A CONTINGENT VALUATION ASSESSMENT of MONTANA DEER HUNTING: ATTITUDES AND ECONOMIC BENEFITS

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MONTANA BIOECONOMICS STUDY

A CONTINGENT VALUATION ASSESSMENT OF MONTANA DEER HUNTING: HUNTER ATTITUDES AND ECONOMIC BENEFITS

Prepared for
Montana Department of Fish, Wildlife and Parks

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EXECUTIVE SUMMARY

Purpose of the Study

The main objective of this study was to estimate the net economic value for deer hunting in Montana. Net economic value is the amount of money a person would be willing to pay over and above what they actually must pay in order to purchase or experience something. In this study that "something" is defined as a deer hunting trip. In addition to estimating the value of the most recent trip taken by hunters, this study also estimated the net economic value of several hypothetical deer hunting trips. This valuation of hypothetical trips was accomplished by asking hunters how much more money they would be willing to pay if (for example) their chances of bagging a large buck were to double. In all, one value for actual trips taken and 3 values for hypothetically improved trips were estimated in this study.

Data Sources

The questionnaire used in this study was administered by the Montana Department of Fish Wildlife and Parks after the end of the 1988 general hunting season. The population targeted by the questionnaire was those people who had purchased a 1988 deer hunting tag or big-game combination license. Hunters first received the questionnaire booklet (see Appendix A) and cover letter along with a stamped, addressed return envelope. One week later a postcard reminder was sent to those hunters not yet responding. Finally, a second copy of the questionnaire was sent to nonrespondents.

An initial sample of 5000 questionnaires was mailed to hunters. Residents received 4325 (86.5%) of the surveys and nonresidents 675 (13.5%). This division closely mirrors the actual percentages of resident and nonresident hunters. Of the 5000 mailed questionnaires 44 were undeliverable and 3328 were completed and returned for a response rate of 66.5%.

Descriptive Statistics

Hunters were broken down two separate ways for the analysis of the data; the total sample was divided into residents and nonresidents and the total sample was divided into hunters who hired guides and those who did not. Comparisons of the characteristics of these four groups showed significant differences. Not surprisingly, nonresidents spent significantly more for their hunting trips than did residents. Nonresidents

spent an average of $1006 per trip or $146 per day while residents spent and average of $112 per trip or $25 per day. There were also significant differences between the four groups in their average incomes. A complete discussion of the comparison between hunter group characteristics is contained in Chapter 4.

Hunting Trip Valuation

Hunters responding to the DFWP Deer Hunting Survey were asked to value four different deer hunting scenarios. The first, was simply the value of their most current deer hunting trip. In order to determine this value, hunters were asked the following question.

> Suppose that everything about this last hunt was the same except your share of the expenses had been $ X more, would you still have made this trip?

In this question "X" was a value between $5 and $2000. The answers to this question were analyzed to determine the average value, or net economic value, of the hunters most current deer hunting trip. The state average net economic value for deer hunting is $302 per trip. This can be interpreted to mean that the average hunter would be willing to spend $302 more than they have already spent for their most recent deer hunting trip.

The net economic value of deer hunting trips varied widely between the four hunter groups. Residents were willing to spend $209 per trip more, nonresidents $706, guided hunters $800 and nonguided hunters $269.

Questions similar to the current trip question above were asked in order to value the hypothetical hunting trips. These hypothetical trips included doubling the chances for a large buck, providing a very good chance of bagging a small buck or doe and allowing the taking of an extra deer.

Responses to the improved conditions questions showed some clear trends. Respondents in all categories consistently valued doubling their chance for a large buck above the chance for an extra deer. Both of these alternative scenarios were valued significantly higher than a good chance for a doe or a small buck. The magnitude of most of the improved conditions values, however, were lower than current trip values. This makes comparisons between the improved conditions questions and the current trip questions difficult.

Analysis of Different Types of Hunters

In addition to the preceding analysis, hunters were "clustered" according to their motivations for hunting and then analyzed as different hunter types. Four basic "types" of deer hunters were identified: specialist meat hunters, specialist trophy hunters, general hunting enthusiasts and generalist meat hunters. A detailed description of these different hunter groups can be found in Chapter 7.

The different hunter groups showed significantly different net economic values for their most recent deer hunting trip. Values were $298 for the general hunting enthusiast, $182 for specialist meat hunters, $471 for trophy hunters and $315 for the generalist meat hunters.

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CHAPTER I

INTRODUCTION

Objectives

This report presents a broad picture of both the qualitative and quantitative aspects of deer hunting in Montana. People who hunt deer in Montana are a very heterogeneous group. Some travel 3000 miles to hunt and others walk out their back door. Some spend $ 10 on a trip and others $ 2000. Some hunt for meat, some for trophies and others for less tangible reasons. This study presents trip characteristics, hunter characteristics, and expenditure data for several subgroups of hunters. The presentation of these descriptive statistics and trip values gains interpretive value when hunters are grouped by such factors as residency, trip type, and motivation for hunting. The qualitative dimension of this study assessed the values which deer hunters place on their current hunting trips as well as the value which they would place on trips which in some way had improved hunting opportunities. These specific improvements were doubling the chance of bagging a large buck, improving the chances of bagging a doe or small buck and allowing a second deer to be taken. Net economic values for hunters most current trip as well as for the three improved trip scenarios are presented for the entire sample, resident/nonresident and guided/nonguided subgroups and for the seven Montana DFWP administrative regions.

This study provides three primary contributions to existing data on Montana deer hunting (Brooks, 1988):

(1) Descriptive statistics are reported for hunter characteristics, trip characteristics and hunter management preferences.

(2) Changes in net economic values associated with improvements to the deer hunting experience are reported.

(3) Economic values are stratified by different types or "clusters" of hunters. These clusters define hunters with similar motivations, expectations and preferences.

Definition of Economic Benefits

The U.S. Water Resources Council Principles and Guidelines (1983) require many Federal agencies to employ net willingness to pay in measuring the value of both marketed and nonmarketed (e.g.,

recreation) resources. When performing natural resource damage assessments the U.S. Department of Interior mandates the use of net willingness to pay in calculation of societal gains and losses (U.S. Department of Interior, 1986). Additionally, the Bureau of Land Management (1982) also uses net willingness to pay in measuring the economic benefits of wildlife when performing cost benefit analysis. Use of net willingness to pay in cost benefit determinations is also recommended in current economic literature (Just, Hueth and Schmitz, 1982; Sassone and Schaffer, 1978).

Many recreationists, when asked if a specific recreational experience was worth more to them than they actually had to spend answer "yes". Net willingness to pay is a measure of that additional amount, over and above what they actually had to pay, which they believed the experience was worth. Therefore, net economic value or "consumer surplus" is the difference between what a person is willing to pay and what they actually must pay. This net willingness to pay is the measure of benefits associated with deer hunting which is used in this study.

CHAPTER II

MEASUREMENT OF NET WILLINGNESS TO PAY: THEORY AND METHODS

The two most widely used methods for estimating net willingness to pay for outdoor recreation are contingent valuation (CVM) and the travel cost model (TCM). These are also the two general methods recommended by the U.S. Water Resources Council (1983) for valuing recreation in federal cost benefit analysis.

