
	Neither	10.7	11.7	1.8		
	Oppose	57.3	68.5	76.5		

Table 3.5 Percent support for alternative deer regulations among people who supported more antlered bucks, Minnesota, 2005.

Regulation	<i>n</i>	Region				Total
		East Central	Northwest	Southeast	Transition	
Early antlerless season	1,092	53.8	52.2	55.9	50.7	53.1
Antler Point Restriction	1,260	59.4	57.4	65.3	61.0	60.9
Prohibit buck cross- tagging	1,155	53.0	55.6	55.8	56.6	55.3
Earn-A-Buck	896	40.6	46.8	42.7	42.6	43.1
Buck lottery	751	32.7	38.2	34.8	39.6	36.4
Move season out of the rut	690	32.6	29.3	40.6	30.5	33.4
Prohibit all cross- tagging	665	30.6	28.8	35.2	32.8	32.0

Figures

Figure 3.1 2004 Minnesota Permit Areas with Choice Survey Regions.

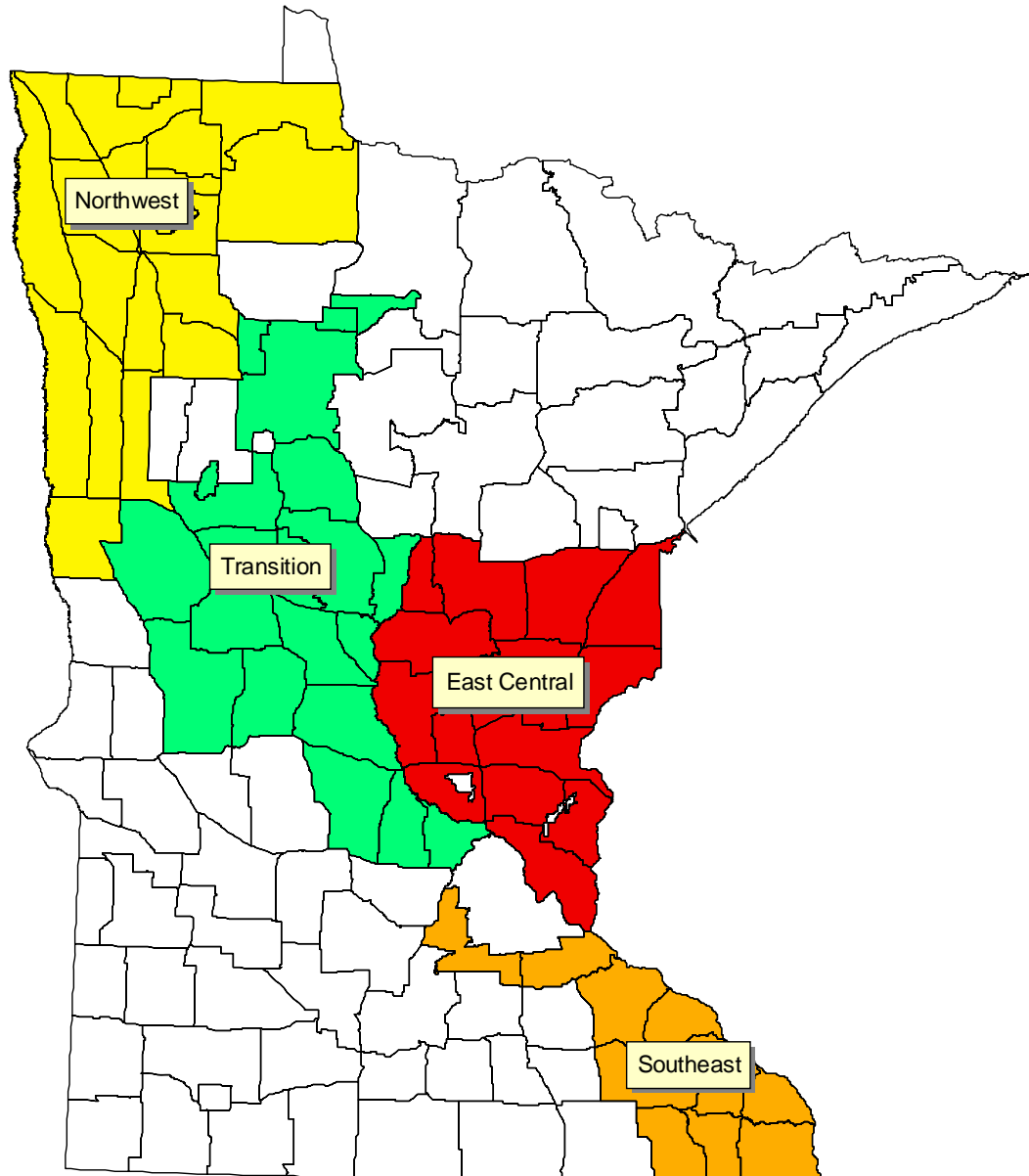


Figure 3.2 Schematic used to distribute deer hunter choice scenarios using the randomized incomplete block design for 7 choices.

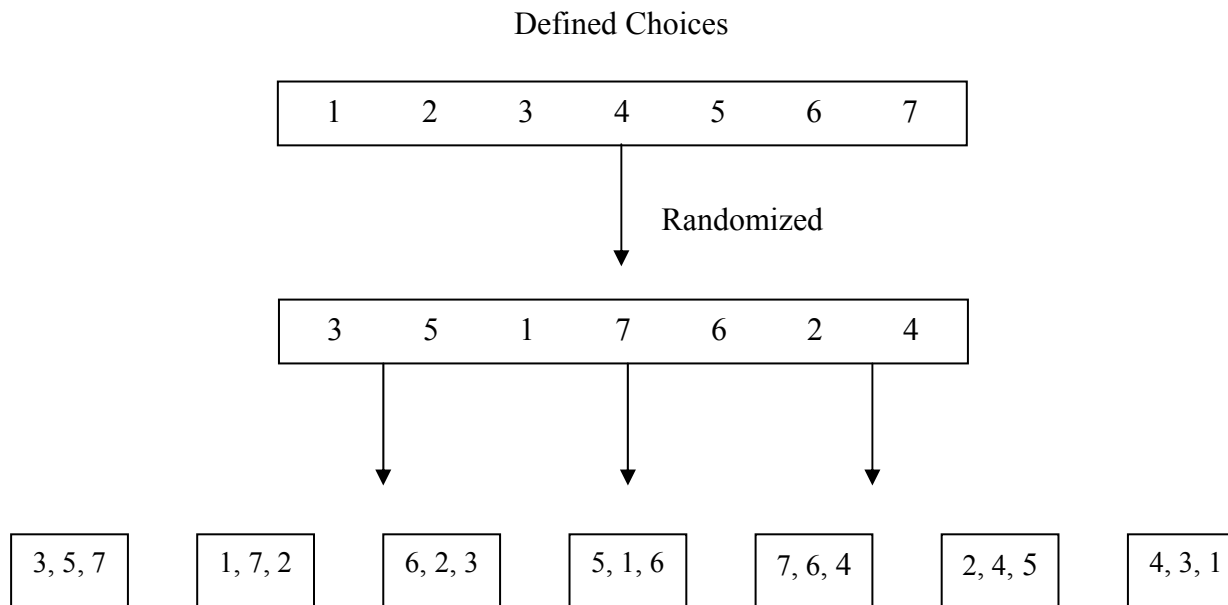


Figure 3.3 Two-level nested structure for choice scenario 1.

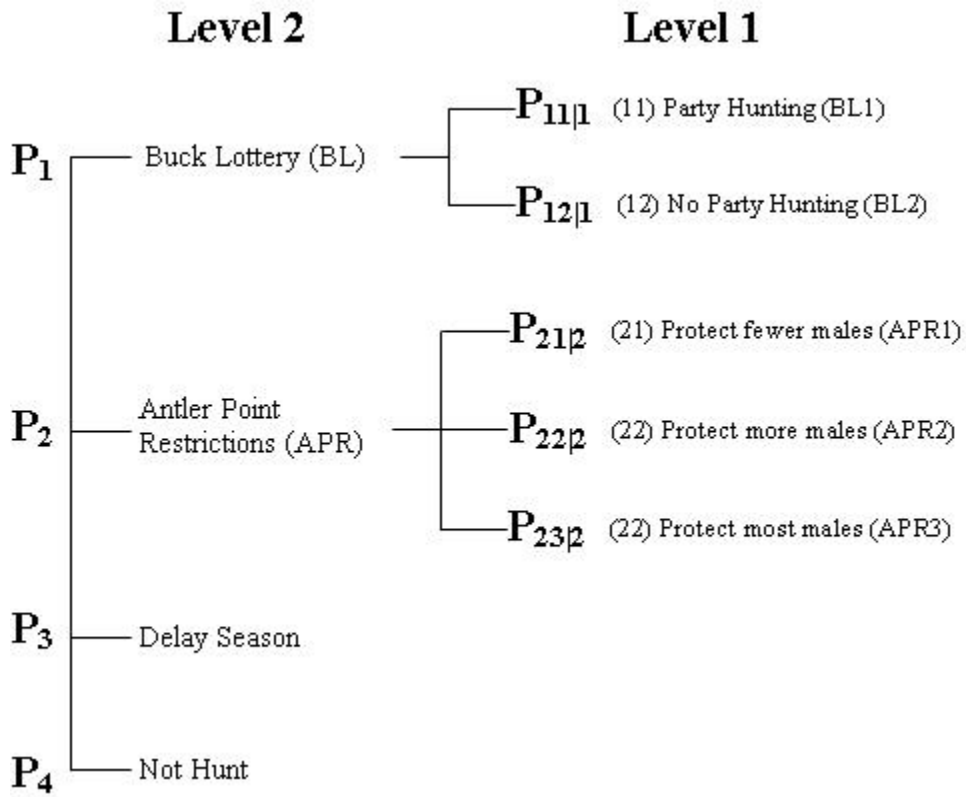
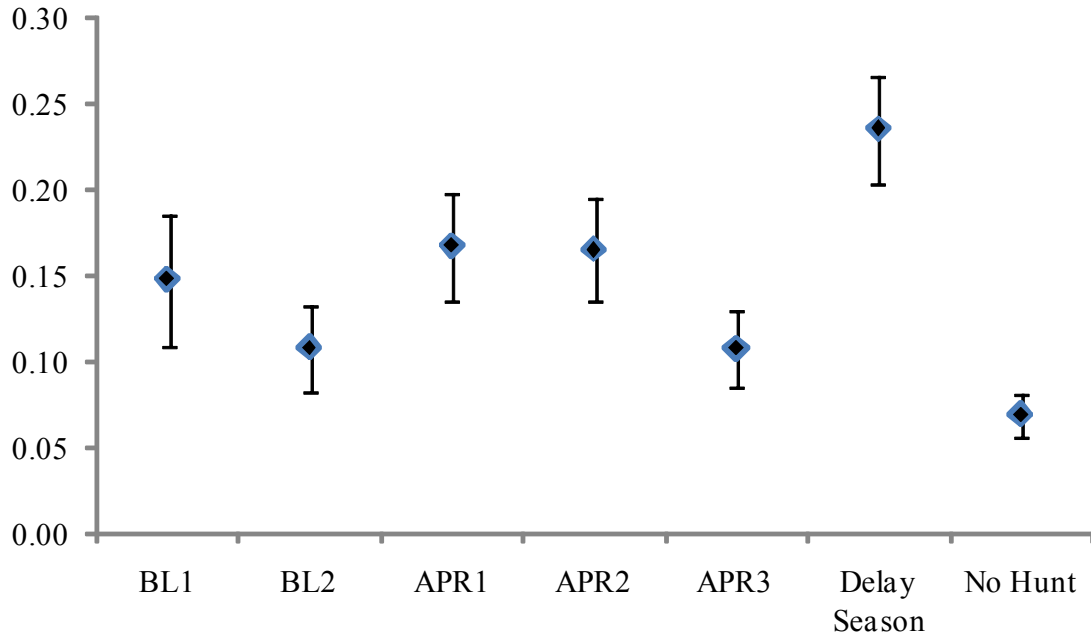


Figure 3.4 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the nested-logit model fitted to the top ranked alternative for scenario 1.

(a) Estimate of choosing each of 7 options



(b) Estimate of choosing nested options

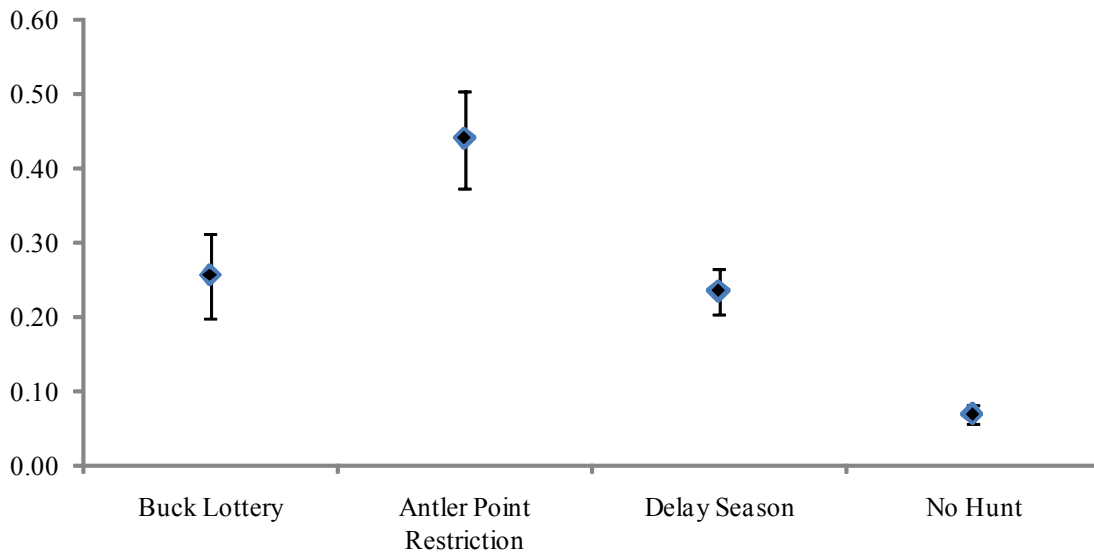


Figure 3.5 Two-level nested structure for choice scenarios 2 (25% reduction) and 3 (50% reduction).

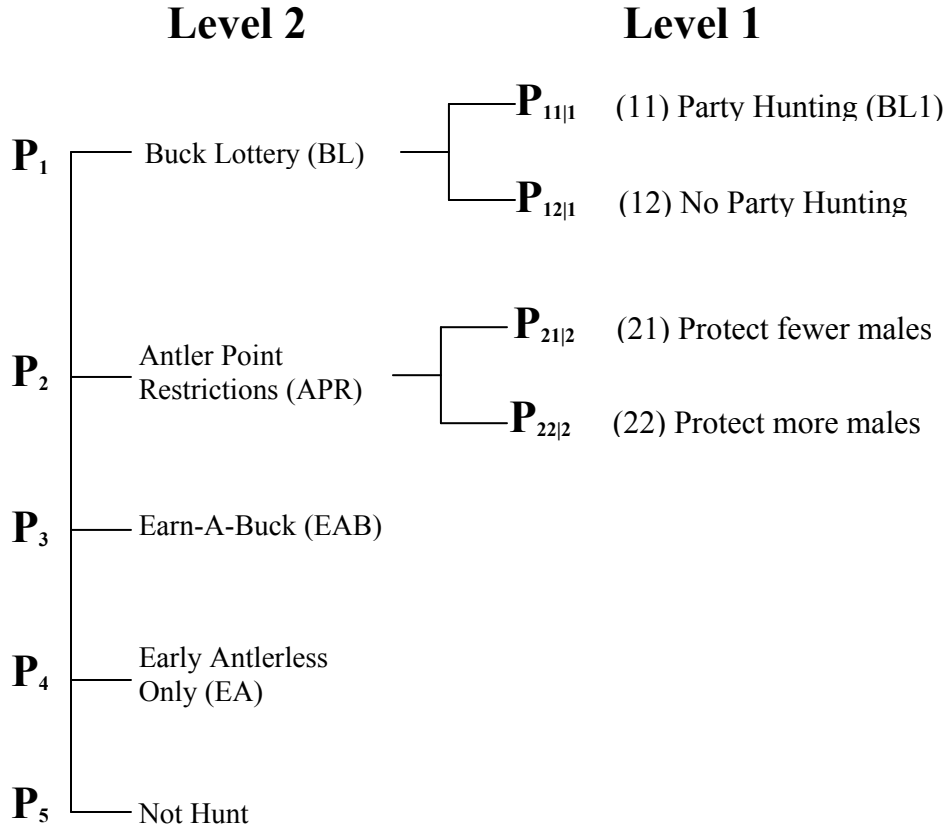
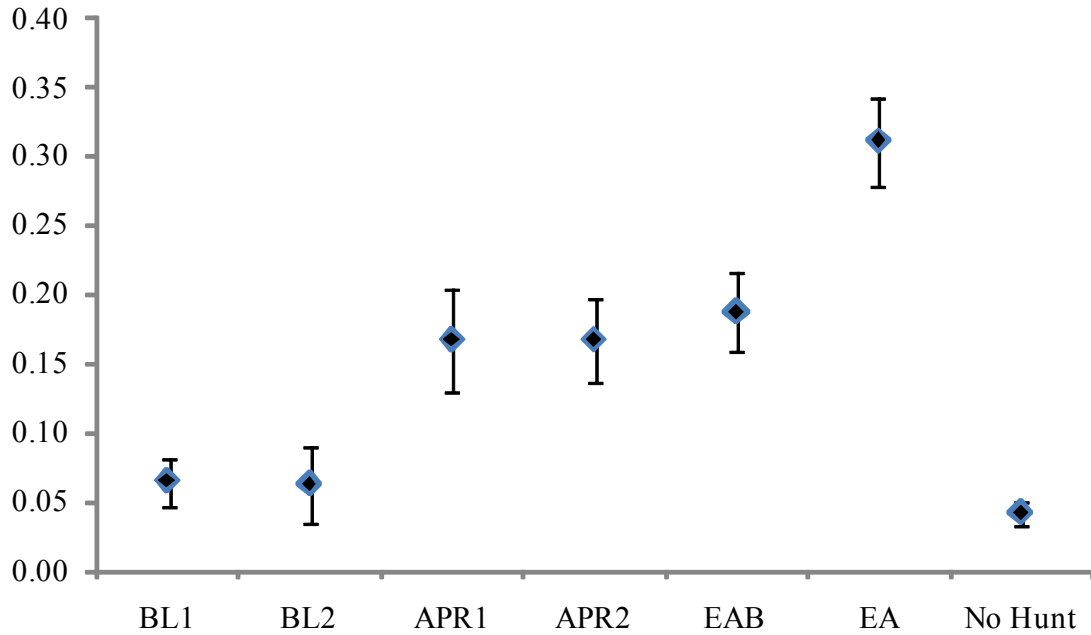


Figure 3.6 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the nested-logit model fitted to the top ranked alternative for scenario 2.

(a) Estimate of choosing each of 7 options



(b) Estimate of choosing nested options

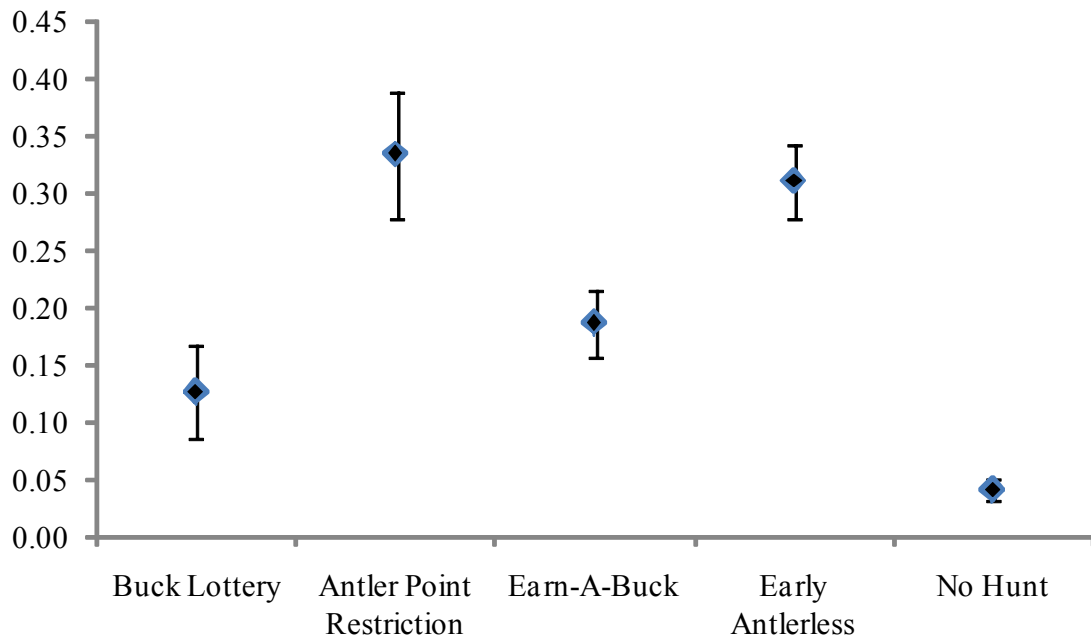
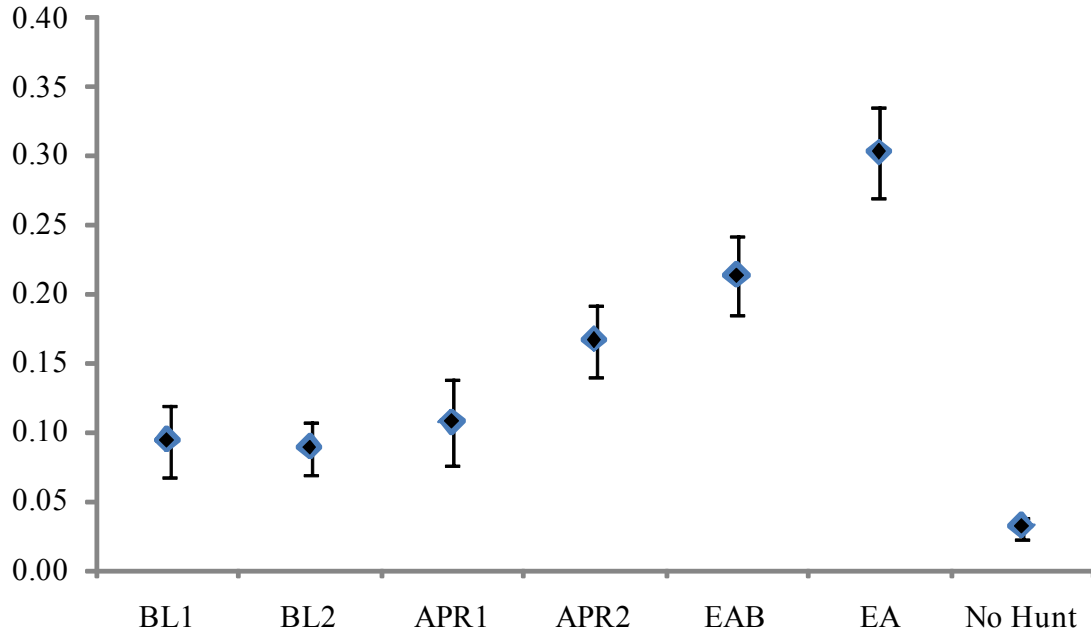


Figure 3.7 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the nested-logit model fitted to the top ranked alternative for scenario 3.

(a) Estimate of choosing each of 7 options



(b) Estimate of choosing nested options

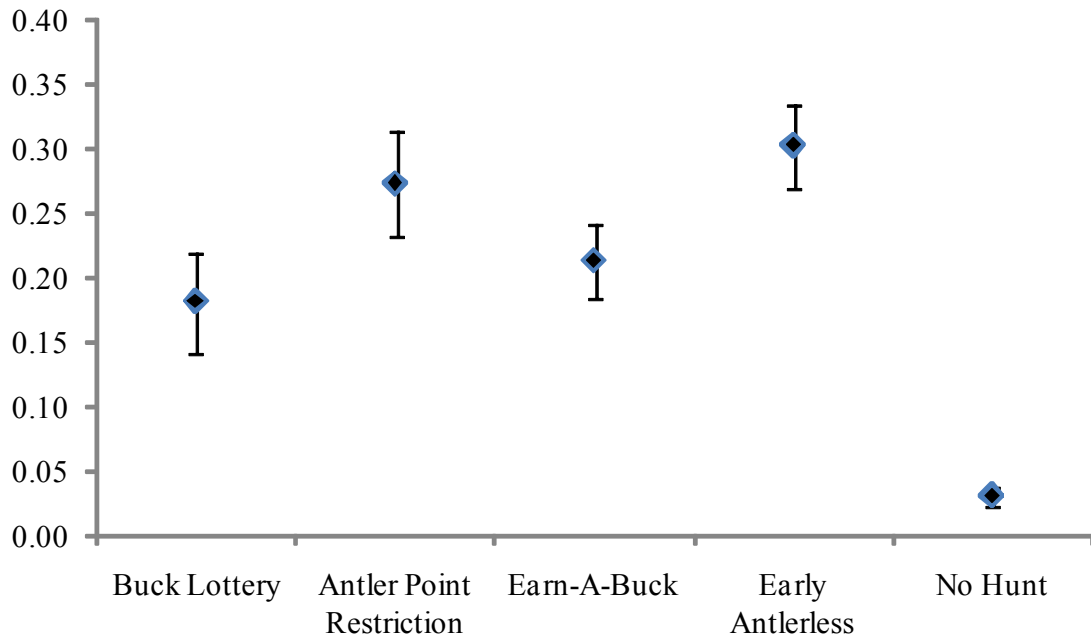


Figure 3.8 Two-level nested structure for choice scenario 4.

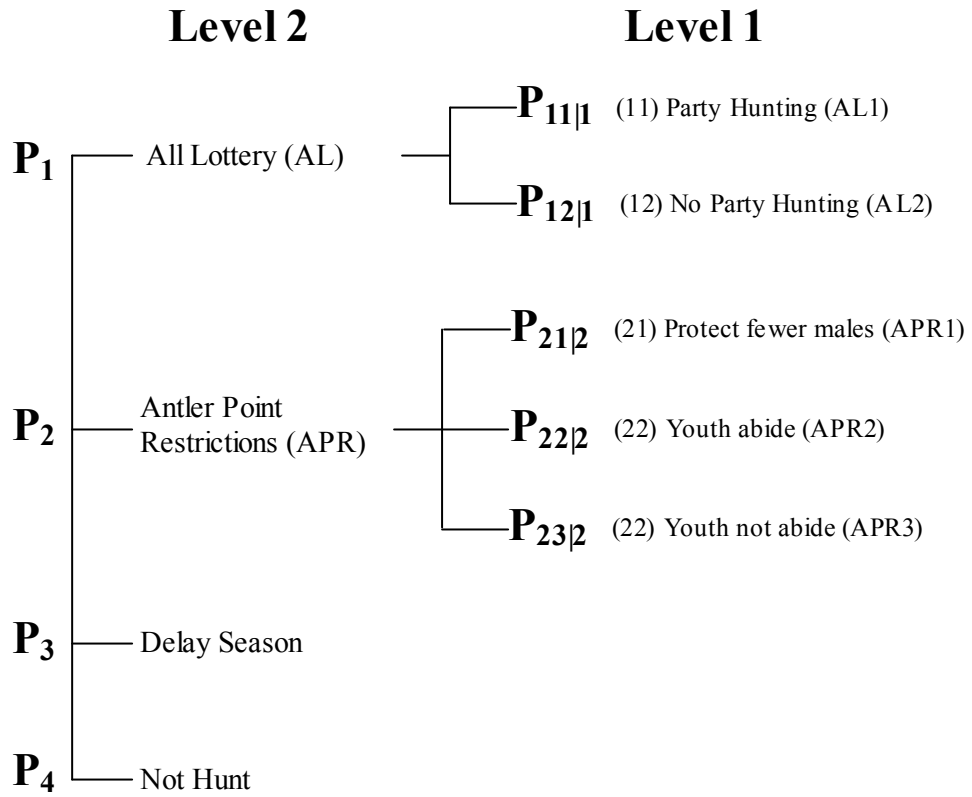
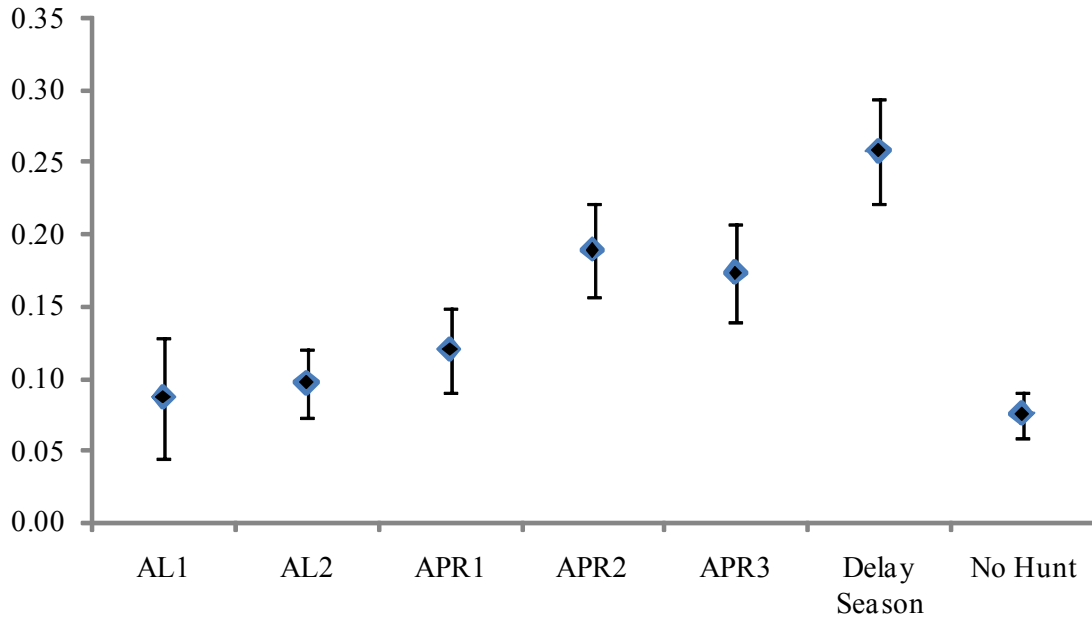


Figure 3.9 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the nested-logit model fitted to the top ranked alternative for scenario 4.