While the Montana Deer Hunting Survey gathered the information necessary to make both CVM and TCM estimates of net willingness to pay only the CVM analysis was undertaken in this study. Brooks (1988) used travel cost methodology to estimate net willingness to pay for Montana deer hunting and the CVM application of this study complements Brooks' work.

The Contingent Valuation Method

In the CVM approach individuals are directly surveyed on their willingness to pay for the services of a given resource contingent on the existence of a hypothetical market situation. This flexible technique has been applied to a wide range of environmental and resource issues including air and water quality changes, scenic beauty, and wildlife (Cummings, Brookshire and Schultze, 1986). The only limitation of the method is the ability of the researcher to frame understandable questions and the ability and willingness of the respondents to accurately value the good or service. Bishop and Heberlein (1985) have described six key methodological choices in a CVM application: 1) target population, 2) product definition, 3) payment vehicle, 4) question format, 5) method of analysis and 6) supplemental data. The target population for this study is the direct users of deer hunting resources (Montana deer hunting license holders) while the product definition is a deer hunting trip.

It is generally agreed upon that the payment vehicle must be specified for the respondent. Mitchell and Carson (1981) suggest two criteria for an appropriate vehicle: realism and neutrality. For this study increases in deer hunting trip costs were used as the payment vehicle. This vehicle presented respondents with a realistic and emotionally neutral (as opposed to increases in taxes) payment method.

The question format used in the CVM in large part also determines the method of analysis to be used. The question format can be one of three basic types. First, the open-ended CVM is the simplest approach: respondents are asked their maximum willingness to pay for the use of a given resource. This approach can be administered at a low cost and is relatively easy to interpret.

A widely used alternative to the open-ended format is the iterative bidding game where interviewers ask respondents for a yes or no response to a specified bid amount. If the respondent is willing to pay that amount the bid is raised in increments until the persons maximum willingness to pay is reached. Iterative bidding is a costly question format which requires face to face or telephone contact between interviewers and respondents.

A third question format, the dichotomous choice approach, combines some of the better features of both open-ended and iterative bidding. In dichotomous choice, the individual is faced with a single specific dollar bid and (like bidding games) the response is a simple market-like yes or no. The dollar bid amount is systematically varied across respondents. This format is amenable to mail surveys and is therefore relatively low cost. This relatively new approach has been successfully applied to valuation of hunting permits (Bishop and Heberlein, 1980), boating and scenic beauty (Boyle and Bishop,1984), and beach recreation (Bishop and Boyle, 1985).

In this study the dichotomous choice approach was used to value deer hunting trips. Although there are advantages and disadvantages to each method recent research shows dichotomous choice models can provide fair approximations to actual market transactions (Bishop and Heberlein, 1980; Welsh, 1986). In general, comparisons of real markets to simulated CVM markets indicate that respondents attempt to give their true value of resources being studied. A discussion of the specific CVM questions asked and the application of CVM analysis to Montana deer hunting is presented in chapter 5.

Estimation of Willingness to Pay Using Dichotomous Choice CVM

The major disadvantage of the dichotomous choice method is that analysis is more complex than with open-ended or iterative bidding methods. In view of the considerable advancements in methods for modeling discrete choice (Amemiya, 1981) this complexity is manageable and acceptable when compared with the advantages which dichotomous choice CVM questions afford. These advantages include: a realistic market-like scenario and a high percentage of responses to the CVM questions.

Dichotomous choice methodology estimates expected maximum willingness to pay in two steps. In the first step, a logistic regression is run between the probability of a yes would pay $X response as the dependent variable and the amount $X as the independent or explanatory variable. Once this logit curve is estimated the area under that curve is the expected maximum willingness to pay.

CHAPTER III

DATA SOURCES

Questionnaire Administration

The questionnaire was administered by the Montana Department of Fish Wildlife and Parks after the 1988 general hunting season. The population targeted by the questionnaire was those people who had purchased a 1988 deer hunting tag or big-game combination license. An adaptation of Dillman's (1978) Total Design Method was used in conducting the mail survey. Hunters first received the questionnaire booklet (see Appendix A) and cover letter along with a stamped, addressed return envelope. One week later a postcard reminder was sent to those hunters not yet responding. Finally, a second copy of the questionnaire was sent to nonrespondents.

Response Rates

An initial sample of 5000 questionnaires was mailed to hunters. Residents received 4325 (86.5%) of the surveys and nonresidents 675 (13.5%). This division closely mirrors the actual percentages of resident and nonresident hunters.

Of the 5000 questionnaires mailed, 44 were undeliverable and 3328 were completed and returned. This response rate of 66.5% is comparable to other Montana hunting surveys (Loomis, Cooper and Allen, 1988; Brooks, 1988) and is quite acceptable for mail questionnaires. Of the 3328 completed questionnaires, 79 either did not hunt in 1988 or were returned too late to be included in the sample.

There was no nonresponse check conducted in this study. It is not possible, therefore, to know if the 33.5% who did not respond differed significantly from the 66.5% who did.

The final sample proportions were 18.8% nonresident and 81.2% resident. Since a larger percentage of nonresidents than residents returned questionnaires the nonresident population is slightly overrepresented in the sample. Rather than employ a weighting scheme to increase the resident percentage in the sample all important results are presented for each residency group.

CHAPTER IV

DESCRIPTIVE STATISTICS

The Montana Deer hunting survey contained many questions regarding characteristics of the hunters, the areas in which they hunted, and the last deer hunting trip which they took. The large sample size of this survey allowed the entire sample to be broken down into hunter subgroups and regional subgroups while still retaining large enough sample sizes to ensure meaningful interpretation of both descriptive statistics and economic models.

Hunter Characteristics

In addition to examining the sample in its entirety the responding hunters were categorized according to two dichotomizations; residents v. nonresidents and guided hunters v. nonguided. Table 1 shows the relationships between these four classifications. Guided hunters in this sample were predominantly a subset of nonresident hunters with roughly 25% of nonresidents employing big game hunting guides. Very few residents (less then 1%) employed guides for their hunts.

Table 2 summarizes the similarities and differences between hunters in the four subgroups. While the vast majority of all hunters were male, resident hunters had a lower percentage of males (85.5%) then did nonresidents (94.8%). Nonresidents and guided hunters spent significantly more time hunting deer each year than did residents. Those nonresidents and guided hunters also were twice as likely as the resident and nonguided hunters to belong to a conservation organization. Two characteristics, average age and percent who hunted with rifles, were fairly stable across subgroups. The percentage of hunters who were successful in killing a deer also is relatively stable across groups, but the information in Table 3 suggests some important differences between groups. While 15.9% of residents bagged other big game species on the same trip, the same statistic for nonresidents was 28.3% and for guided hunters 40.7%. These numbers suggest that a significant number of guided hunters in the sample were primarily guided for other species, elk in particular. One final comparison from Table 2 shows that average income varied widely between subgroups. The average income of guided hunters was nearly twice that of resident hunters. This differential would have surely been greater if response categories on the questionnaire had allowed for reporting of incomes in excess of $100,000.