(a) Estimate of choosing each of 7 options



(b) Estimate of choosing nested options

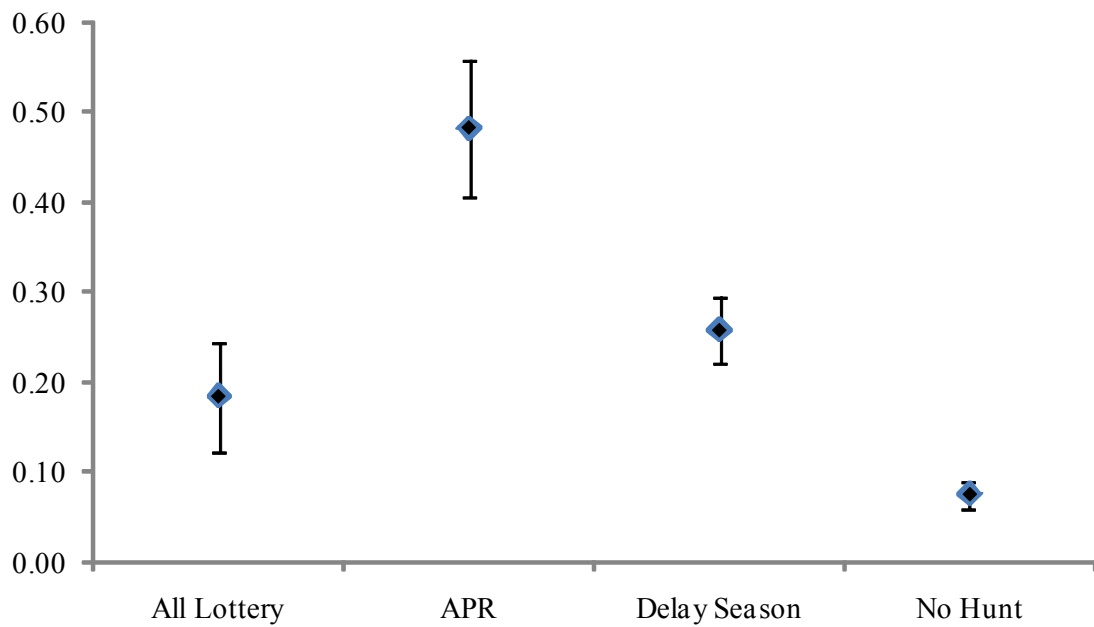
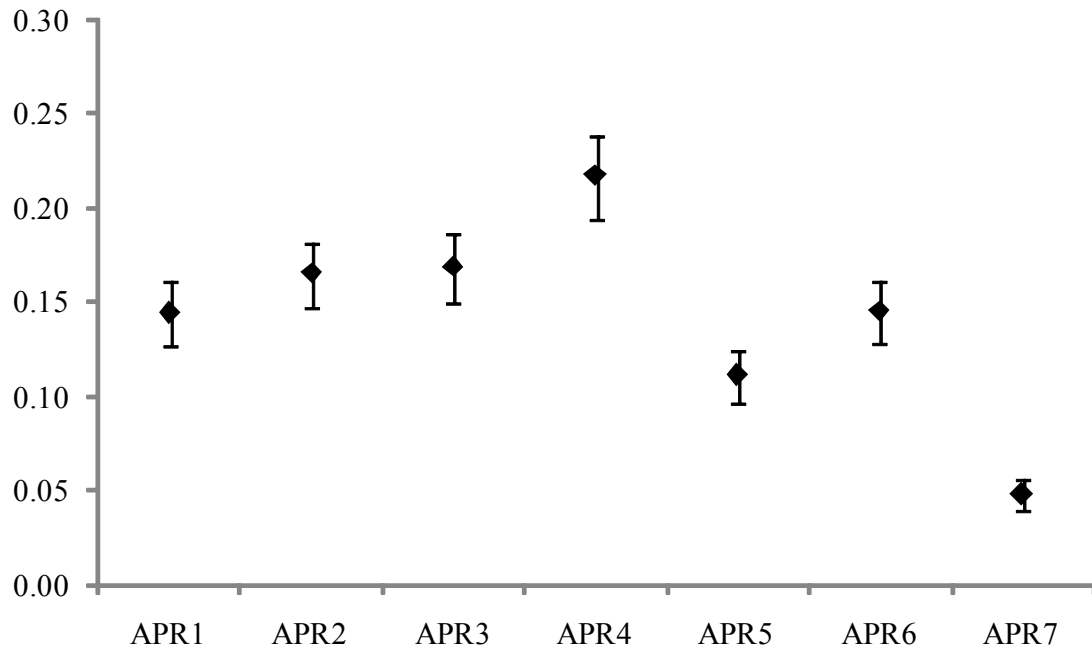


Figure 3.10 Estimates of choice probabilities (and 95% confidence intervals) associated with each alternative regulation using the multinomial logit model fitted to the top ranked alternative for scenario 5.



Endnotes

¹Full methods section from accepted publication using logit modeling to analyze choice data.

Fieberg, J., Cornicelli, L., Fulton, D. C., & Grund, M. D. (in press). Design and analysis of simple choice surveys for natural resource management. *Journal of Wildlife Management*.

DCMs (and the Nested Logit Model)

The multinomial logit (MNL) model is the most commonly used discrete choice model (Manly et al. 2002). The theoretical basis for this model, motivated by economic utility theory, is described in Cooper and Millspaugh (1999). Briefly, individuals are assumed to make choices (among available options) so as to maximize the utility or satisfaction gained from their choice. The utility associated with individual i choosing alternative j is composed of a deterministic component, $X_{ij}\beta$ (with X_{ij} comprising covariates that measure specific attributes associated with alternative j and β is a vector of regression parameters) and a random error component e_{ij} which captures unmeasured variability associated with the utility gained by individual i (from choosing alternative j):

$$U_{ij} = X_{ij}\beta + e_{ij} \quad (1)$$

Option j is chosen by individual i if and only if $U_{ij} > U_{ik}$ (or $X_{ij}\beta - X_{ik}\beta > e_{ij} - e_{ik}$) for all k choices available to the chooser. This framework also allows one to model the influence of various demographic characteristics of the chooser by including additional covariates that model interactions between these characteristics and the choice attributes (Cooper and Millspaugh 1999). The MNL model (choice probabilities) follow from an assumption that the errors are independent (across choices and individuals) and follow a Type I (Gumbel) extreme value distribution:

$$P(\text{Choose option } j) = \exp(X_{ij}\beta) / \sum_k \exp(X_{ik}\beta), \quad (2)$$

where the sum is across all possible alternatives available to the chooser. Importantly, the MNL model assumes that the ratio of probabilities associated with any two choices is the same, regardless of the other alternatives available to the chooser (i.e., the property of independence from irrelevant alternatives, or IIA; Cooper and Millsbaugh 1999, Train 2003). The IIA assumption results in proportionate shifting substitution patterns, where a change in the property of any one choice (or, in the extreme, dropping an alternative from the set of available choices) changes the probabilities of all other choices by the same percentage. This assumption can be problematic when some alternatives share similar (un-modeled) characteristics or “when some alternatives compete more closely with one another than do others” (Koppelman and Bhat 2006:158). For example, consider the antler point restriction options (APR1, APR2) and the antlerless only (EA) option presented to Minnesota deer hunters. Assume APR1, APR2, and EA are originally the only options available, with choice probabilities estimated to be 0.1, 0.3, and 0.6, respectively. The IIA assumption predicts that dropping APR1 from the set of choices (formally, the “choice set”) would result in new choice probabilities of APR2 = $0.3 + 0.1 \times 0.3 / (0.6 + 0.3) = 0.33$ and EA = $0.6 + 0.1 \times 0.6 / (0.6 + 0.3) = 0.67$ (note, that the EA option is twice as likely to be chosen as APR2 before and after dropping APR1 from the choice set). In reality, it is likely that respondents originally choosing APR1 would be more likely [than $0.3 / (0.3 + 0.6)$] to choose APR2 once APR1 is dropped from the choice set.

A nested logit (NL) model provides a relatively simple extension that allows for correlation among the utility (or value) assigned to each option by partitioning choices

into hierarchical sets (or nests) of correlated alternatives (Train 2003, Koppelman and Bhat 2006). The utility for alternative j within nest k is again comprised of deterministic and stochastic components:

$$U_{jk} = X_k \beta + Z_{jk} \gamma + e_k + e_{jk} , \quad (3)$$

with $X_k \beta$ describing features associated with all alternatives in nest k , $Z_{jk} \gamma$ describing features associated with alternative j within nest k (Z_{jk} are alternative-level covariates, γ fixed effects regression parameters), e_k a random component common to all alternatives in nest k , and e_{jk} a random component associated with alternative j within nest k (for convenience, we have dropped the subscript for individual i because in our examples we do not consider any subject-specific covariates). In the traditional nested logit model, the total errors (between + within nest) are assumed to follow a Generalized Extreme value distribution (Train 2003). Because within-nest utilities share a common error component, they will be correlated (while preserving independence among utilities for alternatives in different nests). As a result, the IIA assumption will hold within nests, but not between nests. For example, using the nesting structure in Fig. 2, the probability of choosing APR2 relative to EA may depend on whether or not APR1 is in the choice set, but the probability of choosing APR2 relative to APR1 does not depend on the other choices available to the respondent (since these latter two options are in the same nest).

With only 1 level of nesting, the probability of choosing each option factors into a marginal logit model of nest choice and a conditional logit model for alternatives within the chosen nest (this result follows directly from the laws of probability and does not necessarily imply that individuals make choices sequentially; Koppelman and Bhat 2006). Specifically, the probability of choosing option j within nest k is given by:

$$P_{jk} = P_{j|k} P_k, \quad (4a)$$

$$P_k = \frac{\exp[X_k \beta + \theta_k I_k]}{\sum_s \exp[X_s \beta + \theta_s I_s]} \quad (4b)$$

$$P_{j|k} = \frac{\exp(Z_{jk} \gamma / \theta_k)}{\sum_s \exp(Z_{sk} \gamma / \theta_k)} \quad (4c)$$

$$I_k = \ln \sum_s \exp(Z_{sk} / \theta_k), \quad (4d)$$

with the summation in eq. 4b including all nests and the summations in eq. 4c and 4d including all alternatives in nest k . Each nest with ≥ 2 alternatives has associated with it an extra parameter, θ_k , which measures the degree of dependence among alternatives within the nest (smaller values suggesting more dependence). To be consistent with utility maximization, values of θ must range between 0 and 1 (with a value of 0 indicating a completely deterministic choice pattern and a value of 1 being consistent with a MNL model with independent errors). The I_k , or inclusion values, measure the expected utility associated with the alternatives in nest k .

In our example, each individual was asked to choose among a smaller set (3) of the 7 alternatives. To account for individually varying choice sets, the sum in the denominator of eq. 4b needs to be modified so as to only include those options presented to each individual [note: when the choice set includes only a single option from a nest, this option is represented by $\exp(X_j \beta + Z_{jk} \gamma)$ in eq. 4, i.e., θ_k does not appear in the likelihood for that individual].

We fit the MNL model and a NL model to each respondent's top ranked choice.

The MNL model required 6 dummy variables to distinguish among the 7 alternative

regulations (using the “No hunt” option as the reference level), and the NL model required a set of 4 nest-level dummy variables (again, using the No Hunt option as the reference level) and 2 within nest-level dummy variables (to distinguish among the 2 BL options and the 2 APR options). In addition, the NL model required estimating 2 θ s (for the BL and APR nests). We wrote our own code in Program R (R Development Core Team 2008) to fit both models. This provided us with the extra flexibility to account for survey weights using a pseudo- (weighted) likelihood (the log-likelihood for each observation was weighted by the inverse sampling probability to account for variable sampling rates across strata; Feder et al. 2003). We used a non-parametric bootstrap to calculate appropriate standard errors (with 1000 bootstrap data sets). To mimic the original stratified sampling design, we resampled individuals (with replacement) separately within each stratum (Davison and Hinkley 1997). We compared the two models using Akaike’s information criterion (AIC; Akaike 1974) and also by comparing model-based estimates of the probability of choosing each option (conditional on the set of choices available) with the empirical data (i.e., the proportion of survey respondents in each choice set choosing each of the options available to them). Because 7 different surveys were mailed (each with a different set of 3 choices), we were able to examine $7 \times 3 = 21$ comparisons of model-based and empirical data using the top ranked option. However, seven of these comparisons (we will hereafter refer to them as residuals) are linearly related (e.g., for each choice set, 1 residual involving the top ranked choice is completely determined from the other two).

We compared the two BL options and the two APR options by plotting the bootstrap distribution of the predicted probability of choosing BL2 (given BL1 and BL2)

and the probability of choosing APR2 (given APR1 and APR2). We also constructed 95% bootstrap confidence intervals for these 2 probabilities using simple bootstrap quantiles. Although statistical hypothesis tests (e.g., of equivalent utilities) could also be constructed using the estimated regression coefficients directly, we preferred the above approach because the probabilities are likely to be easier for managers and the public to interpret. Lastly, we illustrate predicted substitution patterns from the two (MNL and NL) models by considering the change in the estimated probabilities of choosing each option after dropping one or more alternatives from the choice set.

CHAPTER 4

Satisfaction and Participation Among Hunters Participating in Deer Hunts with Special Regulations

White-tailed deer (*Odocoileus virginianus*) populations are managed through recreational hunting opportunity. In many areas of the United States, deer numbers have increased to the point where traditional strategies of increasing season length and bag limits have not successfully lowered populations. In Minnesota, 75% of hunters only take one deer so incremental increases in individual bag limits result in only marginal increases in total harvest. Concurrent with agency desires to lower deer populations is an interest from the public for more mature bucks in the deer population. Previous research has shown that while hunters generally support regulations that may result in more mature bucks, no clear majority regulation has surfaced. Consequently, we initiated a project to evaluate antler point restrictions, earn-a-buck, and early antlerless regulations. During 2005 – 2007, individuals who hunted under these regulations were surveyed to assess participation, support, and likelihood of hunting those areas in the future. During the 3 year survey period, we observed increasing satisfaction and participatory intent for the antler point and earn-a-buck hunts; whereas early antlerless hunter satisfaction was high and did not change. We also used structural equation modeling to develop path models to measure future participation based on hunt satisfaction and overall regulatory support. These data have management implications in that support may take time to develop and regulations that achieve less than majority support can still be considered as satisfaction/participation metrics likely will increase with time.

Keywords: attitude survey, deer management, human dimensions, nested logit model, structural equation modeling.

Introduction

In Minnesota, over 440,000 residents and non-residents purchase a firearm deer hunting license annually (Minnesota DNR electronic license data). Collectively, they expended 3.8 million days pursuing deer and generated over \$209 million in economic activity to the state's economy in 2006 (U.S. Department of Interior, 2008). While long-term national trends have indicated declines in hunter numbers (U.S. Department of Interior, 2007), the number of firearm deer hunters in Minnesota has remained stable. These trends are particularly important because recreational hunting is the most effective tool managers have for managing deer populations over large areas (Stedman et al., 2004) and much research has been published on the long-term viability of traditional hunting methods as a mechanism to control deer populations (e.g., Curtis et al., 2000; Riley et al., 2003).

Harvest regulations that require individuals to alter traditional hunting behavior are designed to accomplish management objectives that otherwise may not be achievable. In Minnesota, increases in season length and bag limits have only moderate effects on increasing deer harvest because the majority of individuals do not hunt all season or harvest a maximum number of animals. For example, Minnesota Department of Natural Resources (DNR) harvest data indicates that 95% of hunters register fewer than 3 deer, thus an unlimited bag limit may not result in a significant harvest increase over a bag limit of 2 deer (M. D. Grund, personal communication). Managers need to develop regulations that accomplish biological objectives but are not so objectionable that individuals will stop hunting if they disagree with the change (see Fulton & Manfredo, 2004). However, little research has focused on assessing the satisfaction of individuals

who participated in non-traditional hunting regulations and what effects those changes have on future participation.

Previous research in Minnesota found a majority of deer hunters reported they would rather hunt under special regulations than move to a new location if regulations were changed (Fulton, Cornicelli, & Grund, 2006). That research provided a valuable hypothetical basis for future hunter participation, but the question remains how would deer hunters respond if regulations were actually changed? In 2005, the Minnesota DNR instituted deer hunts with special regulations on several deer permit areas and Minnesota State Parks (see Chapter 1, Table 1.1). These experimental regulations provided an opportunity to extend the hypothetical questions addressed in previous research by evaluating the motivations, satisfaction, and future participatory intent of hunters who participated in deer hunts with special regulations. Prior to the implementation of the experimental regulations, the study areas were open for the taking of any deer (antlered male or antlerless) and hunters had to abide by general statewide hunting regulations.

This chapter uses data collected from hunters who participated in deer hunts with experimental harvest regulations. We tested the multiple satisfaction model of hunting among Minnesota deer hunters participating in hunts with experimental regulations. Over a 3-year period, we independently evaluated 3 different regulations: (1) antler point restriction (APR), (2) earn-a-buck (EAB), and (3) early antlerless (EA) season. The evaluation started the first year the regulations were implemented (2005) and continued for 2 additional years. Over the course of the study, we examined the impact of experimental regulations had on: (1) satisfaction with the hunting experience, (2) perceptions of the experimental regulations as they relate to participation, and (3) future

participation. We theorized *a priori* that the APR regulation was the most restrictive because a large percentage of deer were no longer eligible to be harvest. The EAB was less restrictive in that a hunter only had to harvest an antlerless deer and then they could harvest any buck. The EA regulation was the least restrictive because it was voluntary and actually increased opportunity because while a person could only take antlerless deer, the harvest of an antlerless deer during the EA season did not count towards the yearly season bag limit.

Literature Review

Motivations

Motivational theory attempts to answer such questions as "Why do people hunt waterfowl with friends, hunt deer alone, and go wildlife viewing with family members?" (Pierce, Manfredi, & Vaske, 2001). In seeking to describe these motivations, Driver and his colleagues developed (and refined) a master list of items (the Recreation Experience Preference items) that motivate individuals to pursue recreation (Driver, Tinsely & Manfredi, 1991). The motivations described by the REP are complex and multi-dimensional as evidenced by a meta-analysis conducted by Manfredi, Driver, & Tarrant (1996) who identified no less than 20 latent variables associated with recreation motivation. In one of the first attempts to explain different hunter types, Kellert (1978) characterized hunters into 3 groups based on their primary motivation for hunting: (1) meat hunters, (2) sport hunters, and (3) nature hunters. Similarly, Decker, Brown, Driver, and Brown (1987) organized hunting motivations into 3 broad categories: (1) affiliative (e.g., companionship), (2) achievement (e.g., performance), and (3) appreciative (e.g.,

nature, stress reduction). These characterizations underscore the individual differences among hunters and the underlying motivations surrounding why people to hunt.

Grilliot and Armstrong (2005) examined motivations of disabled and non-disabled deer hunters and reported that experiencing nature and the outdoors was most important and being alone (solitude) was the least-chosen motivation. In a study of Alabama dove hunters, Hayslette, Armstrong, and Mirarchi (2001) noted general agreement among hunters regarding dimensions such as "companionship, nature/aesthetics, exercise, challenge, tradition, escape, and knowledge". Interestingly, most respondents agreed that seeing wildlife was more important than harvesting wildlife and they reacted negatively to bag limit as a criterion for satisfaction (Hayslette et al., 2001). In a study of Minnesota waterfowl hunters, Schroeder, Fulton, & Lawrence (2006) identified 5 different types of waterfowl hunters ranging from long-time participants to achievement-oriented enthusiasts. The authors noted that while all groups reported enjoying nature as the most important fact, the different typologies all sought a different type of recreational experience. They suggested agencies should focus management programs on experiences that satisfy different types of hunters, rather than managing for the average hunter. Satisfaction with the hunting experience should also be regarded as a motivation for participating (Decker & Connelly, 1989). Indeed, the multiple satisfaction concept was based on the understanding there are numerous motivations and benefits associated with an activity (Hammit, McDonald, & Patterson, 1990; Hendee, 1974).

Satisfaction

The ability to discern what factors influence satisfaction allows researchers to define a quality hunting experience (Potter, Hendee, & Clark, 1973). Following the research developed in studying other recreation activities, researchers within the human dimensions field have long argued that wildlife professionals need to shift the management focus from number of animals harvested and days-afield to a multiple satisfaction approach that also measures non-harvest benefits (e.g., exercise, companionship; Hendee, 1974). Driver (1985) suggested that instead of focusing on the number of animals harvested, managers should consider the full-range of outcomes that are produced by wildlife management. Numerous studies have followed the suggestions outlined by Hendee (1974) and Potter et al. (1973) to conduct research to understand what psychological, social, and environmental factors influence recreational hunting satisfaction. Hunter density (Heberlein, Trent, & Baumgartner, 1982; Heberlein & Kuentzel, 2002), harvest success (Diefenbach, Palmer, & Shope, 1997; Langenau et al., 1981; Stankey, Lucas, & Ream, 1973); game density and seeing game (Fulton & Manfredi, 2004; Hammitt et al., 1990); and regulations (Enck & Decker, 1995; Fulton & Hundtermark, 2004; Fulton & Manfredi, 2004) are just some of the many factors that can influence individual hunter satisfaction.

As chronicled by Manning (1999), one principal objective in recreation research is to understand the variables and contexts that shape satisfaction with the recreation experience. Measuring recreation satisfaction and identifying the factors that affect satisfaction has proven challenging. Theory and research indicates; however, that both structural variables (e.g., resource, social and management settings) as well as individual variables (e.g., values, attitudes, norms, preferences, and experiences) influence overall

satisfaction (Manning, 1999; Whisman & Hollenhorst, 1998). In a study focused on white-tailed deer hunting, Hammitt et al. (1990) found that individual success rate was less important than maintaining adequate deer populations and seeing deer, and getting the chance at taking a shot. However, when deer are overabundant, using density as a determinant of hunter satisfaction may have consequences at the landscape level because hunters view optimal densities much differently than other stakeholder groups (Miller & Graefe, 2001).

Participation

Much of the earlier participation research focused on describing hunters (e.g., Applegate, 1977); whereas, more recent research has focused on such aspects as underlying motivations (Hayslette et al., 2001) and constraints (Backman & Wright, 1993; Boxall, Watson, & McFarlane, 2001; Wright, Rodgers, & Backman, 2001). In a hunter effort study, VanDeelen and Etter (2003) described a curvilinear relationship between hunter effort and deer density and effort increases asymptotically as density declines. They concluded that if hunters perceive the deer population is too low and harvesting a deer is unlikely, the deer managers would realize increased agency distrust, withdrawal of support for management, and a reduction in hunter numbers. More specifically, Miller and Vaske (2003) described several personal (e.g., time, finances) and situational (e.g., regulations, land, game) constraints that may limit hunter effort. Further, Magnus, Throgmorton, Carver, and Davenport (2007) suggested the best management alternatives can only really be determined after assessing the public perceptions and attitudes about the topic.

Previous studies have described a national decline in hunter participation, not the least of which includes age and place of residence (e.g., Enck, Decker, & Brown, 2000; Mangun, Hall, & O'Leary, 1996; Poudyal, Cho, & Bowker, 2008). Further explanations for the decline include changes in traditional rural socialization (Stedman & Heberlein, 2001); urbanization (Purdy, Decker, & Brown, 1989); lack of public access (Mehmood et al., 2003; Miller & Vaske, 2003); increased posting of private lands (Jagnow et al., 2006; Stedman et al., 2008); and leasing (Mozumder, Starbuck, Berrens, & Alexander, 2007). Nationally, wildlife agencies are concerned about the predicted declines in participation and the resulting impact on their ability to manage deer populations (Adams, Brown, & Higgenbotham, 2004; Enck et al., 2000). This decline may be further exacerbated by complicated or unpopular regulatory alternatives that lead to declines in participation, which would operate counter to an agency's need to manage overabundant deer populations (Miller & Vaske, 2003).

Research Framework and Hypotheses

In 2005, the Minnesota DNR implemented experimental hunting regulations in several areas to determine the biological response of the deer population (Chapter 1, Table 1-1). That research is designed to help the agency prioritize regulations based on how effective they are at decreasing deer densities. Concurrently, the experimental regulations provided an opportunity to test a multiple satisfaction model that examined the impact of regulations on hunters' satisfaction and decision to participate in future hunts. Consistent with previous research, we postulate that satisfaction is varied, multi-dimensional, and contextual (Hammit et al., 1990; Manfredo, Fix, Teel, Smeltzer, & Kahn, 2004; Miller & Vaske, 2003). In our model, we theorized that multiple exogenous

latent variables representing an individual's motivations, beliefs about the outcomes of regulations, and satisfaction (e.g., nature, achievement, harvest; see Hautaluoma & Brown, 1979) would be significant predictors of future hunt participation (Figure 4.1).

Specifically, we tested the following hypotheses:

- H₁: Support/opposition to experimental regulations will vary depending on how restrictive of harvest opportunity the participant views the regulations.
- H₂: Beliefs about the regulations, satisfaction, and participation will change with direct experience with the regulations.
- H₃: Satisfaction, regulatory support, and participation will increase over time as the regulations become the standard.
- H₄: Hunters will not move to a new location as a result of the experimental regulations.

Methods

Mail Survey Methods

We developed 3 treatment surveys and 1 control survey that were administered over a 3-year period (2005 - 2007) to hunters participating in antler point restriction (APR) at Itasca State Park (ISP), earn-a-buck (EAB) at St. Croix State Park (SCSP), and early antlerless (EA) hunts. Specific regulations for each treatment group were:

- APR - No application was necessary to participate in this hunt, which had a 9-day season. Individuals could take up to 4 antlerless deer but could only take antlered males with at least 1 3-point antler (Appendix C).

- EAB - Hunters had to apply for the opportunity to hunt the area, which had a 4-day season. Individuals were eligible to harvest a buck only after they had taken an antlerless deer (Appendix D).
- EA - No application was necessary to participate in this hunt. Individuals could harvest up to two antlerless deer during the 2-day season (Appendix E).

For the control survey (Appendix F), we selected adult deer hunters from areas that allowed the harvest of either antlered bucks or antlerless deer without making a special application. In all cases, only hunters at least 18 years of age were surveyed. For the APR and EAB hunts, the entire population of adult hunters were surveyed annually; thus, sample size varied slightly between years. For the EA and control surveys, a random sample (n = 1,000 each) was selected from the Minnesota Department of Natural Resources Electronic License System database. The exception was the 2007 EA survey where 2,000 individuals were selected because the hunt was expanded from 8 to 30 deer permit areas. Survey design and implementation generally followed Dillman's (2000) Tailored Design Method. For all surveys, we distributed 3 complete mailings (including personalized cover letter, survey, and business-reply envelope) and a non-response check, which included basic questions related to their hunt.

Data Collection Instrument

The data collection instrument was a 12-page (10 pages of questions), self-administered survey. Survey questions were developed based on our interest in hunter motivations, satisfaction, regulatory support, and future participatory intent. The survey included the following question categories: (1) information related to the overall deer season including questions related to years hunting the study area, days spent scouting

and hunting, and types of property hunted; (2) experiences and opinions regarding their special hunt including satisfaction and intentions to participate in future hunts; (3) experiences and opinions regarding deer hunting in Minnesota including hunting behavior, number of deer harvested, and reasons to support special regulations; and (4) information regarding years hunting deer, hunt site fidelity, and items that contributed to overall hunt satisfaction.

Variable Measurement and Model Development

Respondents rated their experiences on a 5-point Likert scale that ranged from 1 (strongly negative) to 5 (strongly positive). For harvest variables, respondents were asked to indicate the specific number and sex of deer harvested during their hunt. We used the following variables to develop the model depicted in Figure 4.1.

- *Satisfaction* (Figure 4.1a). Study participants were asked to express their level of satisfaction with their special hunt from "very dissatisfied" to "very satisfied". This variable was a single-item predictor and served as the latent endogenous variable "Satisfaction" in our model. We then incorporated several latent exogenous variables to identify the significant predictors of satisfaction. The exogenous latent variables are described below.
 - *Satisfaction with deer observations*. We measured this variable using 5 items. We asked participants to rate their satisfaction with the number and type of deer seen during their hunt. Responses were on a 5-point scale from "strongly disagree" to "strongly agree" and served as a single latent exogenous variable.

- *Number of deer harvested.* We asked participants to indicate the number and sex of deer harvested during their special hunt. This variable was used as a single-item latent exogenous variable.
- *Importance of experience.* We measured experience preference using 21 items adopted from Schroeder et al. (2006). Participants were asked to indicate how important each of the 21 items was to their overall hunt satisfaction. Responses were on a 5-point scale from "not at all important" to "very important" and were subsequently factored into several latent exogenous variables.
- *Support for experimental regulations* (Figure 4.1b). Study participants were asked their level of support for the regulation that was enacted in their area from "strongly oppose" to "strongly support". This variable was a single-item predictor and served as the latent endogenous variable "Regulatory Support" in our model. We then incorporated several latent exogenous variables to identify the significant predictors of regulatory support. The exogenous latent variables were developed from the following items.
 - *Important reasons to support regulations.* We measured reasons to support regulations using 15 items that partially followed Lauber and Brown (2000) who described hunter attitudes towards regulatory change in New York. We believe that individuals have different reasons for supporting or opposing new hunting regulations and those reasons may influence overall hunt satisfaction and participation. Responses were on a

5-point scale from "strongly disagree" to "strongly agree" and were subsequently factored into several latent exogenous variables.

- *Future participation* (Figure 4.1c). Study participants were asked their intention to participate in their hunt the following year from "definitely not hunt" to "definitely will hunt". This variable was a single-item predictor and served as the latent endogenous variable "Participation" in our model.

The only difference among surveys sent to treatment groups was the antlered male questions were omitted from the EA survey because they were not germane to that group. On the EA survey, the questions regarding satisfaction with actual deer observations were not included because 3 of 5 questions related to buck satisfaction; thus, the actual number of antlerless deer observed during the hunt was used a surrogate for satisfaction with deer seen.

As this study was designed to assess participation over time, we developed an "index" model using the 2005 dataset for each survey group (APR, EAB, EA). We then analyzed the subsequent years without modifying any model parameters. We theorized *a priori* that model fit may decline in subsequent years because parameter estimates were constructed only for the index year; however, our goal was to describe how variables related to participation changed throughout the study period. Thus, we did not alter any parameters after development of the index model for each treatment group.

Data Analysis

To compare survey responses between years, we conducted descriptive statistics, chi-square, analysis of variance (ANOVA), principal component analysis (PCA) with

varimax rotation, and reliability analyses in the Statistical Package for Social Sciences (SPSS 17). For the PCA, variables that loaded heavily (greater than 0.5) on one factor without loading heavily on another were included in the analysis (Nunnally & Bernstein, 1994). Factors with 3 or more items were assessed using Cronbach's alpha (α) and were retained when $\alpha \geq 0.60$ (Cronbach, 1951); whereas Pearson correlation coefficients were used for two-item scales and were retained when $P < 0.05$. Because scores from a single-item predictors are unlikely to be free of measurement error (Kline, 2005), we estimated measurement errors by multiplying the observed variance by 0.15 (Jöreskog & Sörbom, 1996). We then used a parallel analysis routine written in SPSS (O'Connor, 2000) to determine how many factors to retain for each path in our model (Horn, 1965). Structural equation modeling (SEM) and a test of model invariance based on survey year were conducted using LISREL (8.80). Structural equation modeling analyzes covariance matrices and builds on regression and factor analysis to provide a flexible method for examining relationships among observed variables and unmeasured latent constructs (McCoach, Black, & O'Connell, 2007). SEM can also explicitly account for measurement error, assess overall model fit, and determine model equivalences across groups (McCoach et al., 2007). In our examination of model invariance, we report changes in chi-square and Akaike's information criterion (AIC). The AIC measure of model fit is commonly used for comparing models; smaller AIC values suggest better fit (Diamantopoulos & Siguaw, 2000).

For each treatment group, we used a robust maximum likelihood method and multiple cutoff criteria to assess model fit. Model fit was deemed acceptable if the Standardized Root Mean Residual (SRMR) was < 0.08 , the Comparative Fit Index (CFI)

> 0.90, and the root mean square error of approximation (RMSEA) < 0.06 (Hu & Bentler, 1999). Finally, we calculated parameter estimates and modification indices on our initial model to determine if parameters should be added or removed or if paths should be modified.

Results

Antler Point Restriction Hunters - Itasca State Park

Response Rate. In total, we mailed 1,498 surveys to ISP hunters of which 72 were undeliverable. Of the remaining 1,426 surveys, 906 were completed and returned, which resulted in a 64% response rate. Although survey response rates were identical all three years, sample size was largest in 2005 ($n = 557$) and declined through 2006 ($n = 488$) and 2007 ($n = 453$) (Table 4.1). As no application is required to hunt ISP and we sampled the adult population annually, we presumed that hunters who returned to the park would be re-sampled annually. Of the 906 returned surveys, 30% completed one, 37% completed two, and 32% completed three surveys. We did not conduct a repeated measures analysis because we did not attempt to describe individual change; rather, we modeled group differences. A non-response survey that assessed demographics and general support for regulatory change did not differ from respondents ($P > 0.05$); thus, we did not weight respondent scores in the analyses.

Respondent Characteristics. During the study period, respondents averaged 15.4 years of experience hunting ISP ($F = 0.24$, $P = 0.74$) and 96% indicated they participated in the ISP hunt ($\chi^2 = 4.20$, $P = 0.12$), which is comparable to the control group who reported 16.4 years of experience and a 98% participation rate. Respondents also spent an average of 1.4 days scouting ($F = 0.31$, $P = 0.73$) and 3.6 days hunting ($F = 0.16$, $P =$

0.85). We observed high site fidelity among ISP hunters during the three years with 94% of respondents indicated they either typically hunt ISP (47%) or hunt the park as part of a group (47%); less than 1% of respondents indicated they hunted ISP because of interest in the APR regulation ($\chi^2 = 8.95, P = 0.18$). Additionally, 80% noted they hunt the same location every year ($\chi^2 = 3.51, P = 0.74$), which is lower than the 91% reported by the control group.

Regulatory Support, Overall Satisfaction, Participatory Intent, and Descriptive Statistics. After participating in their hunt, less than half of ISP hunters indicated they supported the APR regulations (2005 = 40%, 2006 = 45%, 2007 = 42%; $\chi^2 = 6.31, P = 0.61$). However, we observed annual increases in overall satisfaction (2005 = 47%, 2006 = 50%, 2007 = 59%; $\chi^2 = 9.6, P = 0.048$) and intention to participate in future hunts (2005 = 69%, 2006 = 70%, 2007 = 76%; $\chi^2 = 12.2, P = 0.02$).

Prior to conducting the SEM, we examined variables individually to determine if they differed among survey years. In total, we observed differences in 1 of 5 variables related to satisfaction with deer observations during their hunt, only 2 of 21 variables related to experiences that contribute to satisfaction, none of 15 variables related to the factors that should be considered prior to regulatory changes, or the number of deer harvested (Table 4.2).