Table 1

Montana Deer Hunting
Crosstabulation of Residency and Guide Classifications

Guided Hunters	164
Nonguided Hunters	2786
Total Hunters	2950
Resident Hunters	2395
Nonresident Hunters	555
Total Hunters	2950

Note: The total population of responding hunters was divided in two manners for analysis. In the first, the total population of 2950 hunters was divided into guided hunters and nonguided hunters, and in the second, the total population of 2950 was divided into residents and nonresidents.

Table 2

Montana Deer Hunting
Hunter Characteristics

Characteristic	Residents	Nonresidents	Guided	Nonguided
% of all Hunters	81.5	18.5	5.4	94.6
% male	85.5	94.8	94.6	86.7
Average age	37.29	42.10	43.01	37.80
Average Days Per Year Spent Hunting	10.73	18.39	20.12	11.56
% Belonging to a Conservation Club	24.4	55.5	63.3	27.9
% Successful in Killing Deer	63.9	68.8	62.7	65.1
% Rifle Hunters	93.3	91.3	91.1	93.0
Average Income	$28,767	$46,385	$56,806	$30,511

Table 3

Montana Deer Hunters
Percentage That Killed Other Big Game, by Species

Species	Residents	Nonresidents	Guided	Nonguided
Deer	63.9	68.8	62.7	65.1
Elk	9.2	17.4	27.2	9.6
Antelope	4.9	8.8	11.8	5.3
Bear	.2	.5	.5	.3
Other	1.6	1.6	1.2	1.7

Trip Characteristics

The trips which the hunters in the four classifications (resident/nonresident and guided/nonguided) took also show many differences. Table 4 shows that while the average number of round trip miles traveled by all hunters was 508, residents averaged 148 miles and nonresidents averaged 2252 miles. Table 4 also shows how the average number of deer seen, hunters seen, and days the trip lasted varied across the hunter subgroups. Nonresidents and guided hunters tended to see more deer on their trips than resident and nonguided hunters. However, those nonresidents also took longer trips which increased the probability of seeing more deer. Therefore, the average number of deer seen per day was relatively stable across groups. It also appears that the degree of perceived hunter congestion was stable across hunter groups with around 20% of each reporting seeing more hunters than they expected.

Table 5 is presented in order to compare hunter and trip characteristics across Montana Department of Fish, Wildlife and Parks Administrative Regions. There are significant differences in many of these characteristics.

Table 4

Montana Deer Hunting
Trip Characteristics

Characteristic	Residents	Nonresidents	Guided	Nonguided
Average Number of Miles Traveled	148	2252	2992	508
% Who Killed Other Big Game	15.9	28.3	40.7	16.9
Average Number of Deer Seen	44.6	78.9	79.9	49.0
Average Number of Days Per Trip	4.49	6.88	6.56	4.81
Ave. Number of Other Hunters seen	8.9	11.1	7.6	9.38
% Saying Number of Hunters was More than Expected	17.9	20.1	19.9	18.2

Table 5

Montana Deer Hunting
Characteristics by Montana DFWP Administrative Region

Characteristic	Region 1	Region 2	Region 3	Region 4
% Residents	85.0	86.7	81.2	82.9
% Guided	6.0	4.4	5.9	5.7
% Successful	58.6	55.6	53.3	68.6
% that Killed Other Big Game	8.3	19.6	26.9	16.2
# Deer Seen	25.8	27.43	59.12	57.1
# Days Per Trip	5.8	5.31	5.79	4.35
# Hunters Seen	10.05	10.66	13.47	8.51
% Bucks Killed	74.2	79.5	83.2	75.6
Sample Size	440	458	612	637

Characteristic	Region 5	Region 6	Region 7
% Residents	87.4	85.2	72.2
% Guided	4.9	1.0	7.7
% Successful	75.7	78.1	80.5
% that Killed Other Big Game	10.8	24.8	22.1
# Deer Seen	66.4	72.4	58.4
# Days Per Trip	3.47	4.37	4.55
# Hunters Seen	4.63	7.95	6.52
% Bucks Killed	76.7	78.3	79.1
Sample Size	305	289	298

Hunter Expenditure Data

Resident hunters spent an average of $112.64 for transportation, food, and miscellaneous purchases on their 4.49 day long trips (Table 6). This translates to an expenditure of $25.08 per day. Nonresidents and guided hunters paid substantially more per day for their hunting trips because of the long distances which they traveled, the added necessity for overnight lodging and guide fees. Nonresidents spent $1006.12 per trip or $146.23 per day, and guided hunters spent $1591.95 per trip or $242.67 per day. Finally, hunters in the nonguided subgroup spent $217.47 per trip or $45.21 per day.

Table 6

Montana Deer Hunting
Trip Expenditures by Hunter Subgroup

Category	Average Resident	Average Nonresident	Average Guided	Average Nonguided
Transportation	$ 33.03	$ 308.19	$ 410.67	$ 64.15
Food	30.21	242.57	345.42	56.48
Miscellaneous	49.40	455.36	835.86	96.84
Total	112.64	1006.12	1591.95	217.47
Per Day Expenditures	25.08	146.23	242.67	45.21

Hunter Management Preferences

Hunters were asked to answer several questions concerning their perception of deer management in Montana. Resident and nonguided hunters were much more likely than nonresidents and nonguided hunters to say that there were too many hunters in their hunting areas (Table 7). Those resident and nonguided hunters who said that there were too many hunters were much less likely than their nonresident, guided counterparts to say that they would accept restrictions on hunting to improve the situation. In general, resident and nonguided hunters felt that a lack of access to hunting areas affected their hunting more than nonresident and guided hunters did. Summary statistics are also presented for how hunters view the number of bucks in their areas, and what access they believe they should have for game retrieval purposes.

Table 7

Montana Deer Hunting
Management Preferences by Hunter Subgroup

	All	Res.	Nonres.	Guide	Nonguide
(1) % who said there were too many hunters	20.4	22.5	9.7	11.9	20.8
(2) Of (1), % who would Accept restrictions	66.3	65.5	74.2	94.7	65.6
(3) % who said access affects their hunting	51.7	53.6	43.0	35.5	52.6
(4) % who said the number of bucks was					
GOOD	26.1	24.8	31.7	37.2	25.4
OK	51.4	52.2	48.6	37.8	52.2
POOR	22.5	23.0	19.7	25.0	22.4
(5) of POOR % who would accept restrictions to improve # of bucks	71.9	70.8	78.1	81.5	71.5
(6) % who think these roads should be allowed for game retrieval					
ONLY OPEN*	47.6	47.6	48.1	58.3	47.2
OPEN AND CLOSED	29.1	29.5	26.9	20.5	29.6
OFF ROAD ALLOWED	23.2	22.9	24.6	21.1	23.2

* ONLY OPEN indicates that respondents believed game retrieval should be allowed only using open roads. OPEN AND CLOSED responses felt game retrieval should be allowed using open and closed roads. OFF ROAD ALLOWED responses felt off-road driving should be allowed for purposes of game retrieval.

CHAPTER V

MONTANA DEER HUNTING VALUATION ANALYSIS: MODEL SPECIFICATION AND ESTIMATION

Contingent Valuation Questions Asked

The Montana Deer Hunting Survey asked hunters to answer questions on a number of aspects of their most recent hunting trip. Questions were asked regarding their reasons for hunting and their opinions on the management of hunting areas, as well as questions on demographic and trip characteristics. A copy of the questionnaire is included in Appendix A. For economic modeling purposes, four contingent valuation questions were asked regarding the hunter's most recent trip. The first question asked the hunter to place a value on their most recent hunting trip. This question asked:

> Suppose that everything about this last hunt was the same except your share of the expenses had been $ X more, would you still have made this trip?

The hunter would answer this dichotomous choice CVM question by circling either Yes or No. The dollar amount $ X was one of 10 predetermined bid levels ranging from $ 5 to $ 2000. This amount was varied randomly across questionnaires.

Following this question was a set of three dichotomous choice CVM questions presenting hunters with hypothetical changes in their most recent trip and asking them how they would value those changes. These three hypothetical questions were as follows:

> Imagine that everything about this last trip was the same, except that your chances of bagging a mature buck were twice as great AND your trip costs to visit this site increased by $ X , would you still have made the trip?
>
> Imagine everything about this last trip was the same except your chances of killing a doe or small buck were really good and your trip costs increased by $ X . Would you still have made the trip?
>
> Now imagine that everything about your last trip was the same except that you would be able to bag an additional deer and your trip costs increased by $ X , would you still make the hunting trip to this area?

The goal of asking these three hypothetical questions was to determine hunters willingness to pay for alternative deer hunting opportunities. As in the current trip question, the dollar amount asked varied between $ 5 and $ 2000 among respondents.

Outlier and Protest Responses

In the analysis of CVM responses there are two groups of respondents who should be excluded from the sample before any analysis occurs. The first is that group who indicate a willingness to pay the stated bid amount but who would not actually be able to pay that amount given their income. The standard economic definition of demand requires both a willingness and an ability to pay. Therefore those respondents who indicate a willingness but lack the ability to pay the bid amount must be excluded as their response does not meet the constraints of economic theory. Ability to pay was determined by first calculating the percentage of their income which respondents were willing to spend on deer hunting. This was done as follows:

PERCENT = ((TOTAL + BID) * TRIPS) / INCOME

Where:
TOTAL = The amount they reported spending on their most recent trip.
BID = The dollar bid level asked.
TRIPS = The number of separate deer hunting trips they reported taking this season.
INCOME= Their reported annual income.

This percentage statistic was calculated for each of the four CVM questions. As an initial measure all respondents with a percentage figure greater than 1 were excluded since this group most obviously lacks the ability to pay. The percentages for the remaining respondents were then tabulated for each question giving the following results.

	Mean	Std.Dev.	Mean + 3 S.D.	N
PERCENT (Quest.1)	.051	.10	.351	873
PERCENT (Quest.2)	.049	.097	.340	905
PERCENT (Quest.3)	.043	.088	.307	605
PERCENT (Quest.4)	.044	.084	.297	749

Since the distribution of the calculated variable PERCENT was somewhat skewed rather than distributed normally a three standard deviation confidence interval was placed around the four calculated means in order to determine the cutoff limit for outlier exclusion. In total, 106 observations were eliminated from the following economic analysis due to a reported willingness to pay which exceeded the cutoff limits.

The second group of respondents who were excluded from the analysis were those whose responses reflected a "protest" to some aspect of the simulated market. The U.S. Water Resources Council has suggested that a followup question be asked to each CVM

question. In this survey that question was : "If no, would you have made the trip if your share of the expenses had been only $1 more? Following the "No" response to this question was: "if no, could you briefly explain why not." The responses to these questions were analyzed to develop categories of reasons for responding with a "No". Those hunters who indicated a valid reason for their zero willingness to pay were left in the sample. These valid reasons included:

* Respondents who could not afford a higher trip cost.
* Respondents saying they would hunt elsewhere if faced with increased trip costs.
* Respondents who indicated that the trip would just not be worth any more money.

A second group of respondents was excluded from the sample because their reasons indicated they were protesting the market setup rather than legitimately considering the question which was asked. These "protest" responses included:

* Respondents saying they didn't understand the questions.
* Respondents indicating opposition to any increased taxes, or fees.

Specification of the Model

Economic theory suggests that certain independent variables be included in estimated equations. These variables are trips, which in this context is a measure of preference, income, and the amount the respondent is asked to pay. Economic theory also suggests that other variables would influence the probability of a respondent answering "yes" to a CVM question. These variables include other variables measuring the tastes and preferences of the respondent, those measuring the quality of the trip, and those measuring the expectations of the respondents.

The specification of the logit equation to be estimated is shown in Equation (1). This specification relates the log of the odds of answering yes to a CVM question to a group of explanatory variables chosen by the above economic theory criteria on an *a priori* basis.

$$(1) \quad \ln(P/1-P) = B0 - B1 \ln(BID) + B2 \ln(INCOME) - B3 \ln(TRIPS) + B4 \ln(DRSEEN) - B5 \ln(HUNTERS) + B6 \ln(YRSHNT) + B7 (PURPOSE) + B8 (DRKILL) + B9 (CLUB) - B10 \ln(AGE)$$

Where:

P(Y)	=	Probability of stating a "yes" response.
BID	=	Dollar amount of increased trip cost the hunter was asked to pay.
INCOME	=	Hunter's household income.
TRIPS	=	Number of hunting trips to this area this year.
DRSEEN	=	Number of deer seen on this trip.
HUNTERS	=	Number of other hunters seen on this trip.
YRSHNT	=	Number of years hunter has been hunting deer.
PURPOSE	=	Dummy variable indicating hunting as main purpose of trip.
DRKILL	=	Dummy variable indicating hunter was successful in bagging a deer.
CLUB	=	Dummy variable indicating hunter belongs to a conservation organization.
AGE	=	Age of the hunter.
ln	=	Natural log of the previously defined variables.

$-1 < B3 < 0$

This specification, with perhaps the exception of one or two variables, should be valid for the three improved condition CVM questions as well as for the current trip question. Willingness to pay for improvements on the current trip may not be influenced by the number of other hunters seen or by the dummy variable indicating whether the hunter bagged his/her deer.

It may be noted that in Equation (1) all independent variables (except dummy variables) are logged. Previous applications have shown that this double-log model generally provides a better fit to dichotomous choice data

Estimated Equations

Using the data from the Montana DFWP deer Hunting Survey, equations were estimated for the entire sample as well as each of the aggregated subgroups. The hunter subgroups were residents, nonresidents, guided hunters and nonguided hunters. Each of these groups had models estimated for current conditions, for doubling chances of bagging a large buck, for a very good chance of bagging a doe or small buck and for the chance to bag a second deer. Tables 8 - 11 show the estimated models for the current conditions question as well as the three hypothetical questions. Table 8 shows the estimated equation for the probability of paying an increase in hunting costs for the current hunting conditions. All of the included variables for these equations are significant at the 90% level with most being significant at the 95 or 99% level. All variables with the exception of LHUNTERS and PURPOSE have the expected signs. Loomis, Cooper and Allen (1988) also found that the coefficient on LHUNTERS was consistently the opposite of what would be expected for a congestion variable. Perhaps this indicates that in the case of big game hunting in Montana, congestion is correlated with other positive aspects of the hunting experience. The PURPOSE dummy variable was expected to return a positive sign, indicating that those whose main purpose for taking the trip was to hunt would value the experience more highly. In the models where PURPOSE was significant, the opposite was true. This indicates that either the investigators *a priori* expectations about this variable were wrong or that the variable is measuring something other than was intended.