APR Index Model Scale Development. Using the factor structure suggested by the PCA, we identified 5 latent constructs related to experiences that contribute to overall satisfaction (Appendix Itasca, Question 37): (a) Achievement (6 items, $M = 20.3, SD = 4.9, \alpha = 0.83$), (b) Harvest (3 items, $M = 8.8, SD = 3.2, \alpha = 0.81$), (c) Bucks (3 items, $M = 8.9, SD = 2.8, \alpha = 0.78$), (d) Access (3 items, $M = 10.1, SD = 2.6, \alpha = 0.60$), and (e)

Family (2 items, $M = 8.1$, $SD = 1.7$, $r = 0.33$, $p < 0.001$). To complete the satisfaction component of our model, we included satisfaction with deer observations during the special hunt (Appendix Itasca, Question 18) (5 items, $M = 14.2$, $SD = 5.8$, $\alpha = 0.86$) and the number of deer killed during the hunt ($M = 0.69$, $SD = 1.1$) (Table 4.3).

For the regulatory support component of our model, we identified 5 latent constructs (Appendix Itasca, Question 27): (a) Ethics (4 items, $M = 15.7$, $SD = 2.9$, $\alpha = 0.76$), (b) Hunt Opportunity (4 items, $M = 14.9$, $SD = 2.9$, $\alpha = 0.76$), (c) DNR Control (3 items, $M = 11.1$, $SD = 2.1$, $\alpha = 0.57$), (d) Special Opportunity (2 items, $M = 6.2$, $SD = 1.8$, $r = 0.64$, $P < 0.001$), and (e) Harvest Limits (2 items, $M = 5.9$, $SD = 1.6$, $r = 0.40$, $P < 0.001$) (Table 4.3). Due to low reliability ($\alpha < 0.60$), the DNR Control variable was excluded from further analysis.

Path analysis. SEM results from the index model (2005 ISP dataset) failed to meet the specified cutoff criteria even with the addition of correlated error terms (CFI = 0.92, SRMR = 0.083, RMSEA = 0.062). In addition, 2 of the 14 paths specified in the model were not significant ($P > 0.05$). We subsequently removed the exogenous latent variable "achievement" to endogenous latent variable "satisfaction" and exogenous latent variable "harvest limits" to endogenous latent variable "regulatory support". The modification indices also suggested we add both a path from manifest variables Q37O (open areas to the public) to "bucks" and Q37R (see a lot of deer) to "harvest" and also remove the path from Q27H (increase own chance of taking a big buck) to "hunt opportunity". The revised model met the specified cutoff criteria (CFI = 0.96, SRMR = 0.069, RMSEA = 0.048) and explained 66%, 70%, and 80% of the variance in overall

satisfaction, regulatory support, and intention to participate in future hunts, respectively ($\chi^2 = 465.3$, $df = 326$, $P < 0.001$).

The results of the SEM suggest positive relationships between overall satisfaction and regulatory support and ultimately, participation. For satisfaction, deer observations and bucks had the strongest positive relationships; whereas harvest had the strongest negative relationship. For regulatory support, special opportunity was a positively related while ethics was negative (Figure 4.2). Next, we compared the 2005 index model with the 2006 and 2007 respondents. In general, we observed similar means, reliabilities and factor scores between years (Table 4.2 and 4.3); however, we also observed a decline in the number of significant parameters through time. In 2006, deer observations and the number of deer harvested were positively related to satisfaction, whereas beliefs regarding harvest were negative. The variables explained 80% of the variance in satisfaction, 67% of the variance in regulatory support, and 73% of the variance in intention to participate in future hunts (Figure 4.3). The 2006 model met our cutoff criteria and had a good fit to the data ($\chi^2 = 504.3$, $df = 326$, $P < 0.001$, CFI = 0.95, SRMR = 0.071, RMSEA = 0.055). In 2007, deer observation and access were positively related to satisfaction; whereas, harvest was negative. None of the variables in regulatory support were significant in 2007, which may be an artifact of not adjusting model parameters. In total, the model explained 69% of the variance in satisfaction, 56% of the variance in factors to consider, and 74% of intention to participate in future hunts. The 2007 model met our cutoff criteria and had a reasonable fit to the data ($\chi^2 = 489.0$, $df = 326$, $P < 0.001$, CFI = 0.95, SRMR = 0.066, RMSEA = 0.055; Figure 4.4).

Overall, deer observations (positive), beliefs regarding harvest (negative), and the interaction between satisfaction and regulatory support were significant predictors during all 3 years. Results from multi-sample structural equation modeling suggested significant differences between the fully constrained model ($\chi^2 = 1,875.5$, 1,196 *df*, $P < 0.001$, AIC = 1,956.6) and when factor loadings and structural parameters varied across groups ($\Delta\chi^2 = 118.1$, 72 *df*, $P < 0.001$; Δ AIC = -41.6). When error terms from observed variables (along with factor loadings and structural parameters) were allowed to vary freely across groups, fit improved as compared to the varied group model ($\Delta\chi^2 = 48.8$, 15 *df*, $P < 0.001$; Δ AIC = 11.7); however, fit was best for the fully constrained model.

Early Antlerless Hunters

Response Rate. In total, we mailed 4,000 surveys to EA hunters of which 216 were undeliverable. Of the remaining 3,784 surveys, 2,316 were completed and returned, which resulted in a 61% response rate. Overall response rate was highest in 2006 (68%) and lowest in 2005 (58%; Table 4.1). A non-response survey that assessed demographics and general support for regulatory change did not differ from respondents ($p > 0.05$); thus, we did not weight respondent scores in the analyses.

Respondent Characteristics. During the study period, respondents averaged 11.9 years of experience hunting their EA area ($F = 1.05$, $P = 0.351$) and 96% indicated they participated in the EA hunt ($\chi^2 = 1.32$, $P = 0.517$), which is less experience than the control group who reported 16.4 years of experience but close to their 98% participation rate. While less than half of respondents (47%) scouted deer before their season started (mean = 1.72, $F = 2.37$, $P = 0.094$), they tended to hunt both days (mean = 1.81, range 1.77 - 1.83, $F = 4.20$, $P = 0.015$). We also observed high site fidelity among EA hunters

during the 3 years as 80% of respondents indicated they either typically hunted the permit area (45%) or hunted as part of a group (35%); 11% believed the deer population was high in the area; 9% indicated they were interested in the regulations ($\chi^2 = 12.3$, $P = 0.056$). Additionally, 89% noted they hunt the same location every year ($\chi^2 = 2.86$, $P = 0.826$), which is nearly identical to the 91% reported by the control group.

Regulatory Support, Overall Satisfaction, Participatory Intent, and Descriptive Statistics. After participating in their hunt, the vast majority of respondents indicated they supported the EA regulations (2005 = 81%, 2006 = 85%, 2007 = 76%; $\chi^2 = 23.6$, $P = 0.003$). We also observed high overall satisfaction (2005 = 70%, 2006 = 78%, 2007 = 70%; $\chi^2 = 22.6$, $P = 0.004$) and intention to participate in future hunts (2005 = 84%, 2006 = 88%, 2007 = 85%; $\chi^2 = 4.69$, $P = 0.790$). Overall, observed satisfaction for this hunt strategy was the highest for any group (including the control hunters).

One of the objectives of the EA season was to shift harvest from antlered males to antlerless deer. We theorized that harvest rates may not need to increase; rather, if harvest patterns shifted to female deer then population declines would be realized without a need for increased total harvest. Over 3 years, only 15% of hunters indicated the EA season had an effect on their hunting patterns during the firearm deer season ($\chi^2 = 5.11$, $P = 0.078$). When asked what specific effects the EA season might have on their hunting patterns, 33% indicated they would not change their patterns because the type of deer was not important and 26% indicated they typically harvested the first legal deer they observed. Conversely, 19% indicated they did plan to alter their hunting patterns and only harvest a mature buck or antlerless deer and 9% would only take a mature buck (χ^2

= 19.3, $P = 0.082$; Table 4.4). Finally, hunters were asked to indicate if their firearm season hunting patterns were ultimately altered as a result of participating in the EA hunt. While we observed differences across years, the majority of hunters either harvested the first legal deer they saw (33%) or intended to harvest the first legal deer but was unsuccessful (28%). A smaller percentage of respondents (11%) harvested an antlerless deer instead of buck ($\chi^2 = 44.4$, $P < 0.001$; Table 4.4)

Prior to conducting the SEM, we examined variables individually to determine if they differed between survey years. In total, we observed differences in 7 of 19 variables related to experiences that contribute to satisfaction and 3 of 12 variables related to the regulatory support. Neither the number of deer observed or harvested varied among survey years (Table 4.5).

EA Index Model Scale Development. Using the factor structure suggested by the PCA, we identified 4 latent constructs related to experiences that contribute to overall satisfaction (Appendix Early Antlerless, Question 37): (a) Achievement (7 items, $M = 27.4$, $SD = 5.1$, $\alpha = 0.81$), (b) Harvest (3 items, $M = 10.0$, $SD = 3.2$, $\alpha = 0.81$), (c) Family (3 items, $M = 11.2$, $SD = 6.7$, $\alpha = 0.67$), and (d) Access (2 items, $M = 6.1$, $SD = 2.5$, $r = 0.57$, $P < 0.001$). To complete the satisfaction component of our model, we included the total number of antlerless deer observed during the special hunt ($M = 3.8$, $SD = 5.5$) and the number of deer harvested during the hunt ($M = 0.48$, $SD = 0.74$; Table 4.6).

For the regulatory support component of our model, the PCA identified 3 latent constructs (Appendix Early Antlerless, Question 27): (a) Ethics (5 items, $M = 20.3$, $SD = 3.1$, $\alpha = 0.74$), (b) Hunt Opportunity (2 items, $M = 7.1$, $SD = 1.8$, $r = 0.36$, $P < 0.001$), and (c) Special Opportunity (2 items, $M = 7.8$, $SD = 1.5$, $r = 0.48$, $P < 0.001$) (Table 4.6).

Path analysis. SEM results from the initial proposed model suggested we add a path from manifest variable 27E (increased muzzleloader opportunity) to endogenous latent variable "hunt opportunity" and correlate several error terms. The revised model met the specified cutoff criteria (CFI = 0.97, SRMR = 0.052, RMSEA = 0.041) and explained 26%, 53%, and 78% of the variance in overall satisfaction, regulatory support, and intention to participate in future hunts, respectively ($\chi^2 = 525.5$, $df = 329$, $P < 0.001$). Five of the 12 paths in the model were not significant at $P < 0.05$ but when we removed those paths, model fit declined slightly (CFI = 0.96, SRMR = 0.058, RMSEA = 0.049). We opted not to remove the 5 paths because, (1) we observed very high overall satisfaction ($M = 4.0/5$, $SD = 1.3$), hunt support ($M = 4.2/5$, $SD = 1.2$), and intention to participate in future hunts ($M = 4.4/5$, $SD = 0.98$), which yielded low variances and may have diminished the ability of SEM to identify significant contributors to our model; and (2) there were 3 total years of data to analyze and we believed removing so many paths might compromise our ability to explain variance in subsequent years.

The results of the 2005 SEM suggest positive relationships between overall satisfaction and regulatory support and ultimately, participation. For satisfaction, family had a positive relationship, whereas access was negatively related. For regulatory support, hunt opportunity was positively related and ethics was negative. We also observed positive relationships between the satisfaction and regulatory support latent variables (Figure 4.5). Next, we compared the 2005 index model with the 2006 and 2007 respondents.

In general, we observed similar means, reliabilities and factor scores between years and none of the latent exogenous variable revealed $\alpha < 0.60$ or non-significant

correlation coefficients (Table 4.5 and 4.6). The 2006 model met our cutoff criteria and had a good fit to the data (CFI = 0.97, SRMR = 0.047, RMSEA = 0.040). In total, 5 of 12 paths were significant where the number of deer seen and hunt opportunity were positively related satisfaction and regulatory support, respectively. We also observed positive relationships between the satisfaction and regulatory support latent variables and satisfaction and participatory intent. The variables explained 24% of the variance in satisfaction, 46% of the variance in factors to consider, and 79% of the variance in intention to participate in future hunts ($\chi^2 = 546.4$, $df = 329$, $P < 0.001$; Figure 4.6). In 2007, the model met our cutoff criteria (CFI = 0.96, SRMR = 0.046, RMSEA = 0.040) and suggested that 9 of 12 paths were significant. From the perspective of overall satisfaction, both achievement and the number of deer seen were positively related; whereas, the number of deer killed was negative. For regulatory support, hunt opportunity was positively related, while special opportunity and ethics were negative. Similar to previous years, the 3 latent endogenous variables were also positively related. The 2007 model explained 37%, 52%, and 81% of the variance in satisfaction, regulatory support, and participation ($\chi^2 = 546.4$, $df = 329$, $P < 0.001$) (Figure 4.7).

Overall, the relationship between the 3 latent endogenous variables remained positive throughout the 3 study years; however, only the exogenous variable hunt opportunity remained significant (positively related) throughout the study period. Results from multi-sample structural equation modeling suggested significant differences between the fully constrained model ($\chi^2 = 2,364.9$, $1,199$ df , $P < 0.001$, $AIC = 2,240.4$) and when factor loadings and structural parameters varied across groups ($\Delta\chi^2 = 184.7$, 71 df , $P < 0.001$; $\Delta AIC = 8.5$). When error terms from observed variables (along with factor

loadings and structural parameters) were allowed to vary freely across groups, fit declined as compared to the varied group model ($\Delta\chi^2 = 28.2$, 15 *df*, $P = 0.02$; $\Delta\text{AIC} = 10.9$); thus, fit was best for the model that allowed structural parameters to vary across groups.

Earn-A-Buck Hunters (St. Croix State Park)

Response Rate. In total, we mailed 1,490 surveys to EAB hunters of which 89 were undeliverable. Of the remaining 1,401 surveys, 965 were completed and returned, which resulted in a 69% response rate. Overall response rate was highest in 2006 (73%) and lowest in 2007 (65%) (Table 4.1). A non-response survey that assessed demographics and general support for regulatory change did not differ from respondents ($p > 0.05$); thus, we did not weight respondent scores in the analyses.

Respondent Characteristics. During the study period, respondents averaged 22.8 years of total deer hunting experience (2005 = 21.2, 2006 = 23.6, 2007 = 23.7; $F = 3.40$, $P = 0.034$) but had only been hunting deer at SCSP for 5.9 years ($F = 1.00$, $P = 0.367$). The large difference between total experience and years hunting SCSP is likely due to the fact that an application is necessary and not all hunters are selected; thus individuals are not selected every year. In total, 95% of those selected participated in the SCSP special hunt ($\chi^2 = 0.356$, $P = 0.837$), which is comparable to the participation rates observed in the other special hunts.

Overall, only 31% ($\chi^2 = 0.333$, $P = 0.847$) scouted deer before their season started (mean days scouted = 1.36, $F = .827$, $P = 0.437$) and they hunted less than 3 days (mean = 2.55, range 2.41- 2.67, $F = 5.56$, $P = 0.004$). We observed high site fidelity among EAB hunters with 69% of respondents indicated they either typically hunted SCSP (29%)

or hunted as part of a group (40%); 28% believed the deer population was high in the area, and 3% indicated they were interested in the regulations ($\chi^2 = 6.06$, $P = 0.416$). Additionally, 77% noted they hunted the same location every year ($\chi^2 = 6.49$, $P = 0.371$), which is lower than reported for any other group.

Regulatory Support, Overall Satisfaction, Participatory Intent, and Descriptive Statistics. After participating in their hunt, the majority of respondents indicated they supported the EAB regulations (53%; $\chi^2 = .825$, $P = 0.925$). We also observed high overall satisfaction that increased annually (2005 = 59%, 2006 = 60%, 2007 = 74%; $\chi^2 = 19.4$, $P < 0.001$) and intention to participate in future hunts (2005 = 75%, 2006 = 75%, 2007 = 84%; $\chi^2 = 12.1$, $P = 0.016$). Over the 3 years, while 24% of respondents indicated dissatisfaction with their hunt, 78% of those individuals noted they would consider participating in future EAB hunts. These data further indicate that although hunters may not agree with the regulation, they are still motivated to participate.

Prior to conducting the SEM, we examined variables individually to determine if they differed between survey years. In total, we observed differences in none of the 5 variables related to satisfaction with deer observations, 1 of 21 variables related to experiences that contribute to satisfaction, and 3 of 12 variables related to the factors that should be considered prior to regulatory changes. The number of deer killed generally increased annually and was significant between survey years (Table 4.7).

EAB Index Model Scale Development. Using the factor structure suggested by the PCA, we identified 5 latent constructs related to experiences that contribute to overall satisfaction (Appendix EAB, Question 37): (a) Achievement (4 items, $M = 14.3$, $SD = 3.4$, $\alpha = 0.77$), (b) Harvest (3 items, $M = 9.1$, $SD = 3.2$, $\alpha = 0.80$), (c) Bucks (3 items, $M =$

9.8, SD = 3.0, $\alpha = 0.83$), (d) Solitude (6 items, M = 23.4, SD = 3.5, $\alpha = 0.65$), and (e) Family (2 items, M = 7.9, SD = 2.1, $r = 0.47$, $p < 0.001$). To complete the satisfaction component of our model, we included satisfaction with deer observations during the special hunt (Appendix EAB, Question 18) (5 items, M = 15.0, SD = 5.7, $\alpha = 0.85$) and the number of deer harvested during the hunt (M = 0.84, SD = 1.0) (Table 4.8).

For the regulatory support component of our model, we identified 5 latent constructs (Appendix EAB, Question 27): (a) Ethics (4 items, M = 15.5, SD = 2.9, $\alpha = 0.75$), (b) Hunt Opportunity (4 items, M = 15.2, SD = 2.8, $\alpha = 0.70$), (c) Access (2 items, M = 7.8, SD = 1.9, $r = 0.30$, $P < 0.001$), (d) Special Opportunity (2 items, M = 6.8, SD = 2.0, $r = 0.52$, $P < 0.001$), and (e) Harvest Limits (2 items, M = 6.0, SD = 2.0, $r = 0.29$, $P < 0.001$) (Table 4.8).

Path analysis. Other than correlating a few error terms, the SEM results from the initial proposed model suggested no alterations to the model structure. The model had a reasonable fit to the data and met the specified cutoff criteria (CFI = 0.92, SRMR = 0.073, RMSEA = 0.053) and explained 73%, 59%, and 74% of the variance in overall satisfaction, regulatory support, and intention to participate in future hunts, respectively ($\chi^2 = 1,075.1$, $df = 699$, $P < 0.001$). However, 7 of the 15 paths in the model were not significant at $P < 0.05$ but when we removed those paths, model fit declined (CFI = 0.93, SRMR = 0.086, RMSEA = 0.065) and 4 additional paths were no longer significant. We opted not to remove the 7 paths because, (1) we observed high overall satisfaction (M = 3.7/5, SD = 1.4), hunt support (M = 3.3/5, SD = 1.4), and intention to participate in future hunts (M = 4.2/5, SD = 1.1), which yielded low variances and may have diminished the ability of SEM to identify significant contributors to our model; and (2)

there were 3 total years of data to analyze and we believed removing so many paths might compromise our ability to explain variance in subsequent years.

The results of the 2005 SEM suggested positive relationships between overall satisfaction and regulatory support and ultimately, participation. For satisfaction, only the deer observations variable was significant (positive). The other variables related to overall hunt satisfaction were not significant ($P > 0.05$). For regulatory support, we observed significance in 4 of the 5 variables as special opportunity, harvest limits, and hunt opportunity were positively related and access was negative (Figure 4.8). Next, we compared the 2005 index model with the 2006 and 2007 respondents.

Similar to the other treatment groups, we observed similar means, reliabilities and factor scores between years and none of the latent exogenous variables revealed $\alpha < 0.60$ or non-significant correlation coefficients (Table 4.7 and 4.8). The 2006 model met our cutoff criteria and had a reasonable fit to the data (CFI = 0.93, SRMR = 0.073, RMSEA = 0.052). In total, only 5 of 15 paths were significant with only the number of deer seen and killed were positively related satisfaction. Overall, none of the exogenous variables that estimated the regulatory support variable were significant at $P < 0.05$. We also observed positive relationships between satisfaction and regulatory support and satisfaction and participatory intent. Although we failed to identify a majority of significant parameters, the variables explained 66% of the variance in satisfaction, 50% of the variance in regulatory support, and 78% of the variance in intention to participate in future hunts ($\chi^2 = 1,076.9$, $df = 699$, $P < 0.001$) (Figure 4.9). In 2007, the model also met our cutoff criteria (CFI = 0.93, SRMR = 0.073, RMSEA = 0.057) and suggested that 6 of 15 paths were significant. From the perspective of overall satisfaction, the number

of deer seen were positively related; whereas, buck observations was negative. For regulatory support, only ethics had a significant relationship (positive). Similar to previous years, the 3 latent endogenous variables were also positively related. The 2007 model ultimately explained 70%, 48%, and 67% of the variance in satisfaction, regulatory support, and participation, respectively ($\chi^2 = 1,124.6$, $df = 699$, $P < 0.001$) (Figure 4.10). Overall, the relationship between the 3 latent endogenous variables remained positive throughout the 3 study years; however, only the exogenous variable related to the actual number of deer seen remained significant (positively related) throughout the study period.

Results from multi-sample structural equation modeling suggested significant differences between the fully constrained model ($\chi^2 = 3,962.9$, $2,422$ df , $P < 0.001$, $AIC = 3967.4$) and when factor loadings and structural parameters varied across groups ($\Delta\chi^2 = 216.2$, 93 df , $P < 0.001$; $\Delta AIC = 9.3$). When error terms from observed variables (along with factor loadings and structural parameters) were allowed to vary freely across groups, fit improved significantly as compared to other groups ($\Delta\chi^2 = 56.1$, 15 df , $P = 0.02$; $\Delta AIC = 21.8$); thus, fit was best for the model where structural parameters and error variances varied across groups.

Discussion and Implications

A major purpose of our research was to determine if hunters would continue to participate if regulations in their area were changed. While our research was designed to assess demographic information, support/opposition towards new regulations, their hunting experiences, and future participation, we were also interested in evaluating the

underlying factors that contribute both positively and negatively to both satisfaction and participation.

Overall, we found support for Hypothesis 1 in that all 3 single-item measurements (satisfaction, regulatory support, and participation) varied depending on regulatory restrictions. In looking at the interactions between groups and years, we observed significant differences in satisfaction ($\chi^2 = 232.1, P < 0.001$), regulatory support ($\chi^2 = 507.7, P < 0.001$), and participation ($\chi^2 = 82.4, P < 0.001$). In all cases, we observed the lowest percentages among APR hunters and the highest for the EA group. Given APR regulation was the most restrictive, these results were not surprising. The EA results were expected as well because there were few trade-offs associated with this hunt. The primary issues limiting EA participation were likely situational constraints (e.g., was land available to hunt in an EA area, see Miller & Vaske, 2003).

Hypothesis 2 suggested that beliefs about the regulations would relate to direct experience with the regulations. Our results found support for this hypothesis. While our study did not incorporate the full suite of variables presented elsewhere, we did observe congruence with recent studies that concluded seeing and harvesting game is related to satisfaction (Miller & Graefe, 2001; Frey, Conover, Borgo, & Messmer, 2003; Schroeder et al., 2006). For example, we observed strong positive relationships between overall hunt satisfaction and the number of bucks seen ($r = 0.49, P < 0.001$), antlerless deer seen ($r = 0.57, P < 0.001$), satisfaction with total deer seen ($r = 0.57, P < 0.001$), and a significant, but weaker negative relationship between the number of deer killed and overall satisfaction ($r = -0.21, P < 0.001$). SEM results also suggested seeing game (e.g., Hammitt et al., 1990) was an important component of hunt satisfaction. The latent

construct “sighting satisfaction” was the only significant predictor of overall satisfaction for all groups and years. Conversely, although we were able to explain high amounts of variance, SEM failed to identify any other variables that were significant across groups and years. Essentially, other than the beliefs associated with the deer an individual saw, we found no latent constructs that could be pinpointed as stable predictors; rather, the cumulative effect of many variables likely allowed us to explain the variance in participation.

Our results also supported Hypothesis 3. With the exception of EA hunters (satisfaction and future participation exceeded 80%), we observed annual increases in satisfaction and participation for APR and EAB hunters. Certainly, increasing satisfaction may be an artifact of individuals hunting in a new location and while we may have observed this at ISP, it did not occur at levels that were detectable by our research design. A more plausible explanation is there is a strong normative component to hunt participation that will ultimately influence participation. Given norms are situation-specific guides that may be influenced by the behavior of others or even the surrounding environment (Cialdini, Reno, & Kallgren, 1990), we believe that as the regulations progressed through time, a new social norm was created for individuals participating in these hunts.

Overall, even when hunters expressed dissatisfaction with their hunt experience, a low percentage indicated they would not participate in future years. Results presented in Chapter 3 and findings in this paper support Hypothesis 4. Fulton and Manfredi (2004) noted that incremental regulatory adjustments are unlikely to substantially affect satisfaction. While we agree with their additional assessment that the relationships

between regulatory changes and satisfaction are a threshold, we also believe a major change in regulations may not be a significant enough barrier to negatively affect future participation. Ultimately, managers should carefully consider the potential impacts and design regulations that do not discourage satisfaction or participation (Fulton & Manfredi, 2004). For several reasons, we agree with their assessment in that in order to accomplish management objectives, wildlife managers must design a regulatory package that does not constrain participation (Miller & Vaske, 2003). First, agency budgets are predicated on license sales and if hunters fail to participate, budgets and programs will be affected. More importantly, if the regulations are onerous and individuals do not participate, management objectives may not be realized and hunting will not be an effective method of limiting deer population growth.

These results contribute to the multiple satisfaction literature and may aid future researchers predict participation as regulations change. We caution managers that by indexing hunter satisfaction with high deer densities, a management paradox is created in that hunter expectations may not be realized as deer populations decline. Programmatic support and satisfaction with hunting experiences will need to be maintained at high levels despite decreasing deer populations and hunter success rates. If population objectives are to be achieved, the model managers and hunters use to assess their overall satisfaction with hunting will need to shift away from 'deer in the bag' and towards other quantifiable measures (e.g., season length, opportunity, more mature bucks in the population).

Table 4.1 Response rates for each survey.

Antler Point Restriction (Itasca State Park)

Year	Initial Sample Size	Undeliverable	Valid Sample Size	Number Returned	Response
2005	557	28	529	336	63.5%
2006	488	22	466	296	63.5%
2007	452	25	427	269	63.0%
Total	1497	75	1422	901	63.5%

Early Antlerless

Year	Initial Sample Size	Undeliverable	Valid Sample Size	Number Returned	Response
2005	1,000	39	961	561	58.4%
2006	1,000	65	935	635	67.9%
2007	2,000	108	1,888	1,096	58.1%
Total	4,000	212	3,784	2,292	60.6%

Earn-A-Buck (St. Croix State Park)

Year	Initial Sample Size	Undeliverable	Valid Sample Size	Number Returned	Response
2005	510	31	479	332	69.3%
2006	474	28	446	323	72.5%
2007	506	30	476	310	65.2%
Total	1,490	89	1,401	965	68.9%

Grand Total	6,988	377	6,611	4,187	63.3%
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Table 4.2 Comparison of satisfaction-related variables for Itasca State Park respondents in 2005, 2006, and 2007.

Variable	2005			2006			2007			F	P
	N	Mean	SD	N	Mean	SD	N	Mean	SD		
Q18 - Satisfaction during hunt ¹											
18A - Satisfied with legal bucks	283	2.31	1.34	254	2.31	1.35	238	2.36	1.35	.117	.889
18B - Satisfied with buck quality	279	2.78	1.37	247	2.62	1.37	234	2.59	1.42	1.45	.236
18C - Heard or saw legal bucks	286	3.22	1.50	253	3.11	1.55	243	3.15	1.50	.371	.690
18D - Satisfied with antlerless deer	282	2.96	1.51	258	2.66	1.50	245	2.82	1.49	2.87	.058
18E - Satisfied with total deer	298	2.81	1.53	263	2.46	1.55	249	2.60	1.47	3.82	.022
Q27 - Reasons to support regulations ¹											
27A - Do not result in increased buck kill	301	3.04	0.98	268	3.03	1.02	243	2.98	0.96	.300	.741
27B - Do not result in increased doe kill	305	2.84	0.98	268	2.79	1.06	244	2.80	0.92	.226	.798
27C - Increase DNR ability to control deer	309	3.55	1.05	273	3.52	0.99	245	3.52	0.94	.102	.903
27D - Increase bowhunter opportunity	300	3.13	1.02	257	3.11	0.96	232	3.08	0.96	.158	.854
27E - Increase muzzleloader opportunity	298	3.13	0.96	259	3.06	0.94	235	3.11	0.89	.352	.704
27F - Increase firearm opportunity	315	3.90	0.87	273	3.78	0.96	249	3.80	0.88	1.58	.206
27G - Increase my chance at buck	318	3.64	1.02	278	3.55	1.11	252	3.64	1.03	.603	.547
27H - Increase my chance at a large buck	315	3.63	1.09	277	3.52	1.18	251	3.64	1.10	.922	.398
27I - Increase my chance at antlerless deer	318	3.59	0.95	272	3.53	1.02	248	3.50	0.96	.665	.514
27J - Encourage new hunters	312	3.65	1.02	273	3.57	1.10	247	3.68	1.04	.799	.450
27K - Lead to better hunter image	314	4.07	0.96	277	4.00	0.93	247	4.13	0.91	1.33	.264
27L - Protect farmer interests	312	3.90	0.91	272	3.89	0.90	246	3.95	0.94	.292	.746
27M - Protect Forests	314	3.75	0.96	276	3.74	0.99	247	3.72	1.02	.090	.914
27N - Reduce public land crowding	316	3.99	0.95	276	3.93	1.02	249	4.02	0.96	.522	.593
27O - Do not decrease public land access	311	3.76	0.90	265	3.74	0.96	238	3.82	0.86	.614	.542

Table 4.2 (Continued)

Q37 - Importance of Experiences to Satisfaction²

37A - Harvest at least one deer	327	3.25	1.17	282	3.39	1.20	265	3.19	1.20	2.01	.134
37B - Access to different hunting areas	324	3.07	1.22	281	3.27	1.19	261	2.93	1.18	5.42	.005
37C - Harvest any deer	325	3.16	1.28	281	3.33	1.22	255	3.15	1.32	1.73	.177
37D - Being on my own	325	2.95	1.29	279	3.03	1.29	263	3.03	1.33	.374	.688
37E - Hunting with friends	324	4.06	1.00	279	4.12	0.99	258	4.07	0.91	.390	.677
37F - Developing skills and abilities	323	3.49	1.09	280	3.43	1.14	260	3.48	1.11	.230	.794
37G - Hunting with family	323	4.03	1.16	280	4.15	1.11	264	4.13	1.10	.912	.402
37H - Enjoying nature and the outdoors	325	4.44	0.75	283	4.45	0.82	265	4.51	0.70	.645	.525
37I - Getting away from crowds	325	4.16	0.92	281	4.22	0.95	263	4.18	0.88	.272	.762
37J - Getting food for my family	323	2.43	1.32	282	2.48	1.24	260	2.44	1.27	.114	.893
37K - Getting information about seasons	320	3.11	1.10	282	3.06	1.21	261	2.99	1.11	.756	.470
37L - See a lot of bucks	326	2.84	1.09	283	2.89	1.22	264	2.84	1.19	.200	.819
37M - Good behavior among hunters	325	4.46	0.80	279	4.47	0.78	259	4.48	0.76	.039	.962
37N - Long deer season	323	3.10	1.22	281	3.35	1.18	262	3.16	1.24	3.25	.039
37O - Open areas for the public	324	3.95	1.01	282	4.00	1.02	262	3.85	1.04	1.49	.227
37P - Harvest a large buck	325	2.70	1.23	282	2.61	1.28	261	2.58	1.26	.695	.499
37Q - Reducing tension and stress	322	3.56	1.15	282	3.65	1.20	262	3.66	1.13	.661	.516
37R - See a lot of deer	325	3.42	0.99	283	3.53	1.04	262	3.42	1.06	1.15	.316
37S - Sharing my skills and knowledge	325	3.22	1.09	282	3.24	1.10	261	3.28	1.08	.252	.777
37T - Thinking about my personal values	324	3.48	1.11	281	3.48	1.14	263	3.50	1.08	.045	.956
37U - Using my deer hunting equipment	326	3.38	1.11	280	3.38	1.12	264	3.28	1.16	.767	.465
Total number of deer harvested	335	.69	1.06	296	.74	1.08	274	.73	1.07	.165	.848

¹Scale: 1 - Strongly Disagree, 2 - Slightly Disagree, 3 - Neutral, 4 - Slightly Agree, 5 - Strongly Agree

²Scale: 1 - Not at all Important, 2 - Slightly Important, 3 - Somewhat Important, 4 - Very Important, 5 - Extremely Important

Table 4.3 Reliability, factor analysis of scales, and average variance extracted for variables used to measure Itasca State Park hunt participation.