Table 9 shows the estimated models for the probability of paying a higher trip cost for doubling the hunters chances of bagging a mature buck. All of the entered variables in this model are significant to the 95% level and all have the expected signs with the exceptions noted above of LHUNTERS and PURPOSE.

Table 10 presents the estimates for the model which determines the probability of paying a higher trip cost for having a very good chance of bagging a doe or a small buck. The included variables are all significant at the 90% level, and all excepting PURPOSE and LHUNTERS have the expected sign.

Finally, Table 11 shows the estimated models for the probability of paying a higher trip cost for a chance of getting an extra deer. All included variables in these models are significant at the 95% level and all excluding LHUNTERS and PURPOSE have the expected sign.

Table 8

Montana Deer Hunting
Current Trip, Estimation by Hunter Group

Variable	Entire Sample	Residents	Nonres.	Guided	Nonguided
Constant	1.009	3.8378	-3.5533	-4.2878	2.2360
(T-Stats)	(1.43)	(15.61)	(-1.98)	(-1.14)	(2.77)
LBIDTRIP	-.8868	-.9277	-.9321	-1.0049	.8916
	(-24.02)	(-22.29)	(-9.22)	(-4.98)	(-23.56)
LINCOME	.2506	--	.8485	.09525	.1661
	(3.36)		(4.81)	(2.71)	(2.15)
LTRIPS	-.3012	-.1200	--	--	-.2459
	(-5.03)	(-1.75)			(-3.99)
LDRSEEN	.1031	.0739	--	--	.1178
	(4.12)	(2.56)			(4.37)
LHUNTERS	.0212	.0370	--	--	.0337
	(2.09)	(3.05)			(3.10)
LYRSHNT	.1085	--	--	--	--
	(1.99)				
PURPOSE	--	-.1890	--	--	-.1608
		(-1.94)			(-1.87)
DRKILL	--	.1227	--	--	--
		(1.82)			
CLUB	.2730	.1867	--	--	.2753
	(4.78)	(2.70)			(4.60)
LAGE	--	--	--	--	--
Sample Size	2534	2054	462	146	2381

Table 9

Montana Deer Hunting
Double Chance of Buck, Estimation by Hunter Group

Variable	Entire Sample	Residents	Nonres.	Guided	Nonguided
Constant	3.4439	5.3863	- 4.226	9.7235	2.7097
(T-Stats)	(13.05)	(7.90)	(-2.05)	(5.43)	(2.80)
LBIDTRIP	-.9153	-.9005	-1.2513	-1.0049	-.9179
	(-24.56)	(-22.90)	(-10.06)	(-4.98)	(-24.44)
LINCOME	.3140	--	1.0107	--	.2854
	(3.36)		(4.95)		(3.55)
LTRIPS	-.2619	-.1200	--	-3.297	-.1943
	(-4.30)	(-1.75)		(-3.24)	(-3.14)
LDRSEEN	.1166	.0965	--	--	.1229
	(3.89)	(3.19)			(4.11)
LHUNTERS	--	--	--	--	--
LYRSHNT	--	.2045	--	--	.2440
		(2.22)			(2.83)
PURPOSE	--	--	--	--	--
DRKILL	--	--	--	--	--
CLUB	.3258	.2098	.3553	--	.2525
	(5.64)	(3.10)	(2.75)		(4.18)
LAGE	--	-.6584	--	--	-.6924
		(-3.00)			(-3.35)
Sample Size	**2454**	**2060**	**464**	**145**	**2391**

Table 10

Montana Deer Hunting
Good Chance of Doe, Estimation by Hunter Group

Variable	Entire Sample	Residents	Nonres.	Guided	Nonguided
Constant	3.0805	3.2303	4.6240	.7853	3.1833
(T-Stats)	(14.25)	(14.16)	(2.79)	(1.469)	(3.20)
LBIDTRIP	-.8356	-.8838	-.6564	-.3315	-.8700
	(-23.5)	(-21.6)	(-9.58)	(-3.23)	(-23.39)
LINCOME	--	--	--	--	--
LTRIPS	-.2703	-.1851	--	--	-.2422
	(-4.10)	(-2.47)			(-3.56)
LDRSEEN	.0496	--	--	--	.0551
	(1.74)				(1.83)
LHUNTERS	--	.0248	--	--	.0210
		(1.92)			(1.77)
LYRSHNT	--	--	--	--	--
PURPOSE	-.2164	-.2055	--	--	-.2470
	(-2.31)	(-1.96)			(-2.63)
DRKILL	--	--	--	--	--
CLUB	.1863	.1275	.2113	--	.1814
	(2.99)	(1.72)	(1.76)		(2.79)
LAGE	--	--	-1.034	--	--
			(-1.96)		
Sample Size	2447	2055	459	140	2383

Table 11

Montana Deer Hunting
Chance of Extra Deer, Estimation by Hunter Group

Variable	Entire Sample	Residents	Nonres.	Guided	Nonguided
Constant	5.1176	5.5852	-2.2527	4.5345	3.1171
(T-Stats)	(8.61)	(9.00)	(-1.11)	(5.30)	(3.20)
LBIDTRIP	-.9883	-.9844	-1.0477	-.8278	-.9959
	(-24.82)	(-22/70)	(-10.65)	(-5.35)	(-24.51)
LINCOME	.3331	--	.6460	--	.2691
	(3.20)		(3.30)		(3.06)
LTRIPS	-.2400	--	--	-2.07	-.1803
	(-3.61)			(-2.11)	(-2.69)
LDRSEEN	.0855	--	.1767	--	.0695
	(3.04)		(2.46)		(2.48)
LHUNTERS	--	--	--	--	--
LYRSHNT	--	--	--	--	--
PURPOSE	-.2858	-.3257	--	--	-.3002
	(-2.95)	(-3.04)			(-3.11)
DRKILL	--	--	--	--	--
CLUB	.2783	.1776	.3237	--	.2594
	(4.40)	(2.38)	(2.55)		(3.94)
LAGE	-.4180	-.4612	--	--	-.4705
	(-2.80)	(-2.95)			(-3.13)
Sample Size	**2425**	**2037**	**457**	**143**	**2360**

Benefit Estimates

Three alternative measures of willingness to pay are presented for the deer data. The mathematical expectation (mean) of maximum willingness to pay is first presented and is labeled MEAN-LOGIT. The bivariate forms of the estimated equations (showing the probability of a "yes" response as a function of the bid amount) can be graphed with the probability of acceptance on the vertical axis and the bid amount on the horizontal axis. This graphing shows a high probability of acceptance at low bid amounts. This probability declines and asymptotically approaches zero at high bid amounts. The MEAN-LOGIT is obtained by integrating the logit function from a bid level of zero to some upper limit. The mean of the logit corresponds to the area under the two dimensional curve and thus it can be intuitively interpreted as the probability of a "yes" times the bid amount. In this study the models were estimated using a bivariate specification and the MEAN-LOGIT calculation was based upon this bivariate form (the bivariate specifications of all models used in this study are shown in Appendix B). The upper limit of integration to be used in the MEAN-LOGIT calculation is the uppermost bid level asked, or $2000. While there is no clear basis for choosing an upper limit of integration it is inappropriate on statistical grounds to extrapolate beyond the range of the sample data (in this case $2000).

The second measure of willingness to pay presented here is the median of the distribution (labeled MEDIAN). The median is simply the point where the probability of acceptance equals .5. Solving the bivariate estimates of the equations for P=.5 yields a median which is equal to the antilog of the calculated intercept over the slope coefficient on bids.

A final measure of willingness to pay is calculated using a nonparametric estimation technique suggested by Duffield and Patterson (1990). As stated before, the mean of the logit can be intuitively interpreted as the probability of a "yes" times the bid amount. The nonparametric technique explicitly calculates this mean from the bid levels and the responses to those levels. The use of this nonparametric technique sidesteps a constraint of the logit mean by allowing the calculation of a sample variance and hence the construction of confidence intervals around the calculated mean.

Table 12 shows willingness to pay for each of the three measures (MEAN-LOGIT, MEDIAN, and NONPARAMETRIC) for the current conditions question. These statistics are reported for the entire sample as well as for each of the four hunter subgroups. Although there are significant differences between hunter subgroups, it appears that the surveyed trips are relatively valuable to all hunters. It is interesting to note that the estimated MEAN-LOGIT and the calculated NONPARAMETRIC mean are

Table 12

Montana Deer Study
State Average Net Economic Values Per Trip and Per Hunter Day
Current Trip Question

PER TRIP VALUES:

Method	State	Residents	Nonres.	Guided	Nonguided
MEAN-LOGIT	$ 301.51	208.74	705.85	799.99	269.05
MEDIAN	$ 72.97	52.14	343.30	486.21	65.01
NONPARAMETRIC	$ 311.34	229.20	652.17	785.45	281.87

PER DAY VALUES:

Method	State	Residents	Nonres.	Guided	Nonguided
MEAN-LOGIT	$ 61.40	46.48	102.44	122.02	55.81
MEDIAN	$ 14.86	11.61	49.82	74.16	13.49
NONPARAMETRIC	$ 63.41	51.04	94.65	119.81	58.48

consistently quite close. It is not surprising that the guided and nonresident hunters whose average incomes were substantially greater than those of the resident and nonguided group placed a substantially higher value on their hunting experiences. Following the willingness to pay statistics are the per hunter day valuations for each of the three methods. Again, allowing for the longer average length of trip for the nonresident and guided hunters there is a substantial difference between the values which they place on the experience and those of the resident and nonguided subgroups.

As in many other studies, the estimated median values are much lower than the estimated mean values. This indicates that the distribution of willingness to pay is skewed with a greater proportion of individuals being willing to pay high values (compared to a normal bell-shaped curve). The median indicates the minimum amount that at least 50 percent of the population would be willing to pay. However, for purposes of aggregation (such as estimating the total benefits of Montana deer hunting) the mean is the correct measure. See Duffield and Patterson (1990) for further discussion regarding choice of welfare measures.

Analysis of Values Across CVM Questions

One of the major objectives of the Montana DFWP Deer Hunting Survey was to estimate net economic values for the current trip under three scenarios of hypothetically improved conditions. Specifically, these improvements were (1) doubling the hunters chance of bagging a mature buck, (2) increasing the hunters chances of bagging a doe or small buck, and (3) allowing the hunter to bag an extra deer on his/her trip. The results of the economic analysis of these three questions (presented in Table 14) proved to be unexpected and somewhat problematic. The problems did not stem from a qualitative interpretation of values returned, but rather from their magnitudes. Table 13 shows that per trip net economic values were very consistent in their ranking across questions. Doubling chances for a mature buck was valued highest, the chance for an extra deer was valued slightly lower, and a good chance for a doe or small buck was valued significantly below both. The consistency of these responses suggests that Montana deer hunters place very different values on alternative deer hunting experiences. This is consistent with the investigators expectations. What is, however, unexpected is that nearly all of the improved condition questions returned net economic values which were lower than for the current conditions question. There are two possible reasons for this. First, this may simply indicate that Montana deer hunters are, on a whole, satisfied with current hunting conditions and do not view the improved condition scenarios as important to their enjoyment of the current trip. While it is likely that this type of hunter satisfaction plays a role in explaining the differences between

Table 13

Montana Deer Hunting
Net Economic Values Per Trip
Improved Condition Scenarios

PER TRIP VALUES:

DOUBLE CHANCE OF MATURE BUCK

Method	State	Resident	Nonres.	Guided	Nonguided
MEAN-LOGIT	$ 260.92	202.50	490.72	618.00	235.30
MEDIAN	$ 69.70	51.06	224.96	379.40	60.75
NONPARAMETRIC	$ 262.75	213.89	465.96	566.80	243.19

GOOD CHANCE OF DOE OR SMALL BUCK

Method	State	Resident	Nonres.	Guided	Nonguided
MEAN-LOGIT	$ 154.06	123.41	302.11	419.77	140.06
MEDIAN	$ 25.22	23.41	37.76	20.94	25.38
NONPARAMETRIC	$ 157.76	129.39	281.88	332.18	147.25

CHANCE OF AN EXTRA DEER

Method	State	Resident	Nonres.	Guided	Nonguided
MEAN-LOGIT	$ 197.61	150.66	406.56	600.55	176.89
MEDIAN	$ 49.08	37.06	153.95	231.49	45.02
NONPARAMETRIC	$ 214.36	166.10	427.08	639.84	190.90

the current and improved conditions trip values, the values might also be influenced by responses from hunters who were hunting other species in addition to deer.

While the Montana Deer Hunting Survey effectively identified those hunters whose trip was made primarily for the purpose of hunting, the distinction was not made between those primarily hunting deer and those who might primarily be hunting elk or another big game species while at the same time be willing to shoot a deer if the opportunity arose. Respondents were explicitly asked (see section II and Appendix A) about "your last deer hunting trip", and over 60 percent of respondents did bag a deer; however, this does not preclude the possibility that elk were the primary objective of the hunting trip. Two statistics from the survey data give credence to the possibility that a substantial number of elk hunters were included in the survey.

The average number of days which resident hunters report having spent on their most recent trip is more than double the number of days per trip found in a previous DFWP deer study (Brooks 1988). Brooks found that resident hunters spend an average of 1.98 days per trip hunting deer. This makes intuitive sense since a large number of residents engage in only day or weekend deer hunts. The average number of resident days found in this study was 4.49 suggesting that a substantial number of these trips were made for the purpose of hunting elk which generally requires a larger commitment of time and energy and is taken somewhat more seriously by hunters. This difference may also be in part because Brooks (1988) was based on a telephone survey where a list of all hunting trips for the season was obtained from the respondent. The detailed trip information was then asked about one specific trip selected at random. In this study (as in Loomis, Cooper and Allen (1988)), the constraints of using a mail survey required that the specific trip selected for detailed information was the "most recent" or "last" hunting trip. The last hunting trip is more likely to have been a successful trip (and success is in part a function of the length of the trip). This may also in part explain the difference in days per trip between Brooks (1988) and the current study.