Endogenous Variable/Survey Question/Scale/Item	2005			Year 2006			2007		
	α/R^a	Factor loading	AVE	α/R^a	Factor loading	AVE	α/R^a	Factor loading	AVE
Satisfaction									
Q18 - Satisfaction during hunt									
<i>Actual Satisfaction</i>	0.86		0.64	0.87		0.67	0.89		0.70
18A - Satisfied with legal bucks	0.81	0.87		0.83	0.88		0.85	0.89	
18B - Satisfied with buck quality	0.83	0.80		0.84	0.84		0.86	0.87	
18C - Heard or saw legal bucks	0.85	0.72		0.88	0.70		0.89	0.77	
18D - Satisfied with antlerless deer	0.83	0.81		0.84	0.83		0.87	0.81	
18E - Satisfied with total deer	0.82	0.82		0.84	0.84		0.87	0.83	
Q37 - Importance of Experiences to Satisfaction									
<i>Achievement</i>	0.83		0.55	0.84		0.56	0.82		0.53
37F - Developing skills and abilities	0.81	0.73		0.81	0.78		0.79	0.74	
37K - Getting information about seasons	0.82	0.68		0.83	0.69		0.80	0.66	
37Q - Reducing tension and stress	0.82	0.70		0.83	0.68		0.81	0.65	
37S - Sharing my skills and knowledge	0.79	0.81		0.80	0.82		0.77	0.81	
37T - Thinking about my personal values	0.78	0.84		0.79	0.84		0.77	0.80	
37U - Using my deer hunting equipment	0.82	0.69		0.83	0.67		0.80	0.68	
<i>Harvest</i>	0.81		0.72	0.79		0.71	0.86		0.78
37A - Harvest at least one deer	0.79	0.82		0.76	0.82		0.84	0.86	
37C - Harvest any deer	0.61	0.91		0.60	0.90		0.74	0.92	
37J - Getting food for my family	0.79	0.82		0.77	0.81		0.82	0.87	

Table 4.3 (Continued)

<i>Bucks</i>	0.78		0.70	0.81		0.72	0.82	0.74
37L - See a lot of bucks	0.59	0.89		0.59	0.92		0.63	0.92
37P - Harvest a large buck	0.65	0.87		0.72	0.86		0.72	0.88
37R - See a lot of deer	0.83	0.74		0.85	0.76		0.87	0.77
<i>Access</i>	0.60		0.56	0.64		0.58	0.67	0.60
37B - Access to different hunting areas	0.49	0.75		0.57	0.74		0.61	0.75
37N - Long deer season	0.48	0.76		0.54	0.76		0.53	0.80
37O - Open areas for the public	0.52	0.74		0.50	0.79		0.58	0.78
<i>Friends and Family</i>	0.33 ^b		0.66	0.47 ^b		0.73	0.48 ^b	0.74
37E - Hunting with friends		0.82			0.86			0.86
37G - Hunting with family		0.82			0.86			0.86
<i>Solitude</i>	0.56 ^b		0.66	0.54 ^b		0.73	0.54 ^b	0.74
37H - Enjoying nature		0.88			0.88			0.88
37I - Getting away from crowds		0.88			0.88			0.88
<i>Total deer harvested^f</i>	n/a			n/a			n/a	
Regulatory Support								
Q27 - Reasons to support regulations								
<i>Ethics</i>	0.76		0.58	0.81		0.64	0.72	0.56
27J - Encourage new hunters	0.72	0.74		0.79	0.77		0.67	0.74
27K - Lead to better hunter image	0.61	0.87		0.72	0.87		0.56	0.87
27L - Protect farmer interests	0.69	0.78		0.76	0.81		0.64	0.78
27N - Reduce public land crowding	0.76	0.65		0.78	0.77		0.76	0.57

Table 4.3 (Continued)

<i>Hunt Opportunity</i>	0.76		0.58	0.79		0.62	0.84		0.68
27F - Increase firearm opportunity	0.75	0.67		0.78	0.70		0.85	0.72	
27G - Increase my chance at buck	0.59	0.88		0.64	0.91		0.73	0.92	
27H - Increase my chance at a large buck	0.70	0.78		0.70	0.85		0.79	0.85	
27I - Increase my chance at antlerless deer	0.74	0.70		0.80	0.66		0.82	0.80	
<i>Control / Protection^d</i>	0.57		0.54	0.57		0.54	0.53		0.51
27C - Increase DNR ability to control deer	0.37	0.79		0.47	0.73		0.41	0.73	
27M - Protect Forests	0.44	0.75		0.38	0.78		0.42	0.72	
27O - Do not decrease public land access	0.56	0.65		0.53	0.68		0.45	0.70	
<i>Special Opportunity</i>	0.64 ^b		0.82	0.55 ^b		0.78	0.58 ^b		0.79
27D - Increase bowhunter opportunity		0.91			0.88			0.89	
27E - Increase muzzleloader opportunity		0.91			0.88			0.89	
<i>Harvest Limits</i>	0.40 ^b		0.70	0.41 ^b		0.70	0.43 ^b		0.71
27A - Do not result in increased buck kill		0.84			0.84			0.85	
27B - Do not result in increased doe kill		0.84			0.84			0.85	

^aCronbach's alpha reported for scales with at least 3 items. Correlation coefficients reported for two item scales.

^b $p < 0.001$

^cSingle item predictor

^dLatent variable was excluded from analysis due to low reliability

Table 4.4 Harvest intentions and ultimate behavior of hunters that participated in the early antlerless deer hunts, 2005 - 2007.

Question: What effect did the early antlerless hunt have on your decision to harvest deer during the regular season? Please complete the following statement:

	Year		
Because I hunted the early season,	2005	2006	2007
I intended to be more selective during the regular season and only harvest a mature buck.	6%	10%	10%
I intended to be more selective and only take a mature buck or antlerless deer.	18%	21%	19%
I killed a deer during the early season and planned not to hunt anymore.	1%	1%	0%
I did not plan to change my hunting patterns, I only hunt for mature bucks.	5%	4%	3%
I did not plan to change my hunting patterns, I typically shoot the first legal deer I see.	25%	25%	28%
I did not plan to change my hunting patterns because the type of deer I kill is not important.	36%	32%	32%
Other	9%	8%	9%

$\chi^2 = 19.237, p = 0.083$

Question: Ultimately, were your hunting patterns altered by the early antlerless season?

Yes, I decided not to shoot a small antlered buck and I didn't kill another deer	9%	10%	10%
Yes, I held out and shot a mature buck	7%	10%	6%
Yes, I shot an antlerless deer instead of a small-antlered buck	11%	14%	9%
No, I shot a small antlered buck	5%	5%	4%
No, I shot the first deer that I could (buck or antlerless)	32%	36%	32%
No, but I did not get another deer	28%	21%	33%
Other	8%	4%	6%

$\chi^2 = 44.45, p < 0.001$

Table 4.5 Comparison of satisfaction-related variables for Early Antlerless respondents in 2005, 2006, and 2007.

Variable	2005			2006			2007			F	P
	N	Mean	SD	N	Mean	SD	N	Mean	SD		
Q27 - Reasons to support regulations ¹											
27B - Do not result in increased doe kill	522	2.53	1.09	581	2.64	1.05	983	2.79	1.08	10.35	<.001
27C - Increase DNR ability to control deer	528	3.64	0.99	587	3.66	1.01	995	3.52	1.07	4.30	.014
27D - Increase bowhunter opportunity	524	3.51	1.07	576	3.43	1.16	996	3.42	1.10	1.38	.252
27E - Increase muzzleloader opportunity	523	3.59	1.03	568	3.60	1.07	996	3.51	1.05	1.76	.172
27F - Increase firearm opportunity	537	3.89	0.94	603	3.95	0.94	1,040	3.82	0.98	3.54	.029
27I - Increase my chance at antlerless deer	541	3.88	0.82	606	3.85	0.83	1,042	3.83	0.86	.643	.526
27J - Encourage new hunters	530	3.87	0.97	598	3.79	1.02	1,030	3.85	0.98	.953	.386
27K - Lead to better hunter image	536	4.29	0.80	601	4.27	0.81	1,028	4.26	0.82	.263	.769
27L - Protect farmer interests	538	4.25	0.85	607	4.29	0.84	1,042	4.28	0.82	.329	.720
27M - Protect Forests	538	3.92	0.89	599	3.92	0.89	1,026	3.83	0.94	2.82	.060
27N - Reduce public land crowding	531	3.96	0.95	588	3.98	0.95	1,016	3.97	0.93	.085	.918
27O - Do not decrease public land access	517	3.72	1.06	582	3.78	1.06	984	3.67	1.03	2.11	.121
Q37 - Importance of Experiences to Satisfaction ²											
37A - Harvest at least one deer	537	3.46	1.18	589	3.19	1.20	1,025	3.51	1.18	13.78	<.001
37B - Access to different hunting areas	530	2.91	1.35	590	2.67	1.38	1,016	2.67	1.27	6.89	.001
37C - Harvest any deer	525	3.43	1.24	591	3.25	1.20	1,004	3.42	1.25	4.13	.016
37D - Being on my own	531	3.00	1.35	584	2.86	1.33	1,017	3.07	1.26	4.75	.009
37E - Hunting with friends	534	3.69	1.17	585	3.62	1.23	1,012	3.64	1.15	0.40	.667
37F - Developing skills and abilities	535	3.63	1.11	591	3.44	1.26	1,021	3.65	1.1,0	6.90	.001
37G - Hunting with family	537	4.02	1.15	589	3.87	1.28	1,014	4.08	1.06	6.84	.001
37H - Enjoying nature and the outdoors	539	4.49	0.76	594	4.46	0.79	1,025	4.51	0.71	0.76	.467

Table 4.5 (Continued)

37I - Getting away from crowds	533	4.26	1.01	593	4.21	1.03	1,017	4.28	0.94	1.09	.335
37J - Getting food for my family	533	3.15	1.35	593	3.20	1.34	1,020	3.28	1.31	2.05	.128
37K - Getting information about seasons	535	3.54	1.1,0	590	3.48	1.19	1,014	3.42	1.09	2.01	0.13
37M - Good behavior among hunters	537	4.51	0.81	594	4.35	0.95	1,018	4.41	0.81	5.44	.004
37N - Long deer season	536	3.81	1.1,0	591	3.77	1.21	1,018	3.73	1.11	1.01	.363
37O - Open areas for the public	533	3.21	1.44	588	3.13	1.43	1,014	3.05	1.33	2.37	.094
37Q - Reducing tension and stress	533	3.79	1.21	589	3.74	1.19	1,014	3.78	1.13	0.32	.727
37R - See a lot of deer	535	3.51	1.04	591	3.52	1.12	1,018	3.57	1.02	0.66	.517
37S - Sharing my skills and knowledge	536	3.50	1.15	593	3.44	1.17	1,021	3.47	1.13	0.44	.647
37T - Thinking about my personal values	535	3.73	1.16	591	3.64	1.16	1,025	3.68	1.08	0.90	.409
37U - Using my deer hunting equipment	536	3.60	1.15	595	3.60	1.16	1,025	3.68	1.06	1.49	.225
Total number of antlerless deer seen	561	3.83	5.48	632	4.1,0	5.49	1,120	3.52	4.97	2.54	.079
Total number of deer harvested	561	.48	0.74	632	.42	0.76	1,120	.51	0.76	2.45	.087

¹27A (do not increase buck kill) and 27G (increase chances of taking a buck) and 27H (increase chances of taking a large buck) were not assessed.

²37L (see a lot of bucks) and 37P (harvest a large buck) were not assessed.

Table 4.6 Reliability, factor analysis of scales, and average variance extracted for variables used to measure Early Antlerless hunt participation.

Endogenous Variable/Survey Question/Scale/Item	2005			Year			2007		
	α/R^a	Factor loading	AVE	α/R^a	Factor loading	AVE	α/R^a	Factor loading	AVE
Satisfaction									
Q37 - Importance of Experiences to Satisfaction									
<i>Achievement</i>	<i>0.81</i>		<i>0.49</i>	<i>0.80</i>		<i>0.48</i>	<i>0.75</i>		<i>0.42</i>
37D - Being on my own		0.51			0.48			0.40	
37F - Developing skills and abilities		0.67			0.73			0.64	
37H - Enjoying nature		0.76			0.69			0.70	
37I - Getting away from crowds		0.70			0.75			0.65	
37M - Good behavior among deer hunters		0.67			0.66			0.66	
37Q - Reducing tension and stress		0.76			0.73			0.71	
37T - Thinking about my personal values		0.76			0.76			0.72	
<i>Harvest</i>	<i>0.81</i>		<i>0.72</i>	<i>0.77</i>		<i>0.69</i>	<i>0.79</i>		<i>0.71</i>
37A - Harvest at least one deer		0.80			0.78			0.82	
37C - Harvest any deer		0.88			0.89			0.88	
37J - Getting food for my family		0.87			0.82			0.83	
<i>Friends and Family</i>	<i>0.60</i>		<i>0.60</i>	<i>0.69</i>		<i>0.62</i>	<i>0.65</i>		<i>0.59</i>
37E - Hunting with friends		0.74			0.78			0.78	
37G - Hunting with family		0.83			0.82			0.82	
37S - Share knowledge		0.76			0.75			0.70	

Table 4.6 (Continued)

<i>Access</i>	0.57 ^b	0.78	0.55 ^b	0.77	0.53 ^b	0.76
37B - Access to different hunting areas	0.87		0.76		0.76	
37O - Open areas for the public	0.87		0.76		0.76	
<i>Number of deer observed^f</i>	n/a		n/a		n/a	
<i>Total number of deer harvested^c</i>	n/a		n/a		n/a	
Regulatory Support						
Q27 - Reasons to support regulations						
<i>Ethics</i>	0.74	0.50	0.67	0.44	0.73	0.48
27J - Encourage new hunters	0.66		0.66		0.68	
27K - Lead to better hunter image	0.80		0.78		0.80	
27L - Protect farmer interests	0.76		0.64		0.74	
27M - Protect Forests	0.67		0.65		0.65	
27N - Reduce public land crowding	0.62		0.58		0.60	
<i>Hunt Opportunity</i>	0.48 ^b	0.74	0.36 ^b	0.68	0.44 ^b	0.72
27F - Increase firearm opportunity	0.86		0.82		0.85	
27I - Increase my chance at antlerless deer	0.86		0.82		0.85	
<i>Special Opportunity</i>	0.48 ^b	0.74	0.48 ^b	0.74	0.50 ^b	0.75
27D - Increase bowhunter opportunity	0.86		0.86		0.87	
27E - Increase muzzleloader opportunity	0.86		0.86		0.87	

^aCronbach's alpha reported for scales with at least 3 items. Correlation coefficients reported for two item scales.

^b $P < 0.001$

^cSingle item predictor

Table 4.7 Comparison of satisfaction-related variables for Earn-A-Buck respondents in 2005, 2006, and 2007.

Variable	2005			2006			2007			F	P
	N	Mean	SD	N	Mean	SD	N	Mean	SD		
Q18 - Satisfaction during hunt											
18A - Satisfied with legal bucks	262	2.73	1.39	260	2.73	1.38	254	2.94	1.35	2.13	.120
18B - Satisfied with buck quality	256	2.88	1.41	253	2.81	1.33	249	3.00	1.35	1.24	.289
18C - Heard or saw legal bucks	273	3.34	1.45	267	3.52	1.45	267	3.48	1.43	1.19	.304
18D - Satisfied with antlerless deer	278	3.11	1.45	272	2.93	1.48	266	3.17	1.44	1.91	.149
18E - Satisfied with total deer	282	2.84	1.52	281	2.78	1.46	273	2.99	1.50	1.48	.228
Q27 - Reasons to support regulations											
27A - Do not result in increased buck kill	300	3.23	1.04	301	3.06	1.06	286	3.25	1.06	2.84	.059
27B - Do not result in increased doe kill	302	2.75	0.98	304	2.68	1.04	287	2.89	1.01	3.05	.048
27C - Increase DNR ability to control deer	313	3.61	0.95	301	3.72	1.00	287	3.75	0.92	1.81	.164
27D - Increase bowhunter opportunity	305	3.51	1.05	301	3.39	1.13	284	3.43	1.10	0.97	.380
27E - Increase muzzleloader opportunity	296	3.28	0.97	294	3.30	1.01	278	3.28	1.03	0.05	.950
27F - Increase firearm opportunity	320	3.80	0.97	305	3.87	0.95	294	3.77	0.91	0.87	.420
27G - Increase my chance at buck	322	3.77	0.95	311	3.84	1.00	293	3.83	0.96	0.42	.655
27H - Increase my chance at a large buck	323	3.94	1.00	311	3.98	0.91	295	3.94	0.98	0.23	.796
27I - Increase my chance at antlerless deer	322	3.66	0.89	312	3.71	0.85	295	3.73	0.92	0.38	.684
27J - Encourage new hunters	318	3.64	1.05	305	3.73	0.99	295	3.73	1.00	0.98	.378
27K - Lead to better hunter image	320	4.07	0.94	310	4.23	0.86	295	4.27	0.80	4.59	.010
27L - Protect farmer interests	318	3.97	0.94	307	4.09	0.87	295	4.07	0.85	1.81	.164
27M - Protect Forests	316	3.84	0.93	310	3.93	0.83	296	3.94	0.88	1.32	.269
27N - Reduce public land crowding	321	4.11	0.92	308	4.23	0.84	293	4.24	0.83	2.19	.113
27O - Do not decrease public land access	308	3.70	0.96	305	3.85	0.94	285	3.88	0.90	3.06	.047

Table 4.7 (Continued)

Q37 - Importance of Experiences to Satisfaction											
37A - Harvest at least one deer	325	3.26	1.14	309	3.30	1.15	299	3.27	1.16	0.11	.896
37B - Access to different hunting areas	323	3.39	1.10	310	3.35	1.02	298	3.28	1.06	0.77	.465
37C - Harvest any deer	323	3.22	1.25	303	3.27	1.20	292	3.29	1.22	0.28	.755
37D - Being on my own	324	2.93	1.17	305	3.00	1.27	297	3.15	1.19	2.85	.058
37E - Hunting with friends	325	3.93	0.97	308	4.00	0.95	298	3.92	1.01	0.57	.565
37F - Developing skills and abilities	325	3.59	1.08	308	3.52	1.08	297	3.62	1.10	0.64	.528
37G - Hunting with family	322	4.01	1.16	308	4.08	1.14	291	4.01	1.15	0.40	.673
37H - Enjoying nature and the outdoors	323	4.47	0.76	310	4.48	0.75	298	4.55	0.66	1.05	.350
37I - Getting away from crowds	322	4.24	0.90	308	4.26	0.94	295	4.25	0.88	0.05	.947
37J - Getting food for my family	323	2.62	1.38	308	2.58	1.32	299	2.70	1.33	0.60	.549
37K - Getting information about seasons	319	3.42	1.08	306	3.28	1.15	295	3.41	1.12	1.45	.236
37L - See a lot of bucks	325	3.18	1.16	310	3.05	1.18	298	3.04	1.13	1.51	.222
37M - Good behavior among hunters	325	4.47	0.76	310	4.48	0.78	296	4.46	0.80	0.10	.906
37N - Long deer season	323	3.53	1.14	310	3.68	1.08	295	3.51	1.12	2.29	.101
37O - Open areas for the public	324	3.86	0.98	304	3.89	1.08	297	3.84	1.00	0.24	.788
37P - Harvest a large buck	323	3.10	1.26	311	2.89	1.23	298	2.91	1.28	2.59	.075
37Q - Reducing tension and stress	323	3.74	1.14	310	3.73	1.18	296	3.78	1.01	0.20	.815
37R - See a lot of deer	324	3.56	1.01	310	3.56	1.02	298	3.49	1.00	0.51	.602
37S - Sharing my skills and knowledge	323	3.38	1.12	307	3.36	1.07	293	3.37	1.10	0.03	.966
37T - Thinking about my personal values	324	3.67	1.07	307	3.50	1.11	296	3.74	1.09	3.68	.025
37U - Using my deer hunting equipment	324	3.46	1.17	309	3.49	1.14	298	3.47	1.12	0.06	.940
Total number of deer harvested	332	.84	1.03	323	1.00	1.16	310	1.05	1.16	3.16	.043

Table 4.8 Reliability, factor analysis of scales, and average variance extracted for variables used to measure Earn-A-Buck hunt participation.

Endogenous Variable/Survey Question/Scale/Item	Year								
	2005			2006			2007		
	α/R^a	Factor loading	AVE	α/R^a	Factor loading	AVE	α/R^a	Factor loading	AVE
Satisfaction									
Q18 - Satisfaction during hunt									
<i>Actual Satisfaction</i>	0.85		0.62	0.86		0.64	0.86		0.64
18A - Satisfied with legal bucks		0.87			0.89			0.90	
18B - Satisfied with buck quality		0.84			0.86			0.88	
18C - Heard or saw legal bucks		0.68			0.74			0.70	
18D - Satisfied with antlerless deer		0.72			0.68			0.69	
18E - Satisfied with total deer		0.82			0.82			0.82	
Q37 - Importance of Experiences to Satisfaction									
<i>Achievement</i>	0.77		0.59	0.80		0.63	0.76		0.59
37Q - Reducing tension and stress		0.78			0.78			0.77	
37S - Sharing my skills and knowledge		0.76			0.82			0.76	
37T - Thinking about my personal values		0.86			0.83			0.80	
37U - Using my deer hunting equipment		0.69			0.74			0.74	
<i>Harvest</i>	0.80		0.72	0.84		0.76	0.79		0.71
37A - Harvest at least one deer		0.81			0.86			0.82	
37C - Harvest any deer		0.89			0.91			0.90	
37J - Getting food for my family		0.84			0.85			0.81	

Table 4.8 (Continued)

<i>Bucks</i>	0.83	0.75	0.83	0.74	0.80	0.72
37L - See a lot of bucks	0.92		0.91		0.89	
37P - Harvest a large buck	0.88		0.87		0.87	
37R - See a lot of deer	0.80		0.81		0.78	
<i>Solitude</i>	0.65	0.39	0.69	0.42	0.61	0.37
37B - Access to different hunting areas	0.56		0.55		0.57	
37D - Being on my own	0.44		0.52		0.39	
37H - Enjoy nature and the outdoors	0.75		0.74		0.72	
37I - Getting away from crowds of people	0.74		0.74		0.70	
37M - Good behavior among hunters	0.68		0.70		0.69	
37O - Open areas for the public	0.53		0.60		0.53	
<i>Friends and Family</i>	0.50 ^b	0.75	0.51 ^b	0.75	0.39 ^b	0.70
37E - Hunting with friends	0.87		0.87		0.84	
37G - Hunting with family	0.87		0.87		0.84	
<i>Total deer harvested^c</i>	n/a		n/a		n/a	
Regulatory Support						
Q27 - Reasons to support regulations						
<i>Ethics</i>	0.75	0.57	0.76	0.59	0.72	0.55
27J - Encourage new hunters	0.71		0.70		0.76	
27K - Lead to better hunter image	0.83		0.86		0.81	
27L - Protect farmer interests	0.79		0.77		0.77	
27M - Protect Forests	0.69		0.73		0.63	

Table 4.8 (Continued)

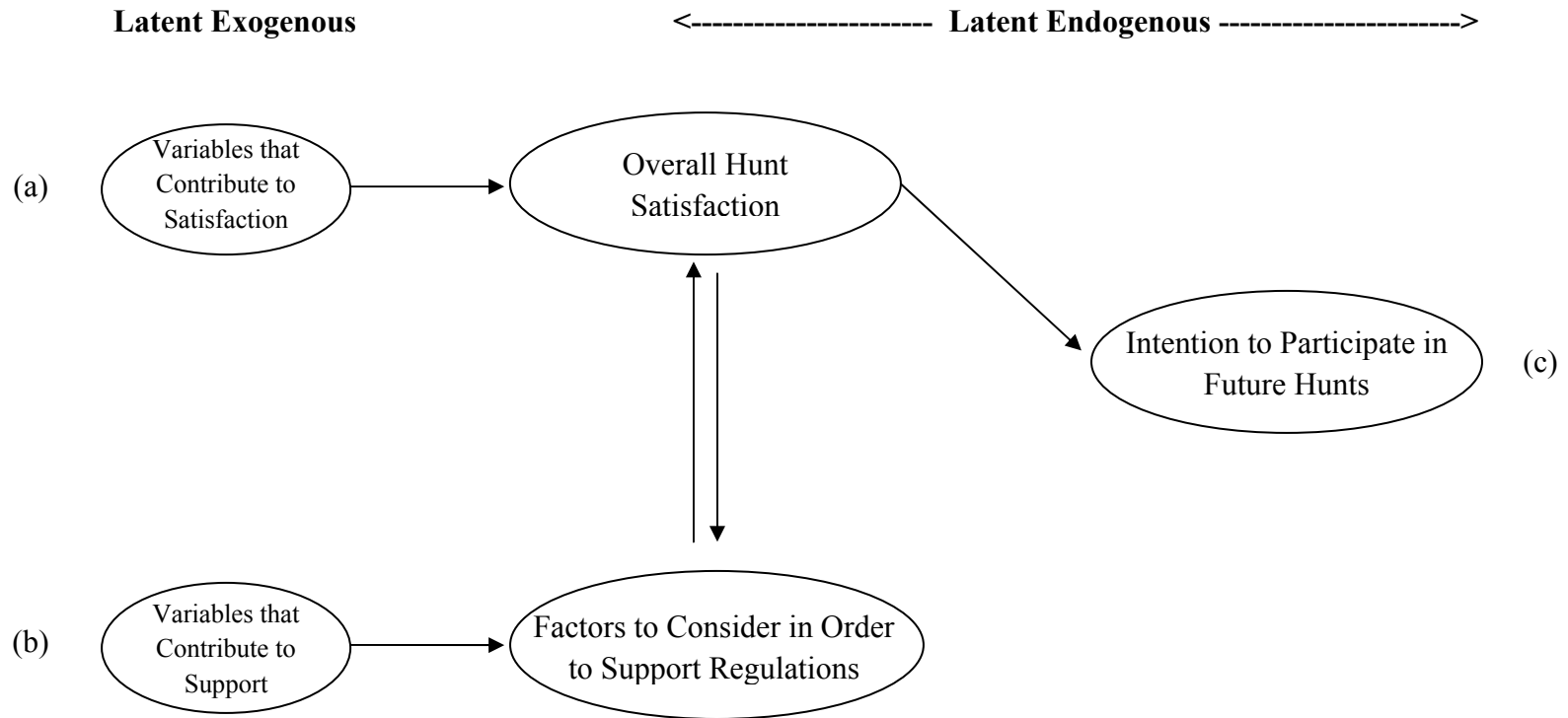
<i>Hunt Opportunity</i>	0.70	0.53	0.79	0.62	0.75	0.57
27F - Increase firearm opportunity	0.66		0.78		0.65	
27G - Increase my chance at buck	0.85		0.86		0.86	
27H - Increase my chance at a large buck	0.76		0.76		0.77	
27I - Increase my chance at antlerless deer	0.63		0.74		0.74	
<i>Access</i>	0.30 ^b	0.65	0.26 ^b	0.63	0.39 ^b	0.69
27N - Reduce public land crowding	0.81		0.79		0.83	
27O - Do not decrease public land access	0.81		0.79		0.83	
<i>Special Opportunity</i>	0.52 ^b	0.76	0.62 ^b	0.84	0.50 ^b	0.75
27D - Increase bowhunter opportunity	0.87		0.90		0.87	
27E - Increase muzzleloader opportunity	0.87		0.90		0.87	
<i>Harvest Limits</i>	0.29 ^b	0.65	0.20 ^b	0.60	0.26 ^b	0.63
27A - Do not result in increased buck kill	0.80		0.77		0.79	
27B - Do not result in increased doe kill	0.80		0.77		0.79	

^aCronbach's alpha reported for scales with at least 3 items. Correlation coefficients reported for two item scales.

^b $P < 0.001$

^cSingle item predictor

Figure 4.1 Hypothesized structural equation model predicting intention to participate in future APR, EA, and EAB hunts.



Footnote: We also tested other latent endogenous relationships (e.g., removed path between satisfaction and factors, added direct path from regulatory support to participation intent) to determine if our theorized model provided the best fit to our data. Ultimately, we observed the lowest AIC with the theorized model above.

Figure 4.2 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2005 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future antler point restriction hunts for best-fit model ($n = 336$).

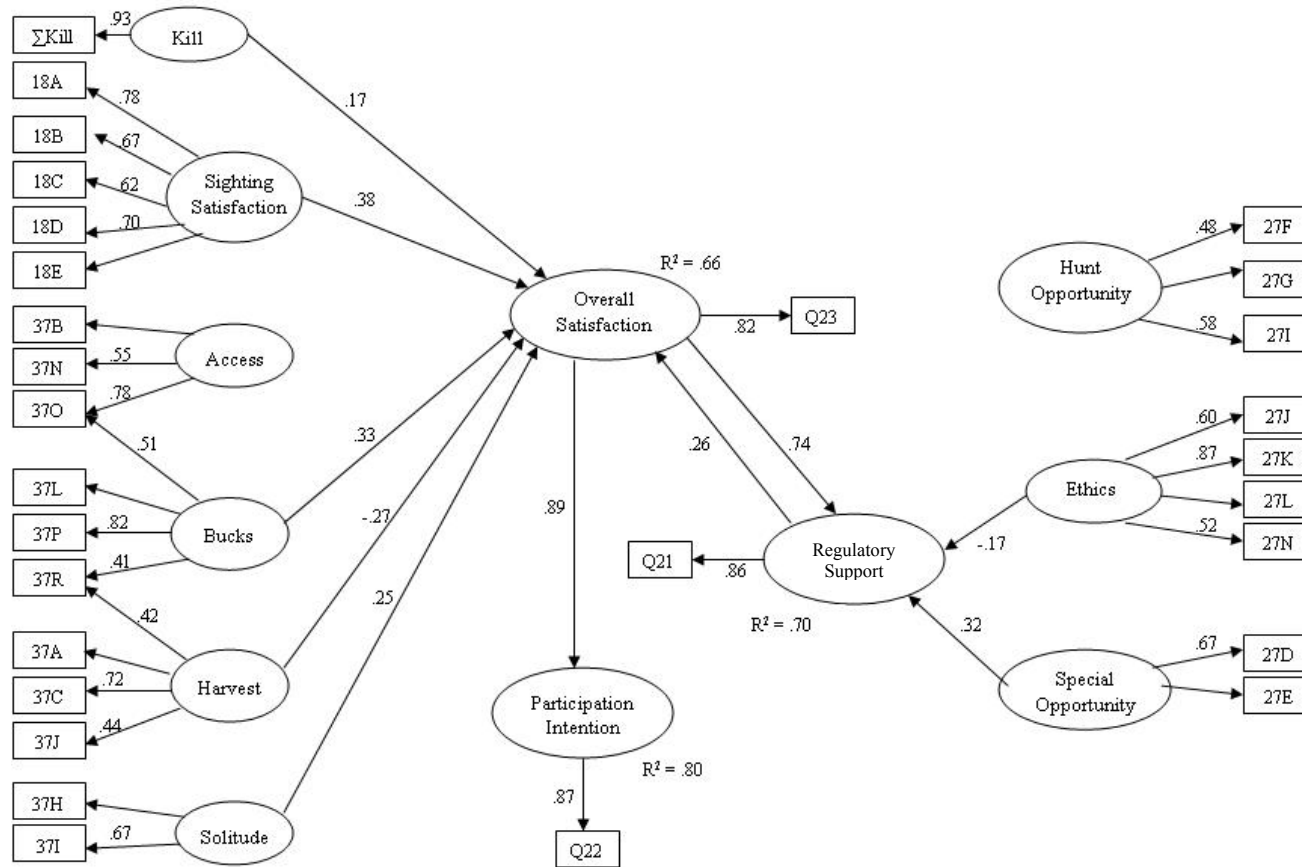


Figure 4.3 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2006 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future antler point restriction hunts for best-fit model ($n = 296$).

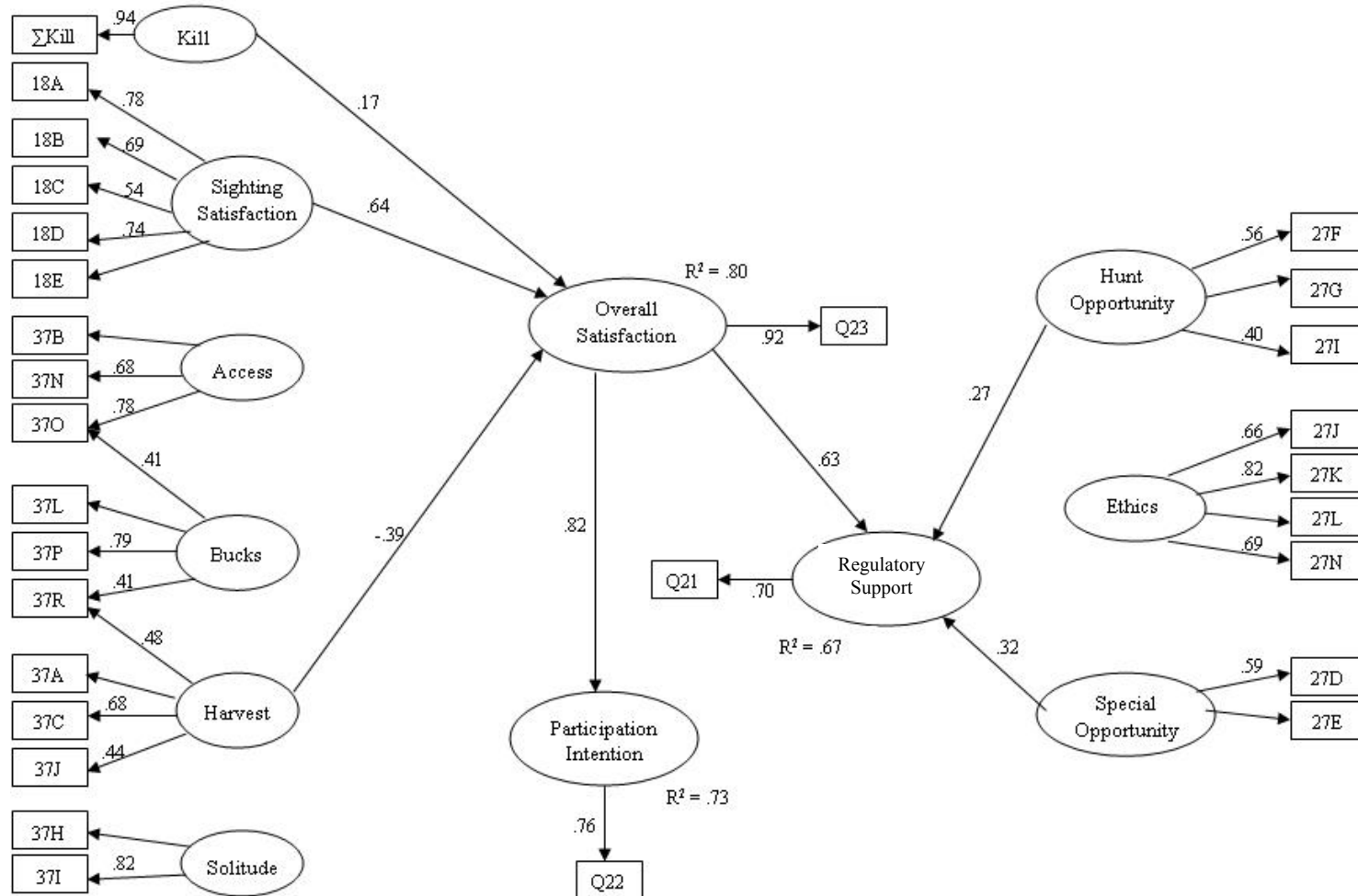


Figure 4.4 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2007 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future antler point restriction hunts for best-fit model ($n = 274$).

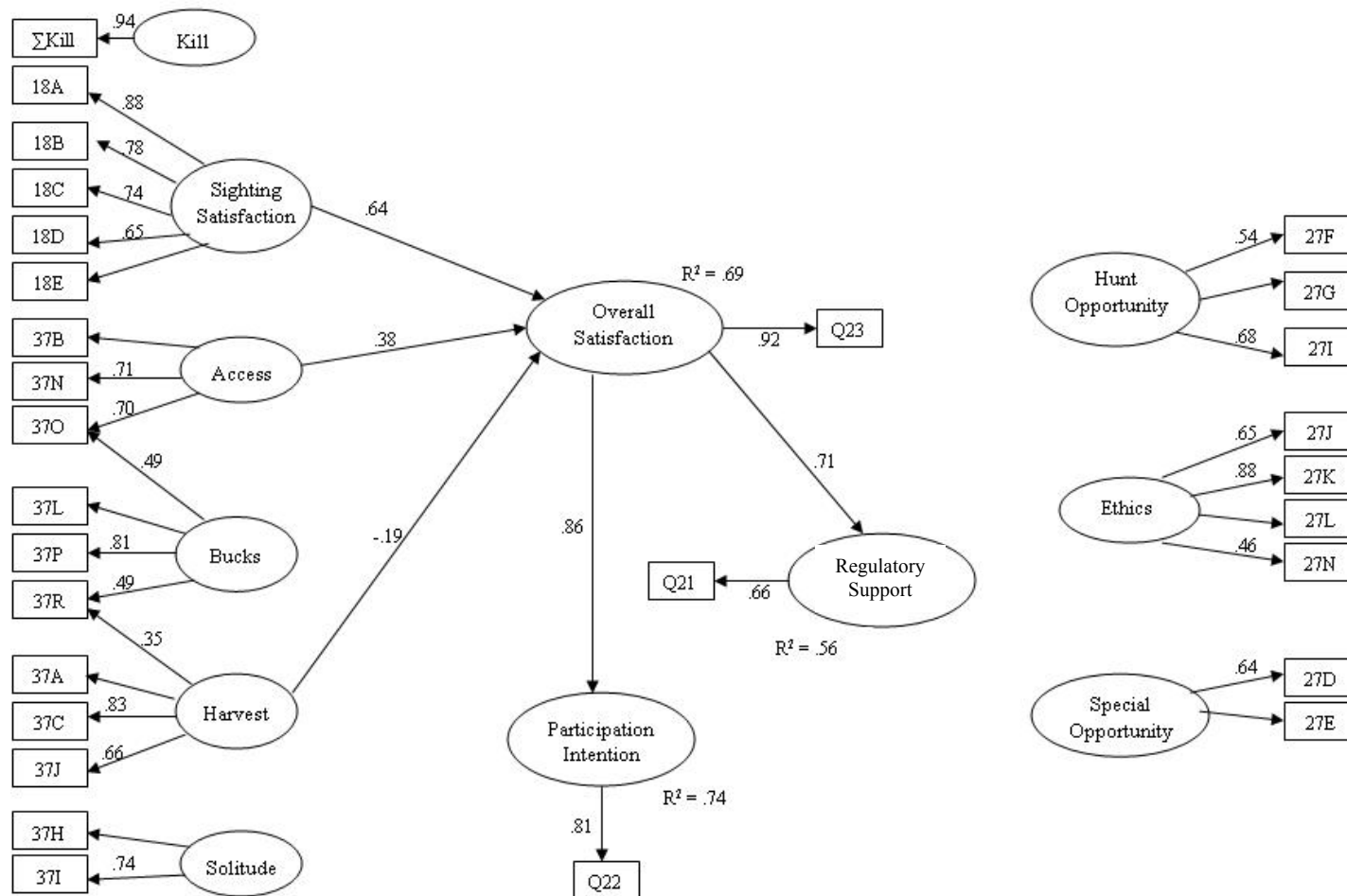


Figure 4.5 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2005 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future early antlerless hunts for best-fit model ($n = 363$).

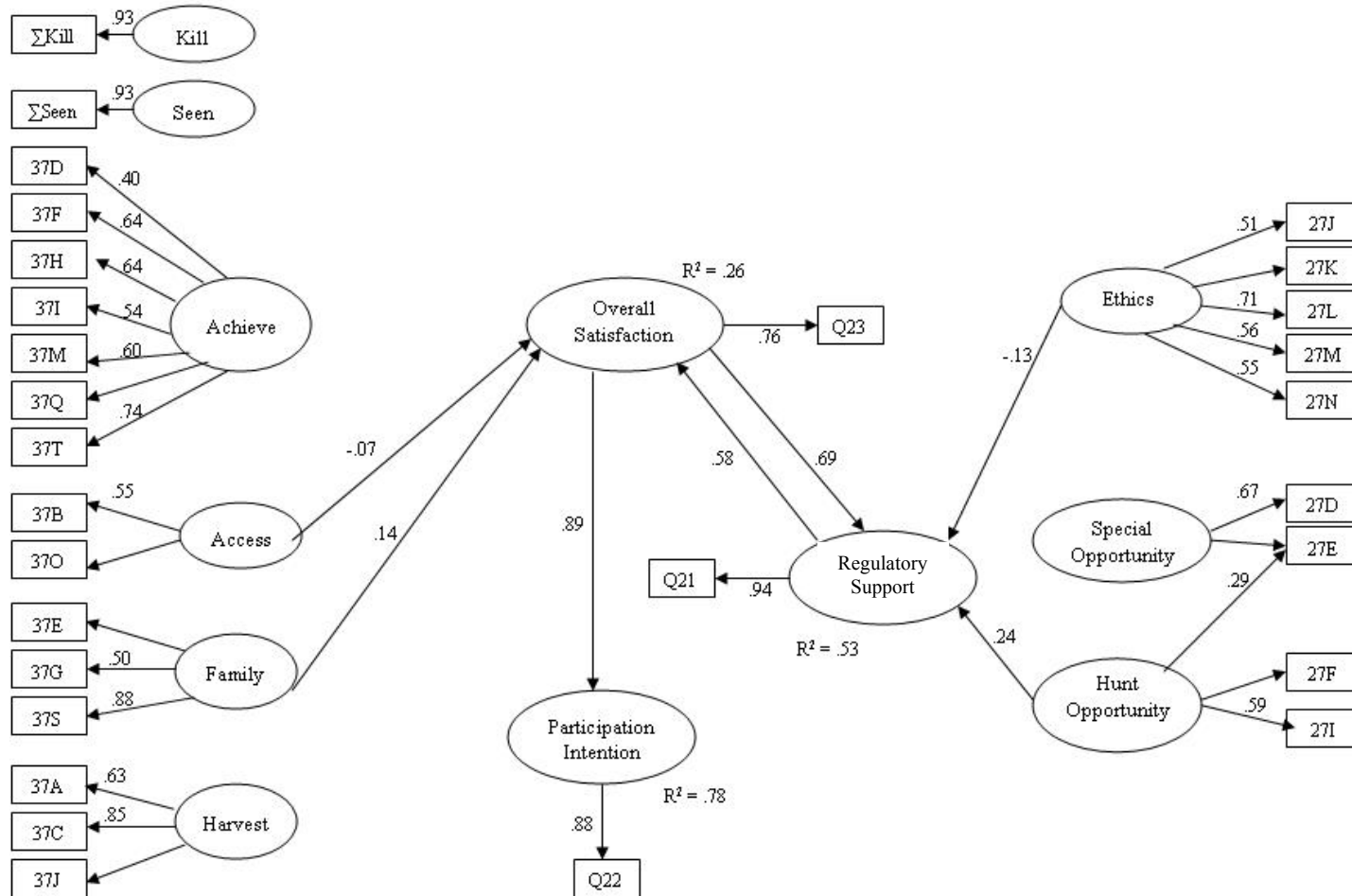


Figure 4.6 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2006 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future early antlerless hunts for best-fit model ($n = 419$).

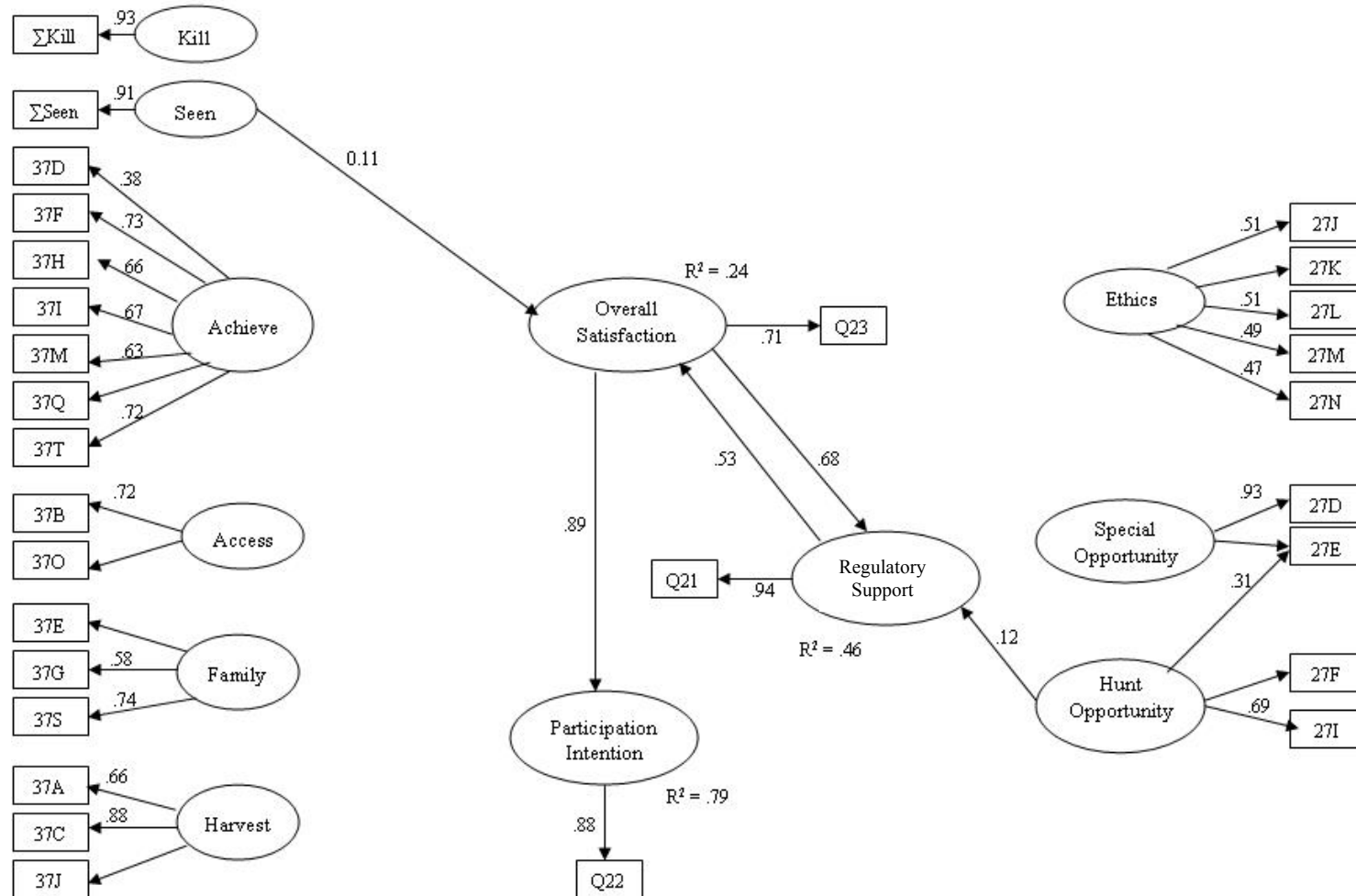


Figure 4.7 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2007 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future early antlerless hunts for best-fit model ($n = 655$).

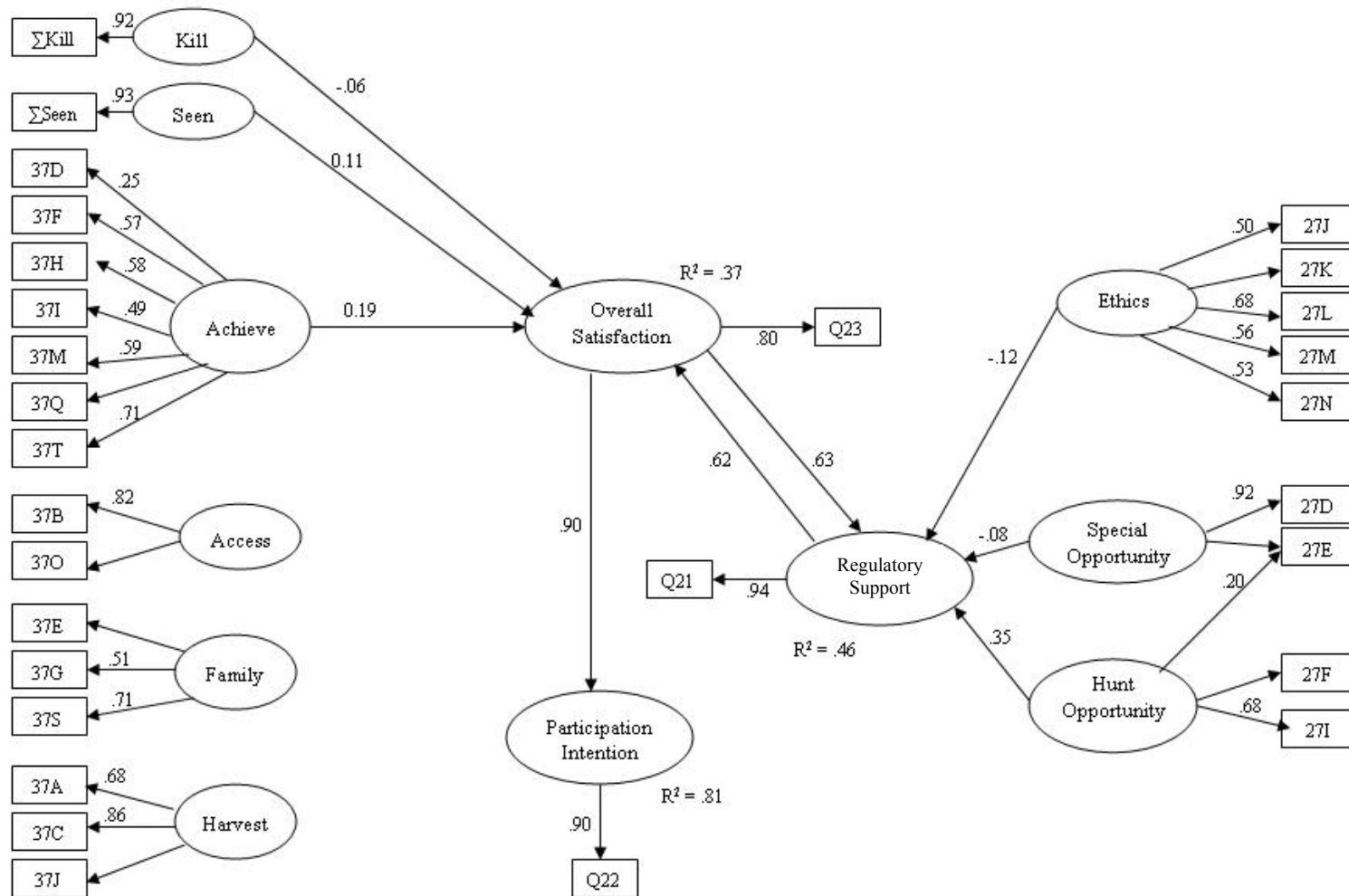


Figure 4.8 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2005 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future earn-a-buck hunts for best-fit model ($n = 196$).

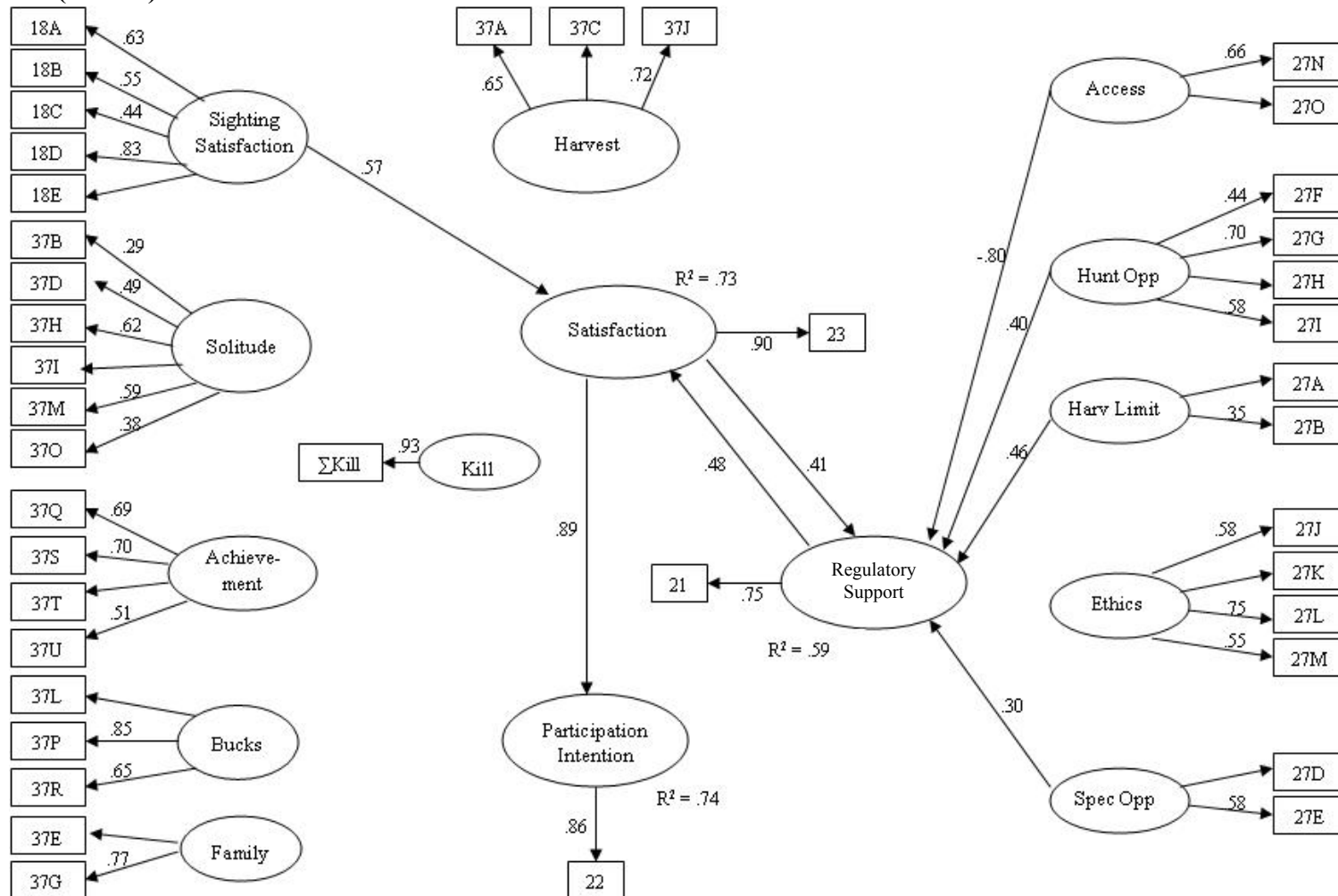


Figure 4.9 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2006 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future earn-a-buck hunts for best-fit model ($n = 197$).

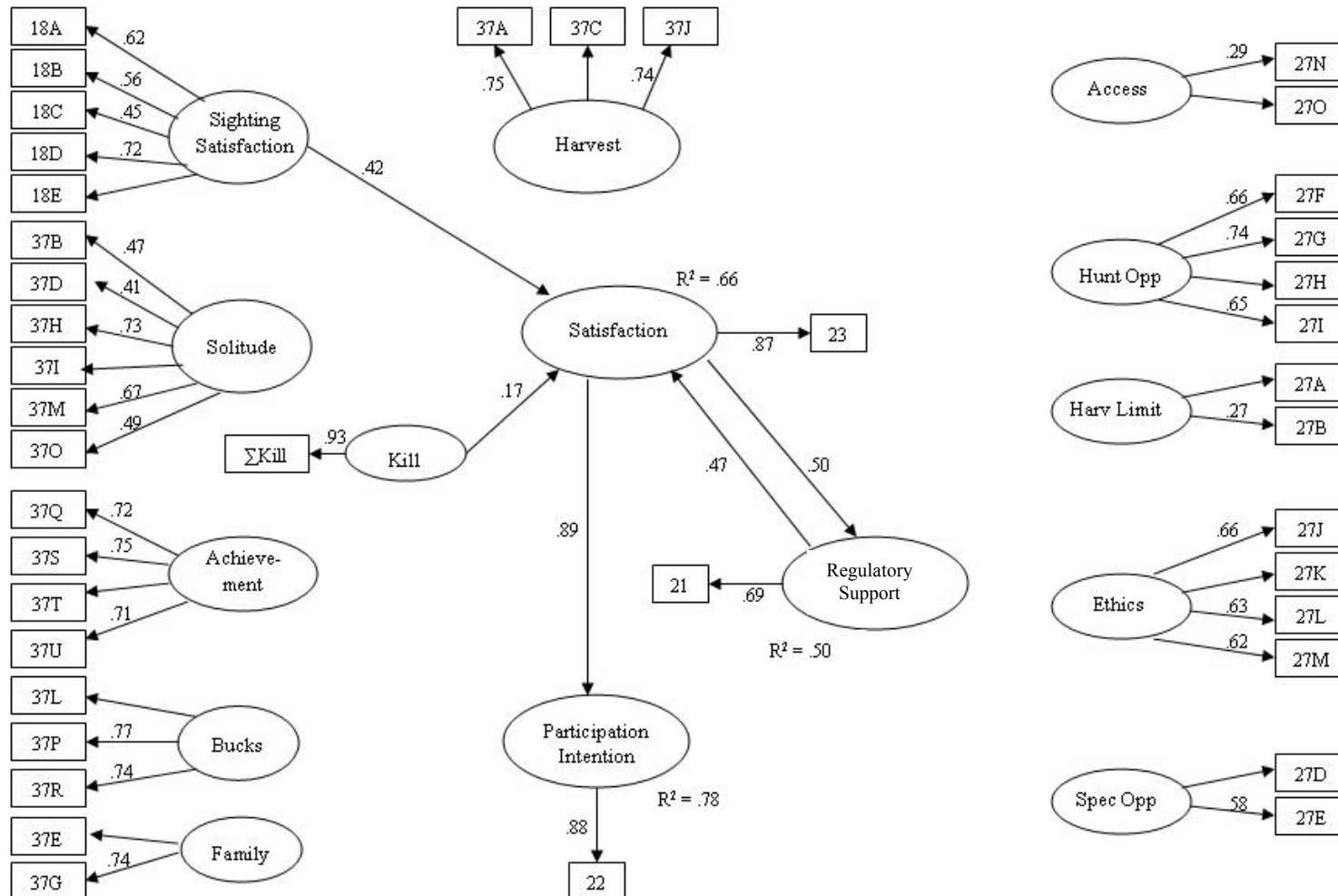
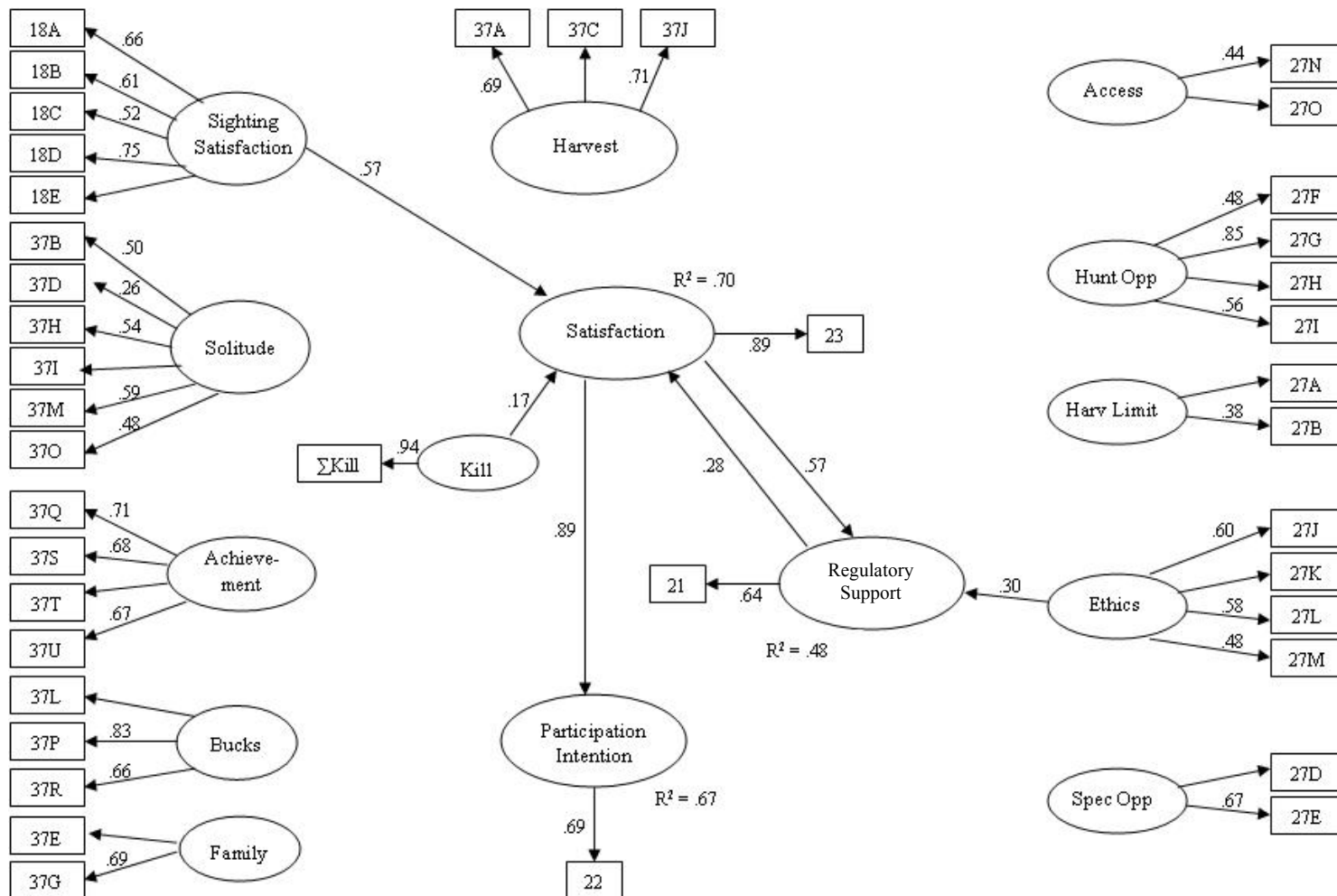


Figure 4.10 Significant ($P < 0.05$) standardized solutions and R^2 for structural equations for 2007 path model relating overall satisfaction, factors to consider prior to changing regulations, and intention to participate in future earn-a-buck hunts for best-fit model ($n = 186$).



CHAPTER 5

Conclusions, Implications, and Future Research

This dissertation describes a progression of deer management from establishing populations objectives to evaluating experimentally regulations both conceptually and in the field. Chapter 1 framed the problem and provided background, history of Minnesota deer management, and literature review. Chapter 2 described a method of setting deer population objectives through a participatory public process that used professional staff as advisors only. Chapter 3 examined how hunters would choose new hunting regulations and used discrete choice modeling to determine relative support of regulations. Chapter 4 modeled regulatory support, satisfaction, and participation among hunters who participated in hunts that had experimental regulations. Specifically, we evaluated the effects of antler point restrictions, earn-a-buck, and early antlerless seasons on satisfaction and future hunt participation. The cumulative findings of this dissertation have implications for deer management policy both locally and nationally. There are also implications for future research and policy goals, which are also described in this chapter.

Management Recommendations and Policy Implications

The mission of the Minnesota Department of Natural Resources (DNR) is to “work with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.” Further, the Minnesota Constitution states "hunting and fishing and the taking of game and fish are a valued part of our heritage that shall be forever preserved for the people and shall be managed by law and regulation for the public good." Consistent with the State Constitution and DNR mission statement, the ultimate objective of a deer management program should be to implement regulations that balance recreational opportunity, yet still achieve population goals using strategies that have broad public support from both hunting and non-hunting stakeholders.

To accomplish this objective, the program must be science-based but also incorporate a human dimensions component (Woolf & Roseberry, 1998). That said, the agency would likely realize increased stakeholder acceptance of policy decisions by using a collaborative decision-making process to make decisions (Gasson & White, 1993; Gigliotti et al., 2000; Lafon et al., 2004). Too often, managers have relied on the authoritative approach to implement policy (Riley et al., 2002). Unfortunately, this top-down approach to management has led to acrimony among stakeholders and subsequent management challenges by interest groups who feel their values and perspectives are not represented (Nie, 2003). The collaborative model described in Chapter 2 introduced a method for setting populations objectives and allowed us to frame the policy issue by

defining the acceptable deer densities across Minnesota. Nie (2003, p. 229) articulated several advantages of using a collaborative approach:

First, there is a public interest in wildlife. Stakeholding is one way the public's multiple values toward wildlife can be represented and expressed. Better information, open communication, increased understanding, and facilitated implementation is also possible. The process allows stakeholders to more effectively communicate their values, beliefs, and opinions to traditional adversaries and managing agencies. It also provides a venue in which non-scientific issues - often the heart of wildlife-centered conflicts- can be communicated and worked through. It also provides a way to balance scientific understanding, technical expertise, and larger public democratic values.