Nonresidents in Brooks' study spent an average of 6.32 days per trip compared to 6.89 days in this study. There is reason to believe that the number of days nonresident deer and elk hunters spend on their trips is relatively equal. Nonresidents, particularly those who are also guided, tend to commit a week to hunting Montana regardless of the species they are hunting (the possible exceptions are those nonresidents living near their desired hunt areas).

More indicative of a possible "elk hunter bias" in the sample is the statistic showing the percentage of each hunter subgroup to bag an elk on their most recent trip. The data showed that 9.2%

of resident hunters reported bagging an elk on their trip. Statewide the success rate in recent years for elk hunters is approximately 19%. This suggests that a significant proportion of responding resident hunters were on trips where elk hunting was at least as important as deer hunting. As was reported previously, over 27% of guided hunters in the sample bagged elk on their trip. This indicates that a majority of these hunters were being primarily guided for elk.

Even if we conclude that a large number of elk hunters were included in the deer survey responses, interpretation of the magnitudes of the improved conditions values remains problematic. This conclusion, however, would make possible an explanation which has intuitive appeal, even though it lacks strict quantitative rigor. If the net economic values for the current trip estimation were influenced by elk hunters the improved condition questions (which dealt exclusively with improvements in deer hunting conditions) might have been viewed as relatively unimportant in the context of their elk hunting trip. The values which they placed on these improvements might therefore have been discounted. With hindsight, it would have been advisable to ask respondents what species was the primary objective of their hunt.

Analysis of Values Across Regions

In addition to the models estimated for the entire state and for the four hunter subgroups, models were estimated for each of the seven DFWP administrative regions. Table 14 shows that there is relative stability of values across the regions for the four CVM questions. Indeed, an analysis of confidence intervals calculated for the nonparametric mean show that no statistical difference between regions exists at the 95% level of confidence. As was the case for the entire sample and for the hunter subgroup samples the net economic values for the three improved conditions questions were consistently ranked, but consistently lower than for the current conditions question.

While the values for the seven regions still show the disparity between the current trip values and the improved conditions values that was discussed above, they also provide support for the magnitudes of the values as applied to deer hunting. Of particular interest are the values for regions 6 and 7. In 1989 the total elk harvest for regions 6 and 7 were 299 and 40, respectively. With such a low harvest of elk, it seems certain that "elk hunter bias" did not play a role in inflating the net economic values of deer hunting from these regions. Region 7, with the lowest incidence of elk hunting, nevertheless, shows the highest values for the current trip question.

Analysis of Dispersion Around Nonparametric Means

As was mentioned previously, a nonparametric mean suggested by Duffield and Patterson (1989) was calculated for each of the estimated equations. The use of this nonparametric technique allowed the calculation of a sample variance and thus the construction of confidence intervals around the calculated means. A comparison of the estimated logit means and the nonparametric means shows them to be quite close in most cases.

Table 15 shows the nonparametric means and 95% confidence intervals for each of the four CVM questions for the entire sample and the four hunter subgroups. An analysis of these figures shows significant variation between hunter subgroup as well as between certain improved conditions values.

Table 16 shows the same calculated statistics for each of the seven Montana DFWP administrative regions. As was mentioned before, an analysis of the 95% confidence intervals surrounding the nonparametric means for the seven regions shows no significant difference in net economic value for deer hunting experiences.

Table 14

Montana Deer Study
Montana Deer Hunting Values by Region

Region 1

	Current Condition	Mature Buck	Doe or Small Buck	Extra Deer
Constant	4.1367	4.0176	2.3179	3.6616
BID Coeff.	-.9616	-.9397	-.7739	-.9523
MEAN-LOGIT	258.41	223.68	151.90	190.07
MEDIAN	73.84	61.59	19.98	46.75
NONPARAMETRIC	314.75	253.41	153.36	235.53

Region 2

	Current Condition	Mature Buck	Doe or Small Buck	Extra Deer
Constant	3.1894	3.7862	2.6712	3.2505
BID Coeff.	-.7858	-.9397	-.8637	-.9361
MEAN-LOGIT	284.16	220.49	131.99	149.48
MEDIAN	57.90	56.21	22.03	32.21
NONPARAMETRIC	269.47	206.17	123.28	175.33

Region 3

	Current Condition	Mature Buck	Doe or Small Buck	Extra Deer
Constant	3.2487	3.5068	2.9427	3.1222
BID Coeff.	-.7565	-.8425	-.8566	-.8205
MEAN-LOGIT	339.77	277.48	169.13	229.90
MEDIAN	73.28	64.22	31.04	44.93
NONPARAMETRIC	340.92	265.77	187.89	237.36

Table 14 Cont.

Montana Deer Study
Montana Deer Hunting Values by Region

Region 4

	Current Condition	Mature Buck	Doe or Small Buck	Extra Deer
Constant	3.8784	4.3255	2.9932	3.9715
BID Coeff.	-.8913	-1.038	-.8896	-.9929
MEAN-LOGIT	292.30	212.68	151.11	200.08
MEDIAN	77.58	64.45	17.37	54.59
NONPARAMETRIC	300.73	203.41	164.56	218.68

Region 5

	Current Condition	Mature Buck	Doe or Small Buck	Extra Deer
Constant	3.5708	3.4922	2.1143	4.0298
BID Coeff.	-.8749	-.8314	-.7405	-1.086
MEAN-LOGIT	251.24	288.70	151.30	140.21
MEDIAN	59.23	66.71	17.37	40.82
NONPARAMETRIC	264.39	280.38	150.48	141.53

Region 6

	Current Condition	Mature Buck	Doe or Small Buck	Extra Deer
Constant	4.6196	4.0181	3.2964	4.4245
BID Coeff.	-1.018	-.8939	-.9291	-1.047
MEAN-LOGIT	285.11	319.26	159.81	220.13
MEDIAN	93.53	89.57	34.74	68.49
NONPARAMETRIC	322.45	332.27	150.83	246.00

Table 14 Cont.

Montana Deer Study
Montana Deer Hunting Values by Region

Region 7

	Current Condition	Mature Buck	Doe or Small Buck	Extra Deer
Constant	3.2246	4.5389	2.4954	4.3207
BID Coeff.	-.7229	-.9771	-.8215	-.9899
MEAN-LOGIT	389.09	320.54	139.70	260.65
MEDIAN	86.54	104.09	20.85	78.63
NONPARAMETRIC	343.18	350.32	162.00	256.21

Table 15

Montana Deer Hunting
Nonparametric Means and Confidence Intervals

CURRENT TRIP QUESTION

Sample	Mean	Lower C.I.[1]	Upper C.I.
Entire Sample	$ 311.34	$ 281.43	$ 341.25
Residents	229.20	200.27	258.14
Nonresidents	652.17	558.98	745.35
Guided	785.45	606.21	964.69
Nonguided	281.87	252.53	311.21

DOUBLE CHANCE OF MATURE BUCK

Sample	Mean	Lower C.I.[1]	Upper C.I.
Entire Sample	$ 262.75	$ 235.79	$ 289.71
Residents	213.89	185.92	241.86
Nonresidents	465.96	394.59	537.33
Guided	566.80	444.45	689.15
Nonguided	243.19	215.98	270.39

[1] Calculated confidence intervals are set at the 95% level of confidence.