This collaborative method allowed us to reach a more tenable solution than might have been reached had the issue been approached from only the agency's perspective (Busenberg, 1999). Further, while there are ongoing discussions among DNR staff and stakeholders regarding how quickly populations are moving towards goal (both up and down) and timelines to re-evaluate established goals, there have not been challenges to the goals established in 2005-2007.

Attributes of a Successful Deer Program

Hunting Participation. Participation among deer hunters is important from a multitude of perspectives and prior to implementing experimental regulations over a broad area, the effects on participation must be considered. From a purely management perspective, hunters not only implement deer management policy (e.g., they manage the deer population within the context of harvest regulations), they also provide the majority of revenue as compared to other licensed hunters. For example, in 2008, \$28 million in hunting license revenue was generated (Minnesota DNR, FY08 Game and Fish Fund Report), of which \$20 million was attributed to deer license sales (Minnesota DNR, license sales data). Thus, regulations that result in participation decreases would result in

multiple negative attributes including reduced ability to manage deer populations, declines in revenue and their associated impacts on other programs.

The finding in this dissertation suggest that hunting participation rates among deer hunters would not be negatively impacted if experimental regulations were implemented over a broad area. When presented with various deer management scenarios that exist throughout Minnesota, theoretical implications reported in Chapter 3 indicated that hunters would not change hunting location if regulations were changed. More importantly, Chapter 4 results suggested participation rates among hunters who participated in experimental regulations would not be adversely affected even if participants expressed dissatisfaction with their hunting experience.

Strive for Long Term Satisfaction. Many agencies index their management decisions off hunter satisfaction yet they do little to evaluate this metric over time. Most surveys evaluate a person's attitude toward an issue at that moment in time. Few research studies have looked at satisfaction longitudinally to assess important factors over the long-term (Fulton & Manfredi, 2004). The literature is also rich with examples of factors that contribute to satisfaction and we know those factors are complex and deeply held. Hendee (1974) originally articulated that satisfaction is based on a multitude of factors and not simply harvest success. Indeed, Brown, Hautaluoma, & McPhail (1977) identified no less than 73 items that contributed to the hunting experience. Nationally, we also know that hunter satisfaction can be influenced by such salient issues as harvest success (Miller & Graefe, 2001), hunter density (Heberlein et al., 1982), and deer density (Heberlein & Kuentzel, 2002).

In Chapter 4, we quantified the effects of experimental regulations over a 3-year period. We learned that by presenting first year attitudes and beliefs, we likely would not portray acceptance over time. We ultimately described annual increase in regulatory support, overall satisfaction, and future participation for regulations that forced individuals to alter their hunting their hunting behavior (APR, EAB). As we move forward and quantify hunter satisfaction and the proximate effects on participation, we must factor in all those metrics in addition to other meaningful items such as land access, experience with family and friends, travel distance, and intrinsic values (see Decker, Brown, & Guitierrez, 1980 for examples of the relative importance of intrinsic values on overall hunting satisfaction).

Of particular importance to measuring hunter satisfaction over time is the demographic of the population. Minnesota deer hunters are overwhelmingly white (95%), male (91%), middle age (median age = 39), and have 25 years of deer hunting experience (DNR Electronic License Database). Over the life expectancy of today's deer hunters there have been profound change in deer abundance, which likely contributes to long-term satisfaction. In the last 10 years, there has been a proliferation of different management styles including quality and trophy deer management, leasing, and selective harvest management (either voluntary or forced; e.g., Collier & Krementz, 2006; Strickland et al., 2001; Woods, Guynn, Hammitt, & Patterson, 1996). Kellert (1978) described hunters as falling into one of three categories: meat, sport, and nature; whereas Jackson, Norton, & Anderson (1979) went a little further and categorized a temporal progression from shooting (at a young age) to "mellowing out" (at an older age). The data further illustrate that an individual's attitudes and beliefs are complex and evolve

over time. In order to evaluate satisfaction in a meaningful way, the technique (e.g., survey) must be designed to capture information at the multi-dimensional level and the data must be analyzed so that subtle variables can be assessed. Confounding these needs are an aging hunter population, declines in participation, and changing attitudes all of which contribute to making satisfaction a moving target in need of constant attention.

Offer Consistent Hunting Opportunity. Choice modeling results presented in Chapter 3 illustrated respondent's preferred stable hunting opportunity. While a low percentage of respondents indicated they would move to a new location if regulations were changed, a small percentage preferred a license drawings as a way to regulate harvest. The underlying presumption is that an individual may have to take an antlerless deer first (EAB) or take a certain type of buck (APR) but they wanted some buck hunting opportunity. By implementing a system where not everyone could hunt every year, the Minnesota DNR would not be able to offer consistent hunting opportunity. Further, hunters typically want regulatory stability and are generally resistant to change simply because of tradition. We know that attitudes are formed early and reinforced in the family, gun or sportsman club meeting, or the local bar (e.g., Mangun, Throgmorton, Carver, & Davenport, 2007). In addition, agencies do not change regulations very often and a person with 20 years of hunting experience (2007 mean = 24 years) are likely hunting under the same general regulations that existed when they first started. For example, the Minnesota deer hunting regulations remained largely unchanged from 1975 - 2003. Those regulations, while restrictive with respect to antlerless deer harvest, allowed for unlimited buck hunting opportunity. Thus, the concept of not hunting every

year would be unfamiliar to most hunters and consequently, was not supported in our results.

As the ability to manage deer populations is dependent on people harvesting deer, it is important to develop a program that does not compromise opportunity. Miller and Vaske (2003) identified several personal (e.g., time, finances) and situational (e.g., land access, regulations) constraints that contributed to hunter effort. For example, the authors found that lack of time, too many regulations, and poor land access all contributed to decreased participation. This is important information because these variables can be mitigated (or offset) by longer seasons, simpler regulations, and acquisition of hunting land, respectively. Once specific constraints are identified, models could be constructed to estimate the effect of a regulatory change on opportunity. For example, if limited time is a concern, we could model the effects of increasing season length on participation. In other words, are you more likely to hunt at all with a 16 versus 6 day season?

Obtain Regulation Support. In order to effectively manage deer populations, complexity of regulations cannot be a barrier to participation. As stated previously, Miller & Vaske (2003) noted that too many regulations are a deterrent to effort. Brown et al. (2000) questioned whether or not hunters in the future could actually control deer populations. Variables like reduction in hunter days (e.g., Fulton & Manfredi, 2004) and the type of animal that can be harvested (e.g., Fulton & Hundertmark, 2004) can affect participation and satisfaction. These data are especially important as the hunting population grows older, properly constructed regulations are critically important. For example, a survey of 2005 Minnesota deer hunters (Fulton et al., 2006) demonstrated that 17% had some trouble understanding the deer hunting regulations. While that is a small

percentage, it represents upwards of 85,000 individuals. With the added pressure of high gas and food prices, demands on time, and other constraints, one could speculate that a suite of complex regulations make hunting no longer worth the effort. Although managers have to control for such variables as general hunter trends (e.g., number of hunters per area) and management style (e.g., bag limit), participation estimates could be completed using electronic license sales data.

Offer License and Season Flexibility. While a majority of hunters pursue deer in only during the firearm season, a significant number hunt during the archery and/or muzzleloader seasons as well. In fact, there has been a significant increase in the number muzzleloader hunters in Minnesota since about 2003. These are not new hunters; rather, they are firearm hunters who decided to extend their time afield (Minnesota DNR electronic license sales data). With deer populations at historic highs, hunting opportunity during multiple seasons can be offered. In fact, hunters increasingly demand they not be restricted into any one season or area and many of the recent regulatory changes in Minnesota are a result of that demand. Such flexibility can also be tracked through license sales (and subsequent harvest patterns) to determine the effect on participation.

Research Limitations and Future Research

Chapter 2 (deer goal setting) applied concepts presented by other authors as a practical application of using public participation to solve a natural resources problem over a large area. While that chapter served as the basis for the subsequent chapters (e.g., harvest regulation would be dependent on the population goal in that area), it also identified areas of future research to further elaborate on and define deer populations in

the future. For example, while we cast a broad net for participation over the internet, we reached a small minority of the public. In addition, we did not calibrate the internet survey with as an assessment of deer population desires of the general (or hunting) public. This creates a need to further develop a method that (1) determines the deer population desires from the general public using a standardized method (e.g., survey), and (2) outlines a process to re-evaluate populations and objectives temporally.

Chapter 3 has theoretical implications to deer management in that the choice methodology suggested that hunters would not move to a new location if regulations were changed in their area. Of all the scenarios and choices that were presented, the option of moving to a new location consistently ranked the lowest. These data are particularly important to managers attempting to balance deer densities with other societal factors (e.g., agricultural depredation, deer-vehicle collisions). While an individual may respond with disfavor to change on an attitude survey, the effects are attenuated by the hunting population who will ultimately not alter their hunting location.

Results from this study also lead to additional questions and future research needs. Our study only assessed the attitudes of hunters towards regulatory change. Future research could more tightly integrate regulatory acceptance/capacity with private/public land. Information on regulatory effectiveness over the broad landscape is important because of the disparity of deer densities between public and private land and future research should be directed towards these disparities. Future research could also be directed at examining offering financial incentives for individuals participating in areas with special regulations. For example, DNR could offer reduced-priced licenses in

areas where certain types of deer were restricted (e.g., APR) or required (e.g., EAB) and examine participation rates as function of regulatory effectiveness.

Further, a method of evaluating landowner opinions is needed. Acquiring regulatory acceptance is a critical component of regulatory change; however, the landowner component is of particular importance on private land. If landowners restrict access because of displeasure with regulations, the effects on deer populations would likely be attenuated. Finally, future research should be directed at leasing and the effects it may have on access and population management. Kilgore, Snyder, Schertz, & Taff (2008) surveyed forest landowners in Minnesota and determined the average cost of acquiring public hunting land was \$50/acre and is likely out of the reach of public agencies. This model should be tested in other areas as well.

Chapter 4 has several practical implications to deer management but also leads to further questions. Structural Equation Modeling demonstrated there are numerous factors that contribute to satisfaction and future participation and that satisfactions with actual observations were consistently significant through both time and treatment groups. The SEM explained high amounts of variance in all groups and years even though all model paths were not significant. Likely, there are a few consistently important metrics (e.g., seeing game) that combine with other less important metrics (e.g., ethics) that ultimately described future participation.

Although we did not attempt to model tradition, the length of time an individual has been hunting an areas likely contributes to participation. For example, Brunke and Hunt (2007) used an expectancy disconfirmation model to measure pre-hunt expectations with overall satisfaction and found that overall satisfaction was influenced positively by

fulfilling expectations, such as harvest-related items. With respect to tradition, all 9 treatment surveys used in Chapter 4 and another study of Minnesota deer hunters (Fulton, Cornicelli, & Grund, 2006) demonstrated the vast majority (upwards of 90%) of people hunt the same location annually. Future studies that examine these relationships should have an attitude component and follow either the Theory of Reasoned Action (Fishbein & Ajzen, 1975) or the Theory of Planned Behavior (Ajzen, 1991). Also, it would be important to determine what happened to the individuals who indicated they would not participate and then followed through with that response. Research on those individuals would be important to learn if they quit hunting or simply moved to a new location. Finally, a longitudinal design using repeated measures statistics should be employed to assess attitude shift among hunters who responded to all three years of surveys.

Conclusions

With respect to motivations and satisfaction, hunter preferences would vary tremendously based on socioeconomic status, personal values, education, race, and a host of other variables. At a basic level, what is important to one group of hunters may be opposed by another. Examples of a changing variable will be the effect of gas prices on participation. More data will need to be collected on travel cost and the ability of hunters to participate closer to home. Local preferences may change when it becomes no longer financially feasible to make multiple deer hunting trips.

Any manipulation of exploited species will likely not attain scientific consensus (Ludwig, Hilborn, & Walters, 1993). To that end, consensus will not be achieved among hunting groups or individuals either (see Woolf & Roseberry, 1998). The best agencies can hope for is to strike a balance between the science behind the decisions and the

greater desires of the public-at-large. Specific to our research, managers would be well-served to examine attitude data over time, and not as a point estimate. Likely, the longer regulations exist, the more likely it is to create a new social norm, where the hunter is not only satisfied with the regulation but comes to expect it annually.

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Appendices

Appendix A 2005 Regulatory Choice Survey

*Note: There were 7 different versions of this survey distributed to hunters. As explained in Chapter 3, each survey had different choices for each scenario and they are omitted from this Appendix. The full suite of scenarios and choices is presented in Appendix B.

2005 DEER HUNTER SATISFACTION AND PREFERENCES FOR REGULATION CHANGES IN MINNESOTA



**A cooperative study conducted by the University of Minnesota for the
Minnesota Department of Natural Resources**

Your help on this study is greatly appreciated!

Please return your completed questionnaire in the enclosed envelope. The envelope is self-addressed and no postage is required. Thanks!

Minnesota Cooperative Fish and Wildlife Research Unit,
Department of Fisheries, Wildlife, and Conservation Biology
University of Minnesota
St. Paul, Minnesota 55108-6124

Section A. Minnesota Deer Hunting Experiences

First, we would like to know about your background and experience as a deer hunter.

1. Would you say you know A GREAT DEAL, A MODERATE AMOUNT, A LITTLE, OR NOTHING about DNR’s deer management program? (Check one).
 - A GREAT DEAL – I read most of the hunting handbook, DNR news releases, and follow the outdoor media
 - A MODERATE AMOUNT - I read parts of the handbook and occasionally follow the outdoor media
 - A LITTLE – I only read the parts of the handbook that pertain to me and otherwise don’t follow the outdoor media
 - NOTHING – I buy my license just before the season and follow the advice of my friends
 - DON'T KNOW

2. In your opinion, should the deer population in the same area you hunt most often be increased, remain the same, or be decreased? (Check one).
 - INCREASED
 - REMAIN THE SAME
 - DECREASED
 - DON'T KNOW

3. Did you hunt deer during the 2004 firearm season? (Check one).
 - YES
 - NO → **SKIP TO QUESTION 8**

4. How much of your deer hunting did you do on each of the following types of land during the 2004 deer hunting season? (Circle one number for each item)

	None	Some	Most	All	Don't Know
Land that I own	1	2	3	4	9
Private land that I do not own	1	2	3	4	9
Public land	1	2	3	4	9

5. Overall, were you satisfied or dissatisfied with your Minnesota deer hunting experiences during the 2004 season? (Check one).

- VERY SATISFIED
- SOMEWHAT SATISFIED
- NEITHER SATISFIED NOR DISSATISFIED
- SOMEWHAT DISSATISFIED
- VERY DISSATISFIED
- DON'T KNOW

6. Please indicate how satisfied or dissatisfied you were with the following issues related to your Minnesota deer hunting experiences in 2004. (Circle one number for each item)

	Very Satisfied	Somewhat Satisfied	Neither	Somewhat Dissatisfied	Very Dissatisfied	Don't Know
Ability to understand the deer hunting regulations	1	2	3	4	5	9
Amount of PUBLIC land for deer hunting	1	2	3	4	5	9
Amount of PRIVATE land for deer hunting	1	2	3	4	5	9
Number of other hunters	1	2	3	4	5	9
Scenic beauty of hunting areas	1	2	3	4	5	9
Experiences with family and friends	1	2	3	4	5	9
Success in killing a deer	1	2	3	4	5	9
Weather conditions	1	2	3	4	5	9

7. Please indicate whether you agree or disagree with the following statements about the area you hunted most often in 2004. Please circle one number for each question. (Circle one number for each item)

	Strongly Agree	Slightly Agree	Neither	Slightly Disagree	Strongly Disagree	Don't Know
I am satisfied with the number of mature bucks	1	2	3	4	5	9
I am satisfied with the quality of bucks	1	2	3	4	5	9
I heard about or saw mature bucks while hunting	1	2	3	4	5	9
I am satisfied with the number of antlerless deer	1	2	3	4	5	9
I am satisfied with the number of deer I see while hunting	1	2	3	4	5	9

8. Which **ONE** of the following best describes how you deer hunt in Minnesota? Would you say you: (Check only one).

- HUNT FOR LARGE ANTLERED BUCKS DURING ENTIRE SEASON
- HUNT FOR LARGE ANTLERED BUCKS EARLY SEASON AND SHOOT ANY LEGAL DEER LATER
- SHOOT ANY ANTLERED BUCK
- SHOOT THE FIRST LEGAL DEER (ANTLERED OR ANTLERLESS) THAT I CAN
- HUNT FOR AN ANTLERLESS DEER FOR THE FREEZER, THEN WAIT FOR A MATURE BUCK
- SHOOT ONLY ANTLERLESS DEER

Section B. Deer Management in Minnesota

We are interested in understanding how you feel about deer management strategies and goals in Minnesota. The following questions will ask you how much you support a variety of deer management options.

9. In general, would you support or oppose a regulation that would increase the proportion of antlered bucks in the deer population you hunt most often? (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT NOR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

10. Currently, Minnesota is one of only a few states that allow hunters to shoot deer for each other. Because hunters can kill multiple bucks per year, the cross-tagging provision might contribute to higher buck harvest rates in Minnesota than in other states. The following two questions assess your level of support for allowing hunters to kill deer for each other.

In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party, but would prohibit hunters from shooting deer for each other (both antlered bucks and antlerless deer)? (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT NOR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

11. In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party but would prohibit shooting antlered bucks for each other? You would still be able to shoot antlerless deer for each other (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT NOR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

Currently, in areas that are above population goals, hunters are encouraged to kill antlerless deer. If hunters selectively kill antlerless deer, the proportion of antlered bucks surviving the hunting season might increase.

The next series of questions addresses specific methods of increasing the harvest of antlerless deer and possibly increasing the proportion of antlered bucks in the deer population.

Please indicate the degree to which you support or oppose each method in the area you hunt most often.

12. The first method would limit the number of buck licenses available to hunters during the firearm season. Under this scenario, the standard firearm license would be valid for **antlerless** deer only.
- Hunters interested in killing antlered bucks would need to apply for a permit through a lottery system.
 - Only lottery winners would be eligible to hunt antlered deer.
 - Unsuccessful applicants would be restricted to hunting antlerless deer during the current year, but would gain preference points in the lottery which would improve their chance of getting drawn for a buck license in future years.
 - A hunter would likely win a buck permit every 2-3 years depending on hunting pressure.

Would you support or oppose a regulation that would limit the number of buck licenses available to hunters during the firearm season in the area you hunt most often. (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT NOR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

13. In the area you hunt most often, would you continue to hunt antlerless deer if you were not able to obtain a buck license through the lottery? (Check one).

- YES
- NO
- DON'T KNOW

14. The second method would protect bucks with less than 3 or 4 antler points on at least one side. The protection level would be designed to protect at least half of all 1½ year old bucks in the population.

- Under this scenario, buck hunters could only kill adult males that met the established legal definition.
- Hunters would first have to identify the animal as a legal buck before shooting the deer.
- As a result of this regulation, harvest rates on antlerless deer should increase. Also, a greater proportion of 1 1/2 year old males should survive to the 2 1/2 year age-class and would be available to hunters the next hunting season.

Would you support or oppose an antler point restriction regulation in the area you hunt most often? (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT NOR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

15. A third method would move the firearm deer season outside of the rut. Under this scenario, the regular firearm season would begin no earlier than mid-November. As a result of this regulation, bucks may be less vulnerable and buck harvest rates may be reduced.

Would you support or oppose this type of regulation that would move the firearm season date outside of the rut in the area you hunt most often? (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT NOR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

16. A fourth method would require all deer hunters to kill an antlerless deer before killing an antlered buck. This is typically called earn-a-buck. Under this scenario, hunters cannot shoot a buck until they first killed an antlerless deer. As a result of this regulation, harvest rates on antlerless deer should increase. Also, harvest rates on antlered deer should decrease, resulting in a greater proportion of antlered bucks that survive to the next hunting season.

Would you support or oppose this type of regulation that would require hunters to kill an antlerless deer before killing an antlered deer in the area you hunt most often? (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT NOR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

17. Suppose an antlerless-only season was offered in addition to the regular firearm deer season that you normally hunt. The season would not last more than a week (most likely a single weekend in mid-October) and killing an antlerless deer during this new season would not affect your regular firearms licenses. The season would be timed to minimize conflicts with peak archery harvest and would not occur during that period known as the 'pre-rut'.

Would you support or oppose this type of regulation? (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT NOR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

Would you participate in an antlerless-only season before the regular firearm season? (Check one).

- YES
- NO

18. If the MnDNR were to adopt new deer management regulations, would you prefer to see them applied.....? (Check one).

- STATEWIDE
- THE ZONE AND PERMIT AREA YOU HUNT
- THE ZONE YOU HUNT BUT ONLY IN A PERMIT AREA YOU DON'T HUNT
- ONLY IN A ZONE YOU DON'T HUNT
- NOT AT ALL

19. Overall, people have different reasons for supporting or opposing new hunting regulations. Please tell us how important to you each of the following reasons is for supporting or opposing new hunting regulations.

When I consider proposed hunting regulation changes, it is important to me that these factors are considered: (Please circle one number for each item)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
Do not result in an increased total buck harvest.	1	2	3	4	5	9
Do not result in an increased doe harvest.	1	2	3	4	5	9
Increase DNR's ability to control the deer population.	1	2	3	4	5	9
Increase hunting opportunity for bowhunters.	1	2	3	4	5	9
Increase hunting opportunity for muzzleloader hunters.	1	2	3	4	5	9
Increase hunting opportunity for firearm hunters.	1	2	3	4	5	9
Increase my own chances of taking an antlered buck.	1	2	3	4	5	9
Increase my own chances of taking a large antlered buck.	1	2	3	4	5	9
Increase my own chances of taking antlerless deer.	1	2	3	4	5	9
Encourage new people to take up deer hunting.	1	2	3	4	5	9
Lead to a better public image of hunters and hunting.	1	2	3	4	5	9
Protect the interests of farmers and other landowners.	1	2	3	4	5	9
Protect areas so that deer do not cause forest and other habitat damages	1	2	3	4	5	9
Reduce crowding of hunters on public lands.	1	2	3	4	5	9

Section C. Past Hunting Experience

20. Including last year, how many years have you hunted deer in Minnesota? _____
Years

21. What hunting method do you primarily use? (check one)

- DEER DRIVE WITH LESS THAN 5 PEOPLE
 - DEER DRIVE WITH 5 OR MORE PEOPLE
 - TREE STAND
 - GROUND BLIND
 - STILL HUNTING OR STALKING
 - OTHER (PLEASE LIST):
-

22. Which statement best characterizes where you hunt? (check one)

- I ALMOST NEVER HUNT THE SAME AREA EVERY YEAR
 - I CHANGE MY HUNTING LOCATION EVERY 1 TO 2 YEARS
 - I CHANGE MY HUNTING LOCATION EVERY 3 TO 5 YEARS
 - I TYPICALLY HUNT THE SAME AREA EVERY YEAR
-

Section D. Preferences for Deer Season Options

We will now present you with 5 deer management scenarios that are occurring in various permit areas throughout Minnesota. These are current issues that will need to be addressed in the coming years. Within each scenario, you will be presented 3 management options. These 3 options represent only a subset of all possible management options. Some hunters will receive surveys with the same options, while others will receive surveys with different options. The options presented to you have been randomly selected from the total set of choices. In the end, when all the surveys are combined, we will be able to create a ranked list of management options.

In all cases, the scenarios are real and the management response is possible. To the best of your ability, please read the scenarios and choices very carefully and answer the following questions as if the scenario exists in the area you hunt most often.

Comments: We are interested in your views about deer hunting in Minnesota. Please write additional comments below. The results of this survey will be available next year on the Minnesota Department of Natural Resources Web site, www.dnr.state.mn.us.

THANK YOU FOR YOUR HELP!

Please return the completed questionnaire in the enclosed self-addressed, stamped envelope

V-1

Appendix B Scenarios and Choices Presented to Hunters on the 2005 Regulatory Preference Survey.

Scenario 1: The deer population is stable and within population goals. It is currently being managed so that either-sex licenses are available over the counter and hunters can also buy additional antlerless permits. Based on requests from some hunters, this area will be managed in the future for more mature bucks.

Please read the following deer season options and rank them from your most preferred to least preferred. Write a “1” by your most preferred, a “2” by your next most preferred, and a “3” by your least preferred option among the three.

Choice (S1C1) _____

- **Buck** licenses would be available **through a lottery**
- **Antlerless** licenses would be available **over the counter**
- Shooting **bucks** and **antlerless deer** for another hunter would be **legal**
- There would be **fewer buck licenses** available because hunters **could shoot bucks** for each other
- Hunters who failed to draw a buck license could hunt antlerless deer and would gain “buck” preference for future years
- Hunters could expect to draw a buck license every 2 to 3 years

Choice (S1C2) _____

- **Buck** licenses would be available **through a lottery**
- **Antlerless** licenses would be available **over the counter**
- Shooting **bucks** for another hunter would be **illegal**
- There would be **more buck licenses** available because hunters **could not shoot bucks** for each other
- Hunters who failed to draw a buck license could hunt antlerless deer and would gain “buck” preference for future years
- Hunters could expect to draw a buck license every 1 to 2 years

Choice (S1C3) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- Only bucks that had at least **one three point antler** would be legal to harvest
- The antler point regulation would protect 50% of the 1½ year old buck population
- Shooting a buck for another hunter would be **illegal** because a lower percentage of 1½ year old bucks would be protected
- Hunters could still shoot antlerless deer for each other

Choice (S1C4) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- Only bucks that had at least **one four point antler** would be legal to harvest
- The antler point regulation would protect 75% of the 1½ year old buck population
- Shooting a bucks and antlerless deer for another hunter would be **legal** because a higher percentage of 1½ year-old bucks would be protected

Choice (S1C5) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- Only bucks that had at least **one four point antler** would be legal to harvest
- The antler point regulation would protect 75% of the 1½ year old buck population
- Shooting a buck for another hunter would be **illegal** so that the **maximum number of bucks could be protected**
- Hunters could still shoot antlerless deer for each other

Choice (S1C6) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- The season length would be comparable to previous years
- The firearm season would begin in mid-November, which is one week later than the current framework
- Shooting a buck for another hunter would **illegal** so more bucks could be protected

Choice (S1C7) _____

- I would not hunt deer in the area if the regulations were changed

Scenario 2: The deer population is currently **25%** above the management goal. The current strategy of allowing five deer per hunter has not been effective in lowering the deer population. A new strategy needs to be developed that lowers the deer population to goal levels within 3 to 5 years.

Please read the following deer season options and rank them from your most preferred to least preferred. Write a “1” by your most preferred, a “2” by your next most preferred, and a “3” by your least preferred option among the three.

Choice (S2C1) _____

- **Antlerless** licenses would be available over the counter
- **Buck** licenses would be available through a lottery
- Shooting **bucks** and **antlerless deer** for another hunter would be **legal**
- There would be **fewer buck licenses** available because hunters could shoot bucks and antlerless deer for each other
- Hunters who failed to draw a buck license could hunt antlerless deer and would gain “buck” preference for future years
- Hunters could expect to draw **a buck license every 2 to 3 years**

Choice (S2C2) _____

- **Antlerless** licenses would be available over the counter
- **Buck** licenses would be available through a lottery
- Shooting **bucks** for another hunter would be **illegal** but hunters could shoot antlerless deer for each other
- There would be **more buck licenses** available because hunters could not shoot bucks for each other
- Hunters who failed to draw a buck license could hunt antlerless deer and would gain “buck” preference for future years
- Hunters could expect to **draw a buck license every 1 to 2 years**

Choice (S2C3) _____

- **Either-sex and antlerless licenses** would be available over the counter
- Only bucks that had at least **one three point antler** would be legal to harvest
- The antler point regulation would protect 50% of the 1½ year old buck population
- Shooting a buck for another hunter would be **illegal** because a lower percentage of 1½ year old bucks would be protected
- Hunters could still shoot antlerless deer for each other

Choice (S2C4) _____

- **Either-sex and antlerless licenses** would be available over the counter
- Only bucks that had at least **one four point antler** would be legal to harvest
- The antler point regulation would protect 75% of the 1½ year old buck population
- Shooting bucks for another hunter would be **legal** because a higher percentage of 1½ year-old bucks would be protected
- Hunters could shoot antlerless deer for each other

Choice (S2C5) _____

- **Either-sex and antlerless licenses** are available over the counter
- The area will be managed as “Earn-A-Buck”
- You must tag an antlerless deer prior to tagging a buck
- The antlerless deer can be taken in any deer season so long as it is killed first

Choice (S2C6) _____

- **Either-sex and antlerless licenses** are available over the counter
- The length of the deer season would be comparable to previous years
- There would be an antlerless only firearms season for 2 days in mid-October

Choice (S2C7) _____

- I would not hunt deer in the area if the regulations were changed

Scenario 3: The deer population is currently **50%** above the management goal. The current strategy of allocating five deer per hunter has not been effective in lowering the deer population. A new strategy needs to be developed that lowers the deer population to goal levels within 3 to 5 years. Please look at the following panel and choose one of the available options.

Please read the following deer season options and rank them from your most preferred to least preferred. Write a “1” by your most preferred, a “2” by your next most preferred, and a “3” by your least preferred option among the three.

Choice (S3C1) _____

- **Buck** licenses would be available through a lottery
- **Antlerless** licenses would be available over the counter
- Shooting **bucks** and antlerless deer for another hunter would be **legal**
- There would be fewer buck licenses available because hunters could shoot deer for each other
- Hunters who failed to draw a buck license could hunt antlerless deer and would gain “buck” preference for future years
- Hunters could expect to **draw a buck license every 2 to 3 years**

Choice 2 (S3C2) _____

- **Buck** licenses would be available through a lottery
- **Antlerless** licenses would be available over the counter
- Shooting **bucks** for another hunter would be **illegal**
- There would be more buck permits available because hunters could not shoot deer for each other
- Hunters who failed to draw a buck license could hunt antlerless deer and would gain “buck” preference for future years
- Hunters could expect to **draw a buck license every 1 to 2 years**

Choice (S3C3) _____

- **Either-sex and antlerless licenses** would be available over the counter
- Only bucks that had at least **one three point antler** would be legal to harvest
- The antler point regulation would protect 50% of the 1½ year old buck population
- Shooting a buck for another hunter would be **illegal** because a lower percentage of 1½ year old bucks would be protected
- Hunters could still shoot antlerless deer for each other

Choice (S3C4) _____

- **Either-sex and antlerless licenses** would be available over the counter
- Only bucks that had at least **one four point antler** would be legal to harvest
- The antler point regulation would protect 75% of the 1½ year old buck population
- Shooting a buck for another hunter would be **legal** because a higher percentage of 1½ year-old bucks would be protected
- Hunters could still shoot antlerless deer for each other

Choice (S3C5) _____

- **Either-sex and antlerless licenses** are available over the counter
- The area will be managed as “Earn-A-Buck”
- You must tag an antlerless deer prior to tagging a buck
- The antlerless deer can be taken in any deer season so long as it is killed first

Choice (S3C6) _____

- **Either-sex and antlerless licenses** are available over the counter
- The length of the deer season would be comparable to previous years
- There would be an antlerless only firearm season for 2 days in mid-October

Choice (S3C7) _____

- I would not hunt deer in the area if the regulations were changed

Scenario 4: The deer population is stable or below population goal and the harvest rate on 1½ year-old bucks is high. Consequently, a low percentage of the buck population lives beyond 1½ years. Currently, buck licenses are available over the counter, either-sex permits are available through the lottery, and hunters can only kill one deer. Based on requests from hunters, this area may be managed in the future to protect young bucks and allow them to get to the next age class.

Please read the following deer season options and rank them from your most preferred to least preferred. Write a “1” by your most preferred, a “2” by your next most preferred, and a “3” by your least preferred option among the three.

Choice (S4C1) _____

- **Buck and antlerless** licenses would be available through a **lottery**
- Shooting bucks and antlerless deer for another hunter would be **legal**
- There would be **fewer** buck permits available because hunters could shoot bucks for each other
- Hunters who failed to draw a buck or antlerless license would not be able to hunt but would gain preference for future years
- Hunters could expect to draw a buck license every 2 to 3 years

Choice (S4C2) _____

- **Buck and antlerless** licenses would be available through a **lottery**
- Shooting bucks for another hunter would be **illegal**
- There would be **more** buck permits available because hunters could not shoot bucks for each other
- Hunters who failed to draw a buck or antlerless license would not be able to hunt but would gain preference for future years
- Hunters could expect to draw a buck license every 1 to 2 years

Choice (S4C3) _____

- **Buck** licenses would be available **over the counter**
- **Antlerless licenses** would be available through a **lottery**
- Only bucks that had at least **one three point antler** would be legal to harvest
- The antler point regulation would protect 50% of the 1½ year old buck population
- Youth hunters must abide by the antler point regulation but could take an antlerless deer without making application
- Shooting a buck for another hunter would be **illegal** because a lower percentage of 1½ year old bucks would be protected

Choice (S4C4) _____

- **Buck** licenses would be available **over the counter**
- **Antlerless licenses** would be available through a **lottery**
- Only bucks that had at least **one four point antler** would be legal to harvest
- The antler point regulation would protect 75% of the 1½ year old buck population
- Youth hunters must abide by the antler point regulation but could take an antlerless deer without making application
- Shooting a buck for another hunter would be **legal** because a higher percentage of 1½ year-old bucks would be protected

Choice (S4C5) _____

- **Buck** licenses would be available **over the counter**
- **Antlerless licenses** would be available through a **lottery**
- Only bucks that had at least **one four point antler** would be legal to harvest
- The antler point regulation would protect 75% of the 1½ year old buck population
- Youth hunters could shoot sub-legal bucks
- Shooting a buck for another hunter would be **legal** because a high percentage of 1½ year old bucks are protected, **except sub-legal bucks could not be killed for a youth hunter**

Choice (S4C6) _____

- **Buck** licenses would be available **over the counter**
- **Antlerless licenses** would be available through a **lottery**
- The season length would be comparable to previous years
- The firearm season would begin in mid-November, which is one week later than the current framework
- Shooting a buck for another hunter would be **illegal** so more bucks could be protected

Choice (S4C7) _____

- I would not hunt deer in the area if the regulations were changed

Scenario 5: Antler point restriction regulations are currently being used by several states to encourage antlerless harvest and protect 1½ year old bucks. The number of hunters and sporting organizations interested in antler-point restriction regulations is increasing in Minnesota. While the harvest rate of bucks varies in Minnesota, the majority of the bucks killed during the firearm season are 1½ years old. Typically, 50 to 75% of the 1½ year old buck population is harvested during the firearm season.

Please read the following deer season options and rank them from your most preferred to least preferred. Write a “1” by your most preferred, a “2” by your next most preferred, and a “3” by your least preferred option among the three.

Choice (S5C1) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- Only bucks that had at least **one three point antler** would be legal to harvest
- The antler point regulation would protect 50% of the 1½ year old buck population
- Youth hunters would have to abide by the same antler restriction regulation
- Shooting a buck for another hunter would be **illegal** because a lower percentage of 1½ year old bucks would be protected
- Hunters could still shoot antlerless deer for each other

Choice (S5C2) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- Only bucks that had at least **one four point antler** would be legal to harvest
- The antler point regulation would protect 75% of the 1½ year old buck population
- Youth hunters would have to abide by the same antler restriction regulation
- Shooting a buck for another hunter would be **legal** because a high percentage of 1½ year old bucks are protected

Choice (S5C3) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- Only bucks that had at least **one three point antler** would be legal to harvest
- The antler point regulation would protect 50% of the 1½ year old buck population
- Youth hunters could shoot any antlered buck
- Shooting a buck for another hunter would be **illegal** because fewer bucks are protected and hunters **could not shoot sub-legal bucks for youth hunters**
- Hunters could still shoot antlerless deer for each other

Choice (S5C4) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- Only bucks that met a minimum antler point would be legal to harvest (either 3 or 4 points on one side)
- The antler point regulation would protect 75% of the 1½ year old buck population
- Youth hunters could shoot any antlered buck
- Shooting a buck for another hunter would be **legal** because a high percentage of 1½ year old bucks are protected, **except sub-legal bucks could not be killed for a youth hunter**
- Hunters could still shoot antlerless deer for each other

Choice (S5C5) _____

- **Either-sex and antlerless licenses** would be available **over the counter**
- Only bucks that had at least **one four point antler** would be legal to harvest
- The antler point regulation would protect 75% of the 1½ year old buck population
- Youth hunters would have to abide by the same antler restriction regulation
- Shooting a buck for another hunter would be **illegal** but hunters could shoot antlerless deer for each other

Choice (S5C6) _____

- While I am generally opposed to antler point restriction regulations, I would still hunt the same area if they were enacted

Choice (S5C7) _____

- I would not hunt deer in the area if the regulations were changed

Appendix C Antler Point Restriction survey at Itasca State Park , 2005 – 2007.
(2006 survey used as reference).

2006 SURVEY OF ITASCA STATE PARK DEER HUNTERS



**A cooperative study conducted by the University of Minnesota
for the Minnesota Department of Natural Resources**

Your help on this study is greatly appreciated!

*Please return your completed questionnaire in the enclosed
envelope. The envelope is self-addressed and no postage is
required. Thanks!*

Minnesota Cooperative Fish and Wildlife Research Unit,
Department of Fisheries, Wildlife, and Conservation Biology
University of Minnesota
St. Paul, Minnesota 55108-6124

SECTION A. The first set of questions is designed to tell us where you hunted deer. Please read the questions carefully and answer the questions to the best of your ability.

When you purchased your firearms license for the 2006 firearms deer season, you indicated that you intended to hunt deer at Itasca State Park (Deer Permit Area 287).

1. **Did you actually hunt at Itasca State Park during the 2006 firearms deer hunting season?**

YES

NO →

2. **If No, during the 2006 firearms deer season, which one deer permit area did you hunt most often?**

DEER PERMIT AREA _____ (write in the number)

3. **How many days did you spend scouting for deer in each of the following seasons? Write "DNH" if you Did Not Hunt during that season.**

October Antlerless Only _____ DAYS

Archery _____ DAYS

Firearm _____ DAYS

Muzzleloader _____ DAYS

→ Skip to
Question 7

4. **Prior to the deer season, how many days did you scout deer at Itasca State Park this year?**

_____ DAYS

5. **How many days did you hunt deer at Itasca State Park this year?**

_____ DAYS

6. **Including this year, how many years have you hunted deer at Itasca State Park?**

_____ YEARS

7. **For the permit area that you hunted most often during the 2006 deer hunting season, how many years have you hunted on this permit area?**

_____ YEARS

7a. If you hunted at the park, please write down which **one** deer permit area you hunted most often besides the park _____ (write in the number)

8. For each of the following 2006 hunting seasons, what types of property did you hunt most often? Please place a check mark in the box below the type of property you hunted most often during each season. Please check only one box per season.

SEASON	Wildlife Management Area	State Forest	Other Public	Private Posted Land	Private Land Not Posted	Did not hunt this season
Early Antlerless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Archery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Firearm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Muzzleloader	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION B. We are now interested in learning about your experiences and opinions regarding your 2006 deer hunt at Itasca State Park.

► **IF YOU DID NOT HUNT DEER AT ITASCA STATE PARK THIS YEAR, PLEASE SKIP TO SECTION C.**

9. What was the primary reason you hunted Itasca State Park during 2006? (*check only one*)

- ITASCA STATE PARK IS THE AREA I TYPICALLY HUNT
- I HUNT AS A PARTY WITH FAMILY OR FRIENDS
- I WAS INTERESTED IN THE ANTLER POINT RESTRICTION REGULATION
- I BELIEVE ITASCA STATE PARK HAS A HIGH DEER POPULATION, WHICH WOULD INCREASE MY CHANCES OF KILLING A DEER
- OTHER (Describe)

10. Which techniques did you use to hunt deer at Itasca State Park? Circle one number for each technique.

Method	None	Some	Most	All	Don't Know
Stand hunting from ground stand/blind	1	2	3	4	9
Stalking or moving slowly	1	2	3	4	9
Hunting from elevated tree stand	1	2	3	4	9
Participated in deer drives as member of a party	1	2	3	4	9

11. What was the first deer or group of deer that you saw that was within your shooting range at Itasca State Park? (*check only one*)

- ANTLERED BUCK
- ANTLERLESS DEER
- MIXED GROUP OF BUCKS AND ANTLERLESS DEER

DID NOT SEE A DEER WHILE HUNTING → SKIP TO QUESTION 18

12. From the first deer or group of deer you saw within shooting range at Itasca State Park, were you able to kill the deer?

YES

NO

13. If no, why were you not able to kill the first deer or group of deer you saw within shooting range at Itasca State Park? (*check only one*)

I WAS UNSURE IF IT WAS A LEGAL BUCK OR COULDN'T TELL IF IT WAS ANTLERLESS

THE DEER DID NOT PRESENT A GOOD OR I SHOT AND MISSED THE DEER

IT WAS A BUCK THAT DID NOT MEET THE MINIMUM NUMBER OF ANTLER POINTS

IT WAS AN ANTLERLESS DEER AND I DO NOT SHOOT ANTLERLESS DEER

OTHER (Describe) _____

14. Did you kill an antlerless deer at Itasca State Park during 2006?

YES → SKIP TO QUESTION 16

NO

15. If no, what was the reason for not killing an antlerless deer at Itasca State Park? (*Check only one*)

I DID NOT SEE AN ANTLERLESS DEER

I ALREADY SHOT A DEER EARLIER IN THE YEAR SO I WAS HUNTING FOR BUCKS

I COULD NOT TELL IF IT WAS AN ANTLERLESS DEER OR A SUB-LEGAL BUCK

I DO NOT SHOOT ANTLERLESS DEER

OTHER (DESCRIBE WHY) _____

16. Did you kill an antlered buck at Itasca State Park during 2006?

- YES
- NO

17. If no, what was the reason for not killing an antlered buck at Itasca State Park? (Check only one)

- I DID NOT SEE A LEGAL BUCK
- THE BUCK DID NOT PRESENT A GOOD SHOT OR I SHOT AND MISSED THE BUCK
- IT DID NOT MEET THE MINIMUM NUMBER OF ANTLER POINTS
- I WAS UNSURE IF THE DEER WAS LEGAL TO SHOOT
- I ALREADY SHOT A DEER EARLIER IN THE YEAR SO I HAD ENOUGH VENISON
- IT WAS A LEGAL BUCK BUT NOT BIG ENOUGH FOR ME TO SHOOT
- OTHER (DESCRIBE WHY) _____

18. Please indicate whether you agree or disagree with the following statements regarding your 2006 Itasca State Park deer hunt. (Circle one number for each item)

	Strongly Agree	Slightly Agree	Neither	Slightly Disagree	Strongly Disagree	Don't Know
I was satisfied with the number of legal bucks	1	2	3	4	5	9
I was satisfied with the quality of bucks	1	2	3	4	5	9
I heard about or saw legal bucks while hunting	1	2	3	4	5	9
I was satisfied with the total number of antlerless deer	1	2	3	4	5	9
I was satisfied with the total number of deer I saw while hunting	1	2	3	4	5	9

19. In total, how many deer did you see while hunting at Itasca State Park during the 2006 deer season? (Write the number of deer you saw in each blank below).

Type of deer	Deer seen
Legal bucks (at least one antler with at least three points)	_____
Sub-legal bucks (for example, spike or fork horn)	_____
Antlerless Deer (for example, doe or button buck)	_____
Deer that I couldn't identify as legal, sub-legal, or antlerless	_____

20. At Itasca State Park, how many antlered and antlerless deer did you personally kill during the past three deer seasons?

Include all deer you killed, regardless of whether you tagged the deer or another hunter tagged the deer. Write in the number of deer you killed in each blank below. If you did not hunt deer at the Park during a particular year, check the appropriate box.

Year	Number of Antlered Deer you killed ▼	Number of Antlerless Deer you killed ▼	I did not hunt at the Park that year ▼
In 2004 I killed...	_____	_____	<input type="checkbox"/>
In 2005 I killed...	_____	_____	<input type="checkbox"/>
In 2006 I killed...	_____	_____	<input type="checkbox"/>

21. The antler point restriction regulation was put in place at Itasca State Park to protect approximately 50% of the 1½ year old buck population, which should put more harvest pressure on antlerless deer. The intent of the regulation is to lower deer populations at the Park but a byproduct may be an increase in the proportion of mature bucks. After hunting under this regulation at Itasca State Park, do you support or oppose the antler point restriction regulation? (Check only one)

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

22. If the antler point restriction regulation is continued for the 2006 deer season, how likely are you to hunt Itasca State Park next year? (*Check only one*)

- I WILL DEFINITELY HUNT ITASCA STATE PARK
- I WILL PROBABLY HUNT ITASCA STATE PARK
- UNDECIDED
- I PROBABLY WILL NOT HUNT ITASCA STATE PARK
- I DEFINITELY WILL NOT HUNT ITASCA STATE PARK

23. Overall, how satisfied were you with your hunting experience at the Park during 2006?

- VERY SATISFIED
- SLIGHTLY SATISFIED
- NEITHER SATISFIED OR DISSATISFIED
- SLIGHTLY DISSATISFIED
- VERY DISSATISFIED

► **SECTION C. We are now interested in learning about your experiences and opinions regarding deer hunting in Minnesota.**

24. Which **ONE** of the following best describes how you deer hunted deer during the 2006 **REGULAR FIREARMS** deer hunting season in Minnesota? Would you say you: (*Check only one*)

- HUNTED FOR LARGE ANTLERED BUCKS DURING THE ENTIRE SEASON
- HUNTED FOR LARGE ANTLERED BUCKS EARLY SEASON AND SHOOT ANY LEGAL DEER LATER
- SHOOT ANY ANTLERED BUCK
- SHOOT THE FIRST LEGAL DEER (EITHER ANTLERED OR ANTLERLESS) THAT OFFERED A GOOD SHOT
- SHOOT ONLY ANTLERLESS DEER
- DON'T KNOW

25. How many antlered and antlerless deer did you kill in each of Minnesota's deer seasons during 2006? Include all deer you killed by archery, rifle, and muzzleloader, regardless of whether you tagged the deer or another hunter tagged the deer. Write in the number of deer you killed in each blank below. If you did not hunt deer in a season, check the appropriate box.

	Number of Antlered Deer you killed in 2006 ▼	Number of Antlerless Deer you killed in 2006 ▼	I did not hunt in that season in 2006 ▼
October Antlerless	<u>No Season</u>	_____	<input type="checkbox"/>
Archery	_____	_____	<input type="checkbox"/>
Firearms	_____	_____	<input type="checkbox"/>
Muzzleloader	_____	_____	<input type="checkbox"/>

26. How many antlered and antlerless deer did you personally kill in Minnesota in 2004 and 2005? Include all deer you killed by archery, rifle, and muzzleloader, regardless of whether you tagged the deer or another hunter tagged the deer. In you did not hunt deer during a year, check the appropriate box.

	Number of Antlered Deer you killed ▼	Number of Antlerless Deer you killed ▼	I did not hunt in Minnesota that year ▼
In 2004 I killed...	_____	_____	<input type="checkbox"/>
In 2005 I killed...	_____	_____	<input type="checkbox"/>

27. Overall, people have different reasons for supporting or opposing new hunting regulations. Please tell us how important each of the following reasons for supporting or opposing new hunting regulations are to you.

When I consider proposed hunting regulation changes, it is important to me that these factors are considered: (Please circle one number for each item)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
Do not result in an increased total buck harvest.	1	2	3	4	5	9
Do not result in an increased doe harvest.	1	2	3	4	5	9
Increase DNR's ability to control the deer population.	1	2	3	4	5	9
Increase hunting opportunity for bowhunters.	1	2	3	4	5	9
Increase hunting opportunity for muzzleloader hunters.	1	2	3	4	5	9
Increase hunting opportunity for firearm hunters.	1	2	3	4	5	9
Increase my own chances of taking an antlered buck.	1	2	3	4	5	9
Increase my own chances of taking a large antlered buck.	1	2	3	4	5	9
Increase my own chances of taking antlerless deer.	1	2	3	4	5	9
Encourage new people to take up deer hunting.	1	2	3	4	5	9
Lead to a better public image of hunters and hunting.	1	2	3	4	5	9
Protect the interests of farmers and other landowners.	1	2	3	4	5	9
Protect areas so that deer do not cause forest and other habitat damages.	1	2	3	4	5	9
Reduce crowding of hunters on public lands.	1	2	3	4	5	9
The regulations do not result in decreased access to private land.	1	2	3	4	5	9

Background: Minnesota hunting regulations allow ‘parties’ of 2 or more licensed hunters to shoot and tag deer for each other if party members are all using the same weapon type and hunting afield together at the time the deer was killed.

28. During any 2006 Minnesota deer season (archery, firearm, and muzzleloader), did you kill a deer for another hunter (a member of your party tagged the deer you killed).

- YES
- NO

29. During any 2006 Minnesota deer seasons (archery, firearm, and muzzleloader), did you use your tag on a deer that another hunter killed?

- YES → → → If yes, during the 2006 Minnesota deer seasons (archery, firearm, and muzzleloader), how many of your tags were used by other hunters?

_____ TAGS

- NO

30. Currently, Minnesota is one of only a few states that allow hunters to shoot deer for each other. Because hunters can kill multiple bucks per year, the cross-tagging provision might contribute to higher buck harvest rates in Minnesota than in other states. The following two questions assess your level of support for allowing hunters to kill deer for each other.

In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party, but would prohibit hunters from shooting deer for each other (both antlered bucks and antlerless deer)? (*Check one*).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

31. In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party but would prohibit shooting antlered bucks for each other? You would still be able to shoot antlerless deer for each other (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

32. Including 2006, how many years have you hunted deer in Minnesota?

_____ YEARS

33. What hunting method do you primarily use? (Check only one)

- DEER DRIVE WITH LESS THAN 5 PEOPLE
- DEER DRIVE WITH 5 OR MORE PEOPLE
- TREE STAND
- GROUND BLIND
- STILL HUNTING OR STALKING
- OTHER (PLEASE LIST) _____

34. Which statement best characterizes where you hunt? (Check only one)

- I ALMOST NEVER HUNT THE SAME AREA EVERY YEAR
- I CHANGE MY HUNTING LOCATION EVERY 1 TO 2 YEARS
- I CHANGE MY HUNTING LOCATION EVERY 3 TO 5 YEARS
- I TYPICALLY HUNT THE SAME AREA EVERY YEAR

35. What is the furthest you are willing to travel from your home to hunt antlered deer?

_____ (number of miles)

36. What is the furthest you are willing to travel from your home to hunt antlerless deer?

_____ (number of miles)

37. Please tell us how important each of the following experiences was to your deer hunting satisfaction during the 2006 Itasca firearms season. (Please circle one response for each.)

	Not at all important	Slightly important	Somewhat important	Very important	Extremely important
Harvesting at least one deer	1	2	3	4	5
Access to a lot of different hunting areas	1	2	3	4	5
Harvesting any deer for meat	1	2	3	4	5
Being on my own	1	2	3	4	5
Hunting with friends	1	2	3	4	5
Developing my skills and abilities	1	2	3	4	5
Hunting with family	1	2	3	4	5
Enjoying nature and the outdoors	1	2	3	4	5
Getting away from crowds of people	1	2	3	4	5
Getting food for my family	1	2	3	4	5
Getting information about hunting seasons	1	2	3	4	5
Seeing a lot of bucks	1	2	3	4	5
Good behavior among other deer hunters	1	2	3	4	5
Having a long deer season	1	2	3	4	5
Hunting areas open to the public	1	2	3	4	5
Harvesting a large buck	1	2	3	4	5
Reducing tension and stress	1	2	3	4	5
Seeing a lot of deer	1	2	3	4	5
Sharing my hunting skills and knowledge	1	2	3	4	5
Thinking about personal values	1	2	3	4	5
Using my deer hunting equipment (gun, stands, etc.)	1	2	3	4	5

38. Please let us know how you feel about the Minnesota Department of Natural Resources. (Please circle one response for each of the following statements).

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
The MnDNR does a good job of managing deer in Minnesota	1	2	3	4	5
When deciding about deer management in Minnesota, the MnDNR will be open and honest in the things they do and say	1	2	3	4	5
The MnDNR can be trusted to make decisions about deer management that are good for the resource.	1	2	3	4	5
The MnDNR will make decisions about deer management in a way that is fair.	1	2	3	4	5
The MnDNR has deer managers and biologists who are well-trained for their jobs.	1	2	3	4	5
The MnDNR listens to deer hunters' concerns	1	2	3	4	5

Appendix D Early Antlerless Survey, 2005 – 2007.
(2006 survey used as reference).

2006 SURVEY OF HUNTERS PARTICIPATING IN EARLY ANTLERLESS SEASON HUNTS



**A cooperative study conducted by the University of Minnesota
for the Minnesota Department of Natural Resources**

Your help on this study is greatly appreciated!

*Please return your completed questionnaire in the enclosed
envelope. The envelope is self-addressed and no postage is
required. Thanks!*

Minnesota Cooperative Fish and Wildlife Research Unit,
Department of Fisheries, Wildlife, and Conservation Biology
University of Minnesota
St. Paul, Minnesota 55108-6124

SECTION A. The first set of questions is designed to tell us where you hunted deer. Please read the questions carefully and answer them to the best of your ability.

When you purchased your firearms license for the 2006 firearms deer season, you also purchased at least one early antlerless permit. Consequently, you were randomly selected from all hunters who purchased early antlerless permits.

2. Did you actually hunt during the 2006 early antlerless season?

YES

NO →

2. If No, during the 2006 REGULAR firearms deer season, which one deer permit area did you hunt most often?

DEER PERMIT AREA _____ (write in the number)

3. How many days did you spend scouting for deer in each of the following seasons? If you hunted but did not scout write in "0". Write "DNH" if you Did Not Hunt during that season.

Archery _____ DAYS

Firearm _____ DAYS

Muzzleloader _____ DAYS

**Skip to
Question 8**

4. How many days did you scout for deer before the early antlerless season this year?

_____ DAYS

5. Which permit area did you hunt most often during the early antlerless season? (*check only one*)

209

210

225

227

236

252

256

257

6. How many days did you hunt deer during the early antlerless season?

_____ DAYS

8. For the permit area that you hunted most often during the early antlerless season, how many years have you hunted this permit area?

_____ YEARS

7a. If you hunted during the REGULAR FIREARMS season, please write down which one deer permit area you hunted most often _____ (write in the number)

8. For each of the following 2006 hunting seasons, what types of property did you hunt most often? Please place a check mark in the box below the type of property you hunted most often during each season. Please check only one box per season.

SEASON	Wildlife Management Area	State Forest	Other Public	Private Posted Land	Private Land Not Posted	Did not hunt this season
Early Antlerless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Archery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Firearm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Muzzleloader	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION B. We are now interested in learning about your experiences and opinions regarding your 2006 early antlerless season hunt.

► **IF YOU DID NOT HUNT DEER DURING THE EARLY ANTLERLESS SEASON THIS YEAR, PLEASE SKIP TO SECTION C.**

10. What was the primary reason you hunted the early antlerless season during 2006? (check only one)

- I NORMALLY HUNT IN THIS AREA AND I AM ALWAYS LOOKING FOR MORE DEER HUNTING OPPORTUNITY
- I NEVER HUNTED IN THIS AREA BUT I AM ALWAYS LOOKING FOR MORE DEER HUNTING OPPORTUNITY
- I THOUGHT IT WAS A GOOD OPPORTUNITY TO PUT VENISON IN THE FREEZER EARLY
- I BELIEVE THERE ARE A LOT OF DEER IN THIS AREA
- OTHER (Describe) _____

10. Which techniques did you use to hunt during the early antlerless season? Circle one number for each technique.

Method	None	Some	Most	All	Don't Know
Stand hunting from ground stand/blind	1	2	3	4	9
Stalking or moving slowly	1	2	3	4	9
Hunting from elevated tree stand	1	2	3	4	9
Participated in deer drives as member of a party	1	2	3	4	9

11. What was the first deer or group of deer that you saw that was within your shooting range during the early antlerless season? (*check only one*)

- ANTLERED BUCK
- ANTLERLESS DEER
- MIXED GROUP OF BUCKS AND ANTLERLESS DEER
- DID NOT SEE A DEER WHILE HUNTING → **SKIP TO QUESTION 18**

12. From the first deer or group of deer you saw within shooting range during the early antlerless season, were you able to kill the deer?

- YES
- NO

13. If no, why were you not able to kill the first deer you saw within shooting range during the early antlerless season? (*Check only one*)

- IT WAS A BUCK
 - THE DEER DID NOT PRESENT A GOOD SHOT OR I SHOT AND MISSED THE DEER
 - I WAS UNSURE IF THE DEER WAS LEGAL TO SHOOT
 - OTHER (DESCRIBE WHY)
-

15. Did you kill an antlerless deer during the early antlerless season?

- YES → **SKIP TO QUESTION 16**
- NO

15. If no, what was the reason for not killing an antlerless deer during the early antlerless season? (*Check only one and then **SKIP TO QUESTION 17***)

- I ONLY SAW BUCKS
 - I DID NOT SEE ANY DEER
 - I COULD NOT TELL IF IT WAS AN ANTLERLESS DEER OR A BUCK
 - OTHER (DESCRIBE WHY)
-

16. In total, how many deer did you kill during the early antlerless season? Include deer that you killed but were tagged by someone else.

I personally killed _____ deer (write in the number)

17. In total, how many deer did you see while hunting during the 2006 early antlerless deer season? (*Write the number of deer you saw in each blank below*).

Type of deer	Deer seen
Antlered Bucks	_____
Antlerless Deer (for example, doe or button buck)	_____
Deer that I couldn't identify as antlered or antlerless	_____

While the early antlerless hunt was enacted to put more harvest pressure on antlerless deer, there was a feeling that hunter behavior might change as a result of the hunt. It was believed that hunters might be less likely to harvest a buck if they had put venison in the freezer prior to the regular deer season opener. The next series of questions will attempt to determine if your hunting patterns changed as a result of hunting during the early antlerless season.

18. Did the early antlerless season have any affect on your hunting patterns during the regular firearm season?

- YES
- NO

19. What effect did the early antlerless hunt have on your decision to harvest deer during the regular season? Please complete the following statement (*check only one*).

Because I hunted during the early antlerless season,

- I INTENDED TO BE MORE SELECTIVE DURING THE REGULAR SEASON AND ONLY HARVEST A MATURE BUCK
- I INTENDED TO BE MORE SELECTIVE AND ONLY TAKE A MATURE BUCK OR ANTLERLESS DEER
- I KILLED A DEER DURING THE EARLY SEASON AND PLANNED NOT TO HUNT ANY MORE
- I DID NOT PLAN TO CHANGE MY HUNTING PATTERNS, I ONLY HUNT FOR MATURE BUCKS
- I DID NOT PLAN TO CHANGE MY HUNTING PATTERNS, I TYPICALLY SHOOT THE FIRST LEGAL DEER I SEE
- I DID NOT PLAN TO CHANGE MY HUNTING PATTERNS BECAUSE THE TYPE OF DEER I KILL IS NOT IMPORTANT
- OTHER _____

20. Ultimately, were your hunting patterns altered by the early antlerless season? (*check only one*)

- YES, I DECIDED **NOT** TO SHOOT A SMALL ANTLERED BUCK AND I DIDN'T KILL ANOTHER DEER
- YES, I HELD OUT AND SHOT A MATURE BUCK
- YES, I SHOT AN ANTLERLESS DEER INSTEAD OF SMALL ANTLERED BUCK
- NO, I SHOT A SMALL ANTLERED BUCK
- NO, I SHOT THE FIRST DEER THAT I COULD
- OTHER _____

21. The early antlerless season was designed to put more harvest pressure on antlerless deer. The intent of the regulation is to lower deer populations, but a byproduct may be an increase in the proportion of mature bucks. After hunting during this season, do you support or oppose the concept of an early antlerless deer season? (*Check only one*)

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE
- DON'T KNOW

22. If the early antlerless season is continued for the 2006 deer season, how likely are you to hunt during it next year? (*Check only one*)

- I WILL DEFINITELY HUNT THE EARLY SEASON NEXT YEAR
- I WILL PROBABLY HUNT THE EARLY SEASON NEXT YEAR
- UNDECIDED
- I PROBABLY WILL NOT HUNT THE EARLY SEASON NEXT YEAR
- I DEFINITELY WILL NOT HUNT THE EARLY SEASON NEXT YEAR

23. Overall, how satisfied were you with your early antlerless hunting experience during 2006? (*check only one*)

- VERY SATISFIED
- SLIGHTLY SATISFIED
- NEITHER SATISFIED OR DISSATISFIED
- SLIGHTLY DISSATISFIED
- VERY DISSATISFIED

► **SECTION C. We are now interested in learning about your experiences and opinions regarding deer hunting in Minnesota.**

24. Which ONE of the following best describes how you hunted deer during the 2006 REGULAR FIREARMS deer hunting season in Minnesota? Would you say you: (*Check only one*)

- HUNTED FOR LARGE ANTLERED BUCKS DURING THE ENTIRE SEASON
- HUNTED FOR LARGE ANTLERED BUCKS EARLY SEASON AND SHOOT ANY LEGAL DEER LATER
- SHOOT ANY ANTLERED BUCK
- SHOOT THE FIRST LEGAL DEER THAT OFFERED A GOOD SHOT
- SHOOT ONLY ANTLERLESS DEER
- DON'T KNOW

25. How many antlered and antlerless deer did you kill in each of Minnesota's deer seasons during 2006? Include all deer you killed by archery, rifle, and muzzleloader, regardless of whether you tagged the deer or another hunter tagged the deer. Write in the number of deer you killed in each blank below. If you did not hunt deer in a season, check the appropriate box.

	Number of Antlered Deer you killed in 2006 ▼	Number of Antlerless Deer you killed in 2006 ▼	I did not hunt in that season in 2006 ▼
Early Antlerless	<u>No Season</u>	_____	<input type="checkbox"/>
Archery	_____	_____	<input type="checkbox"/>
Firearms	_____	_____	<input type="checkbox"/>
Muzzleloader	_____	_____	<input type="checkbox"/>

26. How many antlered and antlerless deer did you personally kill in Minnesota in 2004 and 2005? Include all deer you killed by archery, rifle, and muzzleloader, regardless of whether you tagged the deer or another hunter tagged the deer. In you did not hunt deer during a year check the appropriate box.

	Number of Antlered Deer you killed ▼	Number of Antlerless Deer you killed ▼	I did not hunt in MINNESOTA that year
In 2004 I killed...	_____	_____	<input type="checkbox"/>
In 2005 I killed...	_____	_____	<input type="checkbox"/>

27. Overall, people have different reasons for supporting or opposing new hunting regulations. Please tell us how important each of the following reasons for supporting or opposing new hunting regulations are to you.

When I consider proposed hunting regulation changes, it is important to me that these factors are considered: (Please circle one number for each item)

Background: Minnesota hunting regulations allow ‘parties’ of 2 or more licensed hunters to shoot and tag deer for each other if party members are all using the same weapon type and hunting afield together at the time the deer was killed.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
Do not result in an increased total buck harvest.	1	2	3	4	5	9
Do not result in an increased doe harvest.	1	2	3	4	5	9
Increase DNR’s ability to control the deer population.	1	2	3	4	5	9
Increase hunting opportunity for bowhunters.	1	2	3	4	5	9
Increase hunting opportunity for muzzleloader hunters.	1	2	3	4	5	9
Increase hunting opportunity for firearm hunters.	1	2	3	4	5	9
Increase my own chances of taking an antlered buck.	1	2	3	4	5	9
Increase my own chances of taking a large antlered buck.	1	2	3	4	5	9
Increase my own chances of taking antlerless deer.	1	2	3	4	5	9
Encourage new people to take up deer hunting.	1	2	3	4	5	9
Lead to a better public image of hunters and hunting.	1	2	3	4	5	9
Protect the interests of farmers and other landowners.	1	2	3	4	5	9
Protect areas so that deer do not cause forest and other habitat damages	1	2	3	4	5	9
Reduce crowding of hunters on public lands.	1	2	3	4	5	9
The regulations do not result in decreased access to private land.	1	2	3	4	5	9

28. During any 2006 Minnesota deer season (archery, firearm, and muzzleloader), did you kill a deer for another hunter (a member of your party tagged the deer you killed).

- YES
- NO

29. During any 2006 Minnesota deer seasons (archery, firearm, and muzzleloader), did you use your tag on a deer that another hunter killed?

- YES → → → If yes, during the 2006 Minnesota deer seasons (archery, firearm, and muzzleloader), how many of your tags were used by other hunters?

_____ TAGS

- NO

30. Currently, Minnesota is one of only a few states that allow hunters to shoot deer for each other. Because hunters can kill multiple bucks per year, the cross-tagging provision might contribute to higher buck harvest rates in Minnesota than in other states. The following two questions assess your level of support for allowing hunters to kill deer for each other.

In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party, but would prohibit hunters from shooting deer for each other (both antlered bucks and antlerless deer)? (*Check one*).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

31. In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party but would prohibit shooting antlered bucks for each other? You would still be able to shoot antlerless deer for each other (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

32. Including 2006, how many years have you hunted deer in Minnesota?

_____ YEARS

33. What hunting method do you primarily use? (Check only one)

- DEER DRIVE WITH LESS THAN 5 PEOPLE
- DEER DRIVE WITH 5 OR MORE PEOPLE
- TREE STAND
- GROUND BLIND
- STILL HUNTING OR STALKING
- OTHER (PLEASE LIST) _____

34. Which statement best characterizes where you hunt? (Check only one)

- I ALMOST NEVER HUNT THE SAME AREA EVERY YEAR
- I CHANGE MY HUNTING LOCATION EVERY 1 TO 2 YEARS
- I CHANGE MY HUNTING LOCATION EVERY 3 TO 5 YEARS
- I TYPICALLY HUNT THE SAME AREA EVERY YEAR

35. What is the furthest you are willing to travel from your home to hunt antlered deer?

_____ (number of miles)

36. What is the furthest you are willing to travel from your home to hunt antlerless deer?

_____ (number of miles)

37. Please tell us how important each of the following experiences was to your deer hunting satisfaction during the 2006 EARLY ANTLERLESS firearms season. (Please circle one response for each.)

IF YOU DID NOT HUNT THE 2006 EARLY ANTLERLESS SEASON SKIP TO QUESTION 38

	Not at all important	Slightly important	Somewhat important	Very important	Extremely important
Harvesting at least one deer	1	2	3	4	5
Access to a lot of different hunting areas	1	2	3	4	5
Harvesting any deer for meat	1	2	3	4	5
Being on my own	1	2	3	4	5
Hunting with friends	1	2	3	4	5
Developing my skills and abilities	1	2	3	4	5
Hunting with family	1	2	3	4	5
Enjoying nature and the outdoors	1	2	3	4	5
Getting away from crowds of people	1	2	3	4	5
Getting food for my family	1	2	3	4	5
Getting information about hunting seasons	1	2	3	4	5
Seeing a lot of bucks	1	2	3	4	5
Good behavior among other deer hunters	1	2	3	4	5
Having a long deer season	1	2	3	4	5
Hunting areas open to the public	1	2	3	4	5
Reducing tension and stress	1	2	3	4	5
Seeing a lot of deer	1	2	3	4	5
Sharing my hunting skills and knowledge	1	2	3	4	5
Thinking about personal values	1	2	3	4	5
Using my deer hunting equipment (gun, stands, etc.)	1	2	3	4	5

38. Please let us know how you feel about the Minnesota Department of Natural Resources.
(Please circle one response for each of the following statements).

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
The MnDNR does a good job of managing deer in Minnesota	1	2	3	4	5
When deciding about deer management in Minnesota, the MnDNR will be open and honest in the things they do and say	1	2	3	4	5
The MnDNR can be trusted to make decisions about deer management that are good for the resource.	1	2	3	4	5
The MnDNR will make decisions about deer management in a way that is fair.	1	2	3	4	5
The MnDNR has deer managers and biologists who are well-trained for their jobs.	1	2	3	4	5
The MnDNR listens to deer hunters' concerns	1	2	3	4	5

THANK YOU!

Appendix E Earn-A-Buck Survey at St. Croix State Park, 2005 – 2007.
(2006 survey used as reference).

2006 SURVEY OF HUNTERS PARTICIPATING IN EARN-A-BUCK DEER HUNTS



**A cooperative study conducted by the University of Minnesota
for the Minnesota Department of Natural Resources**

Your help on this study is greatly appreciated!

*Please return your completed questionnaire in the enclosed
envelope. The envelope is self-addressed and no postage is
required. Thanks!*

Minnesota Cooperative Fish and Wildlife Research Unit,
Department of Fisheries, Wildlife, and Conservation Biology
University of Minnesota
St. Paul, Minnesota 55108-6124

SECTION A. The first set of questions is designed to tell us where you hunted deer. Please read the questions carefully and answer them to the best of your ability.

When you purchased your firearms license for the 2006 firearms deer season, you applied for a State Park hunt with an earn-a-buck regulation. For this survey, "the Park" means the Park you applied to hunt in 2006.

1. Did you actually hunt at the Park during the 2006 firearms deer hunting season?

- YES
- NO →

2. If No, during the 2006 firearms deer season, which **one deer permit area did you hunt most often?**

DEER PERMIT AREA _____ (write in the number)

3. How many days did you spend scouting for deer in each of the following seasons? Write "DNH" if you Did Not Hunt during that season.

October Antlerless Only _____ DAYS

Archery _____ DAYS

Firearm _____ DAYS

Muzzleloader _____ DAYS

Skip to
Question
7

4. Prior to the deer season, how many days did you scout deer at the Park this year?

_____ DAYS

5. How many days did you hunt deer at the Park this year?

_____ DAYS

6. Including this year, how many years have you hunted deer at the Park?

_____ YEARS

7. For the permit area that you hunted most often during the 2006 deer hunting season, how many years have you hunted this permit area?

_____ YEARS

7a. If you hunted at the park, please write down which **one deer permit area you hunted most often besides the park _____ (write in the number)**

8. For each of the following 2006 hunting seasons, what types of property did you hunt most often? Please place a check mark in the box below the type of property you hunted most often during each season. Please check only one box per season.

SEASON	Wildlife Management Area	State Forest	Other Public	Private Posted Land	Private Land Not Posted	Did not hunt this season
Early Antlerless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Archery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Firearm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Muzzleloader	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION B. We are now interested in learning about your experiences and opinions regarding your 2006 deer hunt at the Park.

► **IF YOU DID NOT HUNT DEER AT THE PARK THIS YEAR, PLEASE SKIP TO SECTION C.**

9. What was the primary reason you hunted the Park during 2006? (*check only one*)

- I NORMALLY HUNT THIS STATE PARK
- I HUNT AS A PARTY WITH FAMILY OR FRIENDS
- I WAS INTERESTED IN THE EARN-A-BUCK REGULATION
- I BELIEVE THE PARK HAS A HIGH DEER POPULATION, WHICH WOULD INCREASE MY CHANCES OF KILLING A DEER
- OTHER (Describe)

10. Which techniques did you use to hunt deer at the Park? Circle one number for each technique.

Method	None	Some	Most	All	Don't Know
Stand hunting from ground stand/blind	1	2	3	4	9
Stalking or moving slowly	1	2	3	4	9
Hunting from elevated tree stand	1	2	3	4	9
Participated in deer drives as member of a party	1	2	3	4	9

11. What was the first deer or group of deer that you saw that was within your shooting range at the Park? (*check only one*)

- ANTLERED BUCK
- ANTLERLESS DEER
- MIXED GROUP OF BUCKS AND ANTLERLESS DEER
- DID NOT SEE A DEER WHILE HUNTING → **SKIP TO QUESTION 18**

12. From the first deer or group of deer you saw within shooting range at the Park, were you able to kill the deer?

- YES
- NO

13. If no, why were you not able to kill the first deer or group of deer you saw within shooting range at the Park? (*check only one*)

- IT WAS A BUCK AND I HADN'T KILLED AN ANTLERLESS DEER YET
- I COULDN'T TELL IF IT WAS AN ANTLERLESS DEER
- THE DEER DID NOT PRESENT A GOOD SHOT OR I SHOT AND MISSED THE DEER
- I DO NOT SHOOT ANTLERLESS DEER
- OTHER (DESCRIBE WHY)

14. Did you kill an antlerless deer at the Park during 2006?

- YES → **SKIP TO QUESTION 16**
- NO

15. If no, what was the reason for not killing an antlerless deer at the Park? (*Check only one*)

- I DID NOT SEE AN ANTLERLESS DEER
- I ALREADY SHOT A DEER EARLIER IN THE YEAR SO I HAD ENOUGH VENISON
- I COULD NOT TELL IF THE DEER WAS LEGAL TO SHOOT
- I SAW ANTLERLESS DEER BUT THE DEER DID NOT PRESENT A GOOD SHOT OR I SHOT AND MISSED THE DEER
- I DO NOT SHOOT ANTLERLESS DEER
- OTHER (DESCRIBE WHY)

16. Did you kill an antlered buck at the Park during 2006?

- YES
 NO →

**17. If no, what was the reason for not killing an antlered buck at the Park?
 (Check only one)**

- I DID NOT KILL AN ANTLERLESS DEER FIRST
 I DID NOT SEE AN ANTLERED BUCK
 THE BUCK DID NOT PRESENT A GOOD SHOT OR I SHOT AND MISSED THE BUCK
 I SHOT AN ANTLERLESS DEER AND WAS WAITING FOR A BIG BUCK
 OTHER (DESCRIBE WHY)
-

18. Please indicate whether you agree or disagree with the following statements regarding your 2006 State Park deer hunt. (Circle one number for each item)

	Strongly Agree	Slightly Agree	Neither	Slightly Disagree	Strongly Disagree	Don't Know
I was satisfied with the number of legal bucks	1	2	3	4	5	9
I was satisfied with the quality of bucks	1	2	3	4	5	9
I heard about or saw legal bucks while hunting	1	2	3	4	5	9
I was satisfied with the total number of antlerless deer	1	2	3	4	5	9
I was satisfied with the total number of deer I saw while hunting	1	2	3	4	5	9

19. In total, how many deer did you observe while hunting at the Park during the 2006 deer season? (Write the number of deer you saw in each blank below).

I saw a total of _____ Antlered Bucks

I saw a total of _____ Antlered Bucks that I could not shoot because I had not previously shot an antlerless deer

I saw a total of _____ Antlerless Deer

20. At the Park, how many antlered and antlerless deer did you personally kill during the past three deer seasons?

Include all deer you killed, regardless of whether you tagged the deer or another hunter tagged the deer. Write in the number of deer you killed in each blank below. If you did not hunt deer at the Park during a particular year, check the appropriate box.

Year	Number of Antlered Deer you killed ▼	Number of Antlerless Deer you killed ▼	I did not hunt at the Park that year ▼
In 2004 I killed...	_____	_____	<input type="checkbox"/>
In 2005 I killed...	_____	_____	<input type="checkbox"/>
In 2006 I killed...	_____	_____	<input type="checkbox"/>

21. The earn-a-buck regulation was put in place at the Park to put more harvest pressure on antlerless deer. The intent of the regulation is to lower deer populations at the Park but it might also increase the proportion of mature bucks. After hunting under this regulation at the Park, do you support or oppose the earn-a-buck regulation? (Check only one)

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

22. If the earn-a-buck regulation is continued for the 2006 deer season, how likely are you to apply at the Park next year? (*Check only one*)

- I WILL DEFINITELY APPLY AT THE PARK NEXT YEAR
- I WILL PROBABLY APPLY AT THE PARK NEXT YEAR
- UNDECIDED
- I PROBABLY WILL NOT APPLY AT THE PARK NEXT YEAR
- I DEFINITELY WILL NOT APPLY AT THE PARK NEXT YEAR

23. Overall, how satisfied were you with your hunting experience at the Park during 2006?

- VERY SATISFIED
- SLIGHTLY SATISFIED
- NEITHER SATISFIED OR DISSATISFIED
- SLIGHTLY DISSATISFIED
- VERY DISSATISFIED

► **SECTION C. We are now interested in learning about your experiences and opinions regarding deer hunting in Minnesota.**

24. Which **ONE** of the following best describes how you deer hunted deer during the 2006 **REGULAR FIREARMS** deer hunting season in Minnesota? Would you say you: (*Check only one*)

- HUNTED FOR LARGE ANTLERED BUCKS DURING THE ENTIRE SEASON
- HUNTED FOR LARGE ANTLERED BUCKS EARLY SEASON AND SHOOT ANY LEGAL DEER LATER
- SHOOT ANY ANTLERED BUCK
- SHOOT THE FIRST LEGAL DEER (EITHER ANTLERED OR ANTLERLESS) THAT OFFERED A GOOD SHOT
- SHOOT ONLY ANTLERLESS DEER
- DON'T KNOW

25. How many antlered and antlerless deer did you kill in each of Minnesota's deer seasons during 2006? Include all deer you killed by archery, rifle, and muzzleloader, regardless of whether you tagged the deer or another hunter tagged the deer. Write in the number of deer you killed in each blank below. If you did not hunt deer in a season, check the appropriate box.

	Number of Antlered Deer you killed in 2006 ▼	Number of Antlerless Deer you killed in 2006 ▼	I did not hunt in that season in 2006
October Antlerless	<u>No Season</u>	_____	<input type="checkbox"/>
Archery	_____	_____	<input type="checkbox"/>
Firearms	_____	_____	<input type="checkbox"/>
Muzzleloader	_____	_____	<input type="checkbox"/>

26. How many antlered and antlerless deer did you personally kill in Minnesota in 2004 and 2005? Include all deer you killed by archery, rifle, and muzzleloader, regardless of whether you tagged the deer or another hunter tagged the deer. In you did not hunt deer during a year, check the appropriate box.

	Number of Antlered Deer you killed ▼	Number of Antlerless Deer you killed ▼	I did not hunt in MINNESOTA that year
In 2004 I killed...	_____	_____	<input type="checkbox"/>
In 2005 I killed...	_____	_____	<input type="checkbox"/>

27. Overall, people have different reasons for supporting or opposing new hunting regulations. Please tell us how important each of the following reasons for supporting or opposing new hunting regulations are to you.

When I consider proposed hunting regulation changes, it is important to me that these factors are considered: (Please circle one number for each item)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
Do not result in an increased total buck harvest.	1	2	3	4	5	9
Do not result in an increased doe harvest.	1	2	3	4	5	9
Increase DNR's ability to control the deer population.	1	2	3	4	5	9
Increase hunting opportunity for bowhunters.	1	2	3	4	5	9
Increase hunting opportunity for muzzleloader hunters.	1	2	3	4	5	9
Increase hunting opportunity for firearm hunters.	1	2	3	4	5	9
Increase my own chances of taking an antlered buck.	1	2	3	4	5	9
Increase my own chances of taking a large antlered buck.	1	2	3	4	5	9
Increase my own chances of taking antlerless deer.	1	2	3	4	5	9
Encourage new people to take up deer hunting.	1	2	3	4	5	9
Lead to a better public image of hunters and hunting.	1	2	3	4	5	9
Protect the interests of farmers and other landowners.	1	2	3	4	5	9
Protect areas so that deer do not cause forest and other habitat damages.	1	2	3	4	5	9
Reduce crowding of hunters on public lands.	1	2	3	4	5	9
The regulations do not result in decreased access to private land.	1	2	3	4	5	9

Background: Minnesota hunting regulations allow ‘parties’ of 2 or more licensed hunters to shoot and tag deer for each other if party members are all using the same weapon type and hunting afield together at the time the deer was killed.

28. During any 2006 Minnesota deer season (archery, firearm, and muzzleloader), did you kill a deer for another hunter (a member of your party tagged the deer you killed).

- YES
- NO

29. During any 2006 Minnesota deer seasons (archery, firearm, and muzzleloader), did you use your tag on a deer that another hunter killed?

- YES → → → If yes, during the 2006 Minnesota deer seasons (archery, firearm, and muzzleloader), how many of your tags were used by other hunters?

_____ TAGS

- NO

30. Currently, Minnesota is one of only a few states that allow hunters to shoot deer for each other. Because hunters can kill multiple bucks per year, the cross-tagging provision might contribute to higher buck harvest rates in Minnesota than in other states. The following two questions assess your level of support for allowing hunters to kill deer for each other.

In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party, but would prohibit hunters from shooting deer for each other (both antlered bucks and antlerless deer)? (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

31. In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party but would prohibit shooting antlered bucks for each other? You would still be able to shoot antlerless deer for each other (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

32. Including 2006, how many years have you hunted deer in Minnesota?

_____ YEARS

33. What hunting method do you primarily use? (Check only one)

- DEER DRIVE WITH LESS THAN 5 PEOPLE
- DEER DRIVE WITH 5 OR MORE PEOPLE
- TREE STAND
- GROUND BLIND
- STILL HUNTING OR STALKING
- OTHER (PLEASE LIST) _____

34. Which statement best characterizes where you hunt? (Check only one)

- I ALMOST NEVER HUNT THE SAME AREA EVERY YEAR
- I CHANGE MY HUNTING LOCATION EVERY 1 TO 2 YEARS
- I CHANGE MY HUNTING LOCATION EVERY 3 TO 5 YEARS
- I TYPICALLY HUNT THE SAME AREA EVERY YEAR

35. What is the furthest you are willing to travel from your home to hunt antlered deer?

_____ (number of miles)

36. What is the furthest you are willing to travel from your home to hunt antlerless deer?

_____ (number of miles)

37. Please tell us how important each of the following experiences was to your deer hunting satisfaction during the 2006 firearms season. (Please circle one response for each.)

	Not at all important	Slightly important	Somewhat important	Very important	Extremely important
Harvesting at least one deer	1	2	3	4	5
Access to a lot of different hunting areas	1	2	3	4	5
Harvesting any deer for meat	1	2	3	4	5
Being on my own	1	2	3	4	5
Hunting with friends	1	2	3	4	5
Developing my skills and abilities	1	2	3	4	5
Hunting with family	1	2	3	4	5
Enjoying nature and the outdoors	1	2	3	4	5
Getting away from crowds of people	1	2	3	4	5
Getting food for my family	1	2	3	4	5
Getting information about hunting seasons	1	2	3	4	5
Seeing a lot of bucks	1	2	3	4	5
Good behavior among other deer hunters	1	2	3	4	5
Having a long deer season	1	2	3	4	5
Hunting areas open to the public	1	2	3	4	5
Harvesting a large buck	1	2	3	4	5
Reducing tension and stress	1	2	3	4	5
Seeing a lot of deer	1	2	3	4	5
Sharing my hunting skills and knowledge	1	2	3	4	5
Thinking about personal values	1	2	3	4	5
Using my deer hunting equipment (gun, stands, etc.)	1	2	3	4	5

38. Please let us know how you feel about the Minnesota Department of Natural Resources. (Please circle one response for each.)

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
The MnDNR does a good job of managing deer in Minnesota	1	2	3	4	5
When deciding about deer management in Minnesota, the MnDNR will be open and honest in the things they do and say	1	2	3	4	5
The MnDNR can be trusted to make decisions about deer management that are good for the resource.	1	2	3	4	5
The MnDNR will make decisions about deer management in a way that is fair.	1	2	3	4	5
The MnDNR has deer managers and biologists who are well-trained for their jobs.	1	2	3	4	5
The MnDNR listens to deer hunters' concerns	1	2	3	4	5

Appendix F Minnesota Deer Hunter Control Survey, 2005 – 2007.
(2006 survey used as reference).

2006 SURVEY OF MINNESOTA DEER HUNTERS



**A cooperative study conducted by the University of Minnesota
for the Minnesota Department of Natural Resources**

Your help on this study is greatly appreciated!

*Please return your completed questionnaire in the enclosed
envelope. The envelope is self-addressed and no postage is
required. Thanks!*

Minnesota Cooperative Fish and Wildlife Research Unit,
Department of Fisheries, Wildlife, and Conservation Biology
University of Minnesota
St. Paul, Minnesota 55108-6124

► SECTION A. The first set of questions will tell us where you hunted deer. Please read the questions carefully and answer them as accurately as you can.

When you purchased your firearms license for the 2006 firearms deer season, you also purchased at least one early antlerless permit. For this reason, you were randomly selected from all hunters who purchased early antlerless permits.

1. Did you actually hunt during any of the 2006 firearms deer seasons?

- YES
- NO → **SKIP TO QUESTION 21**

2. How many days did you spend scouting for deer in each of the following seasons? If you hunted but did not scout write in "0". Write "DNH" if you Did Not Hunt during that season.

Early Antlerless _____ DAYS
Archery _____ DAYS
Firearm _____ DAYS
Muzzleloader _____ DAYS

3. During 2006, which one deer permit area did you hunt most often during the firearm season?

DEER PERMIT AREA _____ (*write in the number*)

4. How many days did you hunt deer during the firearms deer season?

_____ DAYS

5. For the permit area that you hunted most often during the 2006 deer hunting season, how many years have you hunted this permit area?

_____ YEARS

6. For each of the following 2006 hunting seasons, what types of property did you hunt most often? Please place a check mark in the box below the type of property you hunted most often during each season. Please check only one box per season.

SEASON	Wildlife Management Area	State Forest	Other Public	Private Posted Land	Private Land Not Posted	Did not hunt this season
Early Antlerless	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Archery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Firearm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Muzzleloader	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION B. We are now interested in learning about your experiences and opinions regarding your 2006 firearms deer season.

7. What was the primary reason you hunted the permit area listed in question 3 in 2006? (*check only one*)

- I NORMALLY HUNT THIS PERMIT AREA
- I HUNT AS A PARTY WITH FAMILY OR FRIENDS
- I BELIEVE THERE ARE A LOT OF DEER IN THIS AREA WHICH INCREASES MY CHANCE OF GETTING A DEER
- I BELIEVE THERE ARE TOO MANY DEER IN THIS AREA
- OTHER (Describe)

8. Which techniques did you use to hunt during the 2006 firearms deer season? Circle one number for each item.

Method	None	Some	Most	All	Don't Know
Stand hunting from ground stand/blind	1	2	3	4	9
Stalking or moving slowly	1	2	3	4	9
Hunting from elevated tree stand	1	2	3	4	9
Participated in deer drives as member of a party	1	2	3	4	9

9. What was the first deer or group of deer that you saw that was within your shooting range? (*check only one*)

- ANTLERED BUCK
- ANTLERLESS DEER
- MIXED GROUP OF BUCK AND ANTLERLESS DEER
- DID NOT SEE A DEER WHILE HUNTING → **SKIP TO QUESTION 17**

10. From the first deer or group of deer you saw within shooting range during the regular firearms deer season, were you able to kill the deer?

- YES
- NO

11. If no, why were you not able to kill the first deer you saw during the regular firearms deer season? (*Check only one*)

- THE DEER DID NOT PRESENT A GOOD SHOT OR I SHOT AND MISSED THE DEER
 - IT WAS A BUCK BUT TOO SMALL TO HARVEST SO SOON
 - I WAS UNSURE IF THE DEER WAS LEGAL TO SHOOT
 - IT WAS AN ANTLERLESS DEER AND I DO NOT SHOOT ANTLERLESS DEER
 - IT WAS AN ANTLERLESS DEER AND I DID NOT WANT TO HARVEST AN ANTLERLESS DEER EARLY IN THE SEASON
 - OTHER (DESCRIBE WHY)
-


12. Did you kill an antlerless deer during the 2006 regular firearms deer season?

- YES → **SKIP TO QUESTION 14**
- NO

13. If no, what was the reason for not killing an antlerless deer during the 2006 regular firearms deer season? (*Check only one*)

- I DID NOT SEE AN ANTLERLESS DEER
- I SHOT A DEER EARLIER IN THE YEAR SO I HAD ENOUGH VENISON
- I COULD NOT TELL IF THE DEER WAS LEGAL TO SHOOT
- I SAW ANTLERLESS DEER BUT THE DEER DID NOT PRESENT A GOOD SHOT
- I DO NOT SHOOT ANTLERLESS DEER
- OTHER (DESCRIBE WHY) _____

14. Did you kill an antlered buck during the 2006 regular firearms deer season?

- YES
- NO 

15. If no, what was the reason for not killing an antlered buck during the 2006 regular firearms deer season? (*Check only one*)

- I DID NOT SEE A LEGAL BUCK
- I ALREADY SHOT A DEER EARLIER IN THE YEAR SO I HAD ENOUGH VENISON
- THE BUCK DID NOT PRESENT A GOOD SHOT
- I SHOT AND MISSED THE BUCK
- I WAS UNSURE IF THE BUCK WAS LEGAL TO SHOOT
- IT WAS A LEGAL BUCK BUT NOT BIG ENOUGH FOR ME TO SHOOT
- OTHER (DESCRIBE WHY) _____

16. In total, how many deer did you observe while hunting during the 2006 firearms deer season? (*Write the number of deer you saw in each blank below*).

I saw a total of _____ Antlered Bucks

I saw a total of _____ Antlerless Deer

I saw a total of _____ Deer that I could not tell if they were Antlered or Antlerless

17. Please indicate whether you agree or disagree with the following statements regarding your 2006 firearms deer hunt. (Circle one number for each item)

	Strongly Agree	Slightly Agree	Neither	Slightly Disagree	Strongly Disagree	Don't Know
I was satisfied with the number of legal bucks I saw	1	2	3	4	5	9
I was satisfied with the quality of bucks I saw	1	2	3	4	5	9
I heard about or saw legal bucks while hunting	1	2	3	4	5	9
I was satisfied with the total number of antlerless deer I saw	1	2	3	4	5	9
I was satisfied with the total number of deer I saw while hunting	1	2	3	4	5	9

18. How many antlered and antlerless deer did you personally kill in Minnesota in 2004 and 2005? Include all deer you killed by archery, rifle, and muzzleloader, regardless of whether you tagged the deer or another hunter tagged the deer. If you did not hunt deer during a year, check the appropriate box

	Number of Antlered Deer you killed ▼	Number of Antlerless Deer you killed ▼	I did not hunt in MINNESOTA that year
In 2004 I killed...	_____	_____	<input type="checkbox"/>
In 2005 I killed...	_____	_____	<input type="checkbox"/>

19. Overall, how satisfied were you with your 2006 firearms deer hunt?

- VERY SATISFIED
- SLIGHTLY SATISFIED
- NEITHER SATISFIED OR DISSATISFIED
- SLIGHTLY DISSATISFIED
- VERY DISSATISFIED

20. Which ONE of the following best describes how you hunted deer during the 2006 REGULAR FIREARMS deer hunting season in Minnesota? Would you say you: (Check only one)

- HUNTED FOR LARGE ANTLERED BUCKS DURING THE ENTIRE SEASON
- HUNTED FOR LARGE ANTLERED BUCKS EARLY IN THE REGULAR SEASON AND SHOOT ANY LEGAL DEER LATER
- SHOOT ANY ANTLERED BUCK
- SHOOT THE FIRST LEGAL DEER (EITHER ANTLERED OR ANTLERLESS) THAT OFFERED A GOOD SHOT
- SHOOT ONLY ANTLERLESS DEER
- DON'T KNOW

► SECTION C. We are now interested in learning about your experiences and opinions regarding deer hunting in Minnesota.

21. How many antlered and antlerless deer did you kill in each of Minnesota's deer seasons during 2006? Include all deer you killed by archery, rifle, and muzzleloader, regardless of whether you tagged the deer or another hunter tagged the deer. Write in the number of deer you killed in each blank below. If you did not hunt deer in a season, check the appropriate box.

	Number of Antlered Deer you killed in 2006 ▼	Number of Antlerless Deer you killed in 2006 ▼	I did not hunt in that season in 2006
October Antlerless	No Season	_____	<input type="checkbox"/>
Archery	_____	_____	<input type="checkbox"/>
Firearms	_____	_____	<input type="checkbox"/>
Muzzleloader	_____	_____	<input type="checkbox"/>

22. Overall, people have different reasons for supporting or opposing new hunting regulations. Please tell us how important each of the following reasons for supporting or opposing new hunting regulations are to you.

When I consider proposed hunting regulation changes, it is important to me that these factors are considered: (Please circle one number for each item)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
Do not result in an increased total buck harvest.	1	2	3	4	5	9
Do not result in an increased doe harvest.	1	2	3	4	5	9
Increase DNR's ability to control the deer population.	1	2	3	4	5	9
Increase hunting opportunity for bowhunters.	1	2	3	4	5	9
Increase hunting opportunity for muzzleloader hunters.	1	2	3	4	5	9
Increase hunting opportunity for firearm hunters.	1	2	3	4	5	9
Increase my own chances of taking an antlered buck.	1	2	3	4	5	9
Increase my own chances of taking a large antlered buck.	1	2	3	4	5	9
Increase my own chances of taking antlerless deer.	1	2	3	4	5	9
Encourage new people to take up deer hunting.	1	2	3	4	5	9
Lead to a better public image of hunters and hunting.	1	2	3	4	5	9
Protect the interests of farmers and other landowners.	1	2	3	4	5	9
Protect areas so that deer do not cause forest and other habitat damages	1	2	3	4	5	9
Reduce crowding of hunters on public lands.	1	2	3	4	5	9
The regulations do not result in decreased access to private land.	1	2	3	4	5	9

Background: Minnesota hunting regulations allow ‘parties’ of 2 or more licensed hunters to shoot and tag deer for each other if party members are all using the same weapon type and hunting afield together at the time the deer was killed.

23. During any 2006 Minnesota deer season (archery, firearm, and muzzleloader), did you kill a deer for another hunter (a member of your party tagged the deer you killed).

- YES
- NO

24. During any 2006 Minnesota deer seasons (archery, firearm, and muzzleloader), did you use your tag on a deer that another hunter killed?

YES → → → If yes, during the 2006 Minnesota deer seasons (archery, firearm, and muzzleloader), how many of your tags were used by other hunters?

NO _____ TAGS

25. Currently, Minnesota is one of only a few states that allow hunters to shoot deer for each other. Because hunters can kill multiple bucks per year, the cross-tagging provision might contribute to higher buck harvest rates in Minnesota than in other states. The following two questions assess your level of support for allowing hunters to kill deer for each other.

In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party, but would prohibit hunters from shooting deer for each other (both antlered bucks and antlerless deer)? (*Check one*).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

26. In the area you hunt most often, would you support or oppose a regulation that would allow hunters to continue to hunt together as a party but would prohibit shooting antlered bucks for each other? You would still be able to shoot antlerless deer for each other (Check one).

- STRONGLY SUPPORT
- MODERATELY SUPPORT
- NEITHER SUPPORT OR OPPOSE
- MODERATELY OPPOSE
- STRONGLY OPPOSE

27. Including 2006, how many years have you hunted deer in Minnesota?

_____ YEARS

28. What hunting method do you primarily use? (Check only one)

- DEER DRIVE WITH LESS THAN 5 PEOPLE
- DEER DRIVE WITH 5 OR MORE PEOPLE
- TREE STAND
- GROUND BLIND
- STILL HUNTING OR STALKING
- OTHER (PLEASE LIST) _____

29. Which statement best characterizes where you hunt? (Check only one)

- I ALMOST NEVER HUNT THE SAME AREA EVERY YEAR
- I CHANGE MY HUNTING LOCATION EVERY 1 TO 2 YEARS
- I CHANGE MY HUNTING LOCATION EVERY 3 TO 5 YEARS
- I TYPICALLY HUNT THE SAME AREA EVERY YEAR

30. What is the furthest you are willing to travel from your home to hunt antlered deer?

_____ (number of miles)

31. What is the furthest you are willing to travel from your home to hunt antlerless deer?

_____ (number of miles)

32. Please tell us how important each of the following experiences was to your deer hunting satisfaction during the 2006 firearms season.

(If YOU DID NOT HUNT WITH A FIREARM IN 2006, SKIP TO QUESTION 33)

(Please circle one response for each.)	Not at all important	Slightly important	Somewhat important	Very important	Extremely important
Harvesting at least one deer	1	2	3	4	5
Access to a lot of different hunting areas	1	2	3	4	5
Harvesting any deer for meat	1	2	3	4	5
Being on my own	1	2	3	4	5
Hunting with friends	1	2	3	4	5
Developing my skills and abilities	1	2	3	4	5
Hunting with family	1	2	3	4	5
Enjoying nature and the outdoors	1	2	3	4	5
Getting away from crowds of people	1	2	3	4	5
Getting food for my family	1	2	3	4	5
Getting information about hunting seasons	1	2	3	4	5
Seeing a lot of bucks	1	2	3	4	5
Good behavior among other deer hunters	1	2	3	4	5
Having a long deer season	1	2	3	4	5
Hunting areas open to the public	1	2	3	4	5
Harvesting a large buck	1	2	3	4	5
Reducing tension and stress	1	2	3	4	5
Seeing a lot of deer	1	2	3	4	5
Sharing my hunting skills and knowledge	1	2	3	4	5
Thinking about personal values	1	2	3	4	5
Using my deer hunting equipment (gun, stands, etc.)	1	2	3	4	5

33. Please let us know how you feel about the Minnesota Department of Natural Resources.
(Please circle one response for each of the following statements).

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
The MnDNR does a good job of managing deer in Minnesota	1	2	3	4	5
When deciding about deer management in Minnesota, the MnDNR will be open and honest in the things they do and say	1	2	3	4	5
The MnDNR can be trusted to make decisions about deer management that are good for the resource.	1	2	3	4	5
The MnDNR will make decisions about deer management in a way that is fair.	1	2	3	4	5
The MnDNR has deer managers and biologists who are well-trained for their jobs.	1	2	3	4	5
The MnDNR listens to deer hunters' concerns	1	2	3	4	5

Thank You!