Table 15 Cont.

Montana Deer Hunting
Nonparametric Means and Confidence Intervals

GOOD CHANCE OF DOE OR SMALL BUCK

Sample	Mean	Lower C.I.[1]	Upper C.I.
Entire Sample	$ 157.76	$ 136.52	$ 179.00
Residents	129.39	108.43	150.35
Nonresidents	281.88	216.04	347.73
Guided	332.18	204.03	460.33
Nonguided	147.25	126.13	168.37

CHANCE OF AN EXTRA DEER

Sample	Mean	Lower C.I.[1]	Upper C.I.
Entire Sample	$ 214.36	$ 188.45	$ 240.27
Residents	166.10	141.27	190.92
Nonresidents	427.08	341.35	512.82
Guided	639.84	427.91	851.77
Nonguided	190.90	166.42	215.38

Table 16

Montana Deer Hunting
Nonparametric Means and Confidence Intervals

CURRENT TRIP QUESTION

Region	Mean	Lower C.I.[1]	Upper C.I.
1	$ 314.75	$ 224.08	$ 405.41
2	269.47	199.34	339.59
3	340.92	272.05	409.79
4	300.73	238.48	362.98
5	264.39	171.83	356.96
6	322.45	216.14	428.75
7	343.18	259.32	427.03

DOUBLE CHANCE OF A MATURE BUCK

Region	Mean	Lower C.I.[1]	Upper C.I.
1	$ 253.41	$ 179.93	$ 326.89
2	206.17	149.49	262.84
3	265.77	205.30	326.24
4	203.41	157.88	248.94
5	280.38	189.63	371.12
6	332.27	223.16	441.38
7	350.32	248.98	451.67

Table 16 Cont.

Montana Deer Hunting
Nonparametric Means and Confidence Intervals

GOOD CHANCE OF DOE OR SMALL BUCK

Region	Mean	Lower C.I.[1]	Upper C.I.
1	$ 153.36	$ 92.91	$ 213.81
2	123.38	81.51	165.06
3	187.89	129.39	246.40
4	164.56	116.16	212.96
5	150.48	87.02	213.94
6	150.83	96.59	205.06
7	162.00	85.92	238.08

CHANCE OF AN EXTRA DEER

Region	Mean	Lower C.I.[1]	Upper C.I.
1	$ 235.53	$ 152.97	$ 318.09
2	175.33	110.05	240.60
3	237.36	174.71	300.02
4	218.68	162.07	275.29
5	141.53	91.03	192.04
6	246.00	143.31	348.71
7	256.21	170.16	342.26

Comparison of Results to Previous Studies

The results of this study can be compared to several other Montana big game hunting studies. Since questions remain as to whether this study was successful in isolating only deer hunters in its sampling process, comparisons will be made with previous elk hunting studies as well as those for deer hunting.

Brooks (1988) undertook a travel cost model analysis of Montana deer hunting (see Dwyer, Kelly and Bowes (1977) for a discussion of travel cost methodology). His study was based on a sample of 1,031 Montana deer hunting license holders and used a reported cost of 37 cents per mile in the calculation of net economic values. Brooks found a per trip value for Montana deer hunting of $ 108.00, and a per day value of $ 54.94.

Also in 1988 Duffield undertook another TCM study of Montana elk hunting as a companion to Brooks' deer study. Duffield's study was based on a sample of 553 hunters whose main purpose was elk hunting. This study, which utilized a reported cost of 42.2 cents per mile found that the average Montana elk hunting trip has a net economic value of $ 184.56 per trip or $ 65.58 per day.

Loomis, Cooper, and Allen (1988) studied Montana elk hunting using both open ended CVM and dichotomous choice CVM methodology. Using a sample size of 5,000 Montana elk hunting license holders they found a per trip mean net economic value of $ 262.31 for the dichotomous choice question, $ 93.61 for the open ended CVM question and $ 72.27 for the median of the dichotomous choice responses. These values translate into per day values of $ 39.90 for the mean logit, $14.24 for the mean open ended CVM and $ 10.99 for the median logit. Loomis *et al.* used an upper integration limit of $ 1100 for the calculation of their mean logit values.

Loomis, Creel and Cooper (1989) conducted a study of the economic value of deer hunting in California using a dichotomous choice CVM methodology and found a statewide average net economic value of $ 191.45 per trip, or $68.73 per day.

Table 17 shows a comparison of the current studies results with those of the studies mentioned above. Each studies values are reported in the study years dollars so comparison across studies must be made with care. A comparison of the per day values of Table 17 show that the current study values are comparable to the results of other deer hunting valuation studies. The per day comparison is more appropriate given the difference in days per trip across studies as discussed previously. This lends a degree of validation to the magnitudes of the values reported here. It should be noted that the benefit estimates for the contingent

valuation models are sensitive to the upper limit of integration. The upper limit for the two Montana CVM studies were based on the maximum bid amount asked : $1100 for Loomis *et al.* (1988) on elk and $2000 for the current study on deer. When the Loomis *et al.* (1988) is extrapolated to a $2000 integration limit and corrected for inflation, the per day value is very similar to the results of the current study.

The maximum bid amount was increased to $2000 for the current study because of the relatively high proportion of respondents who were willing to pay up to $1100 in the previous surveys.

Table 17

Montana Deer Hunting
Comparison of Results With Previous Big Game Studies

Method / Study	Value Per Trip (Study Year Dollars)	Value Per Day
Travel Cost Method		
Duffield (1988) Elk	$ 184.56	$ 65.58
Brooks (1988) Deer	$ 108.00	$ 54.94
Contingent Valuation Method		
Loomis *et al.*(1988) Elk	$ 262.31	$ 39.90
Current Study Deer ($2000 integration limit)	$ 301.51	$ 61.40
Loomis *et al.*(1989) Deer	$ 191.45	$ 68.73

Note:1) For travel cost models, the cents per mile factor was: Duffield (1988) 42.2 cents/mile reported cost. Brooks (1988) 37 cents/mile reported cost.

2) Note that Loomis *et al.* (1989) is for deer hunting in California, all other studies are for Montana hunting experiences.

3) For the contingent valuation models, the benefits are sensitive to the upper limit of integration. Loomis *et al.* (1988) used a $1100 upper limit of integration because this was the highest bid amount asked. In the current study, the maximum bid amount was $2000. Results for Loomis *et al.* (1988) when extrapolated to a $2000 bid limit and corrected for inflation are nearly identical to the current studies per day values.

CHAPTER VI

MARKET SEGMENTATION: CLUSTER ANALYSIS OF HUNTER TYPES

Market Segmentation

The mean net economic values presented thus far are useful in gaining an understanding of how the average deer hunter values his/her recreational experiences. Further, the values which hunter subgroups place on their trips illuminate differences across such things as residency and guided, nonguided status. Useful as these groupings are, they nevertheless mask very real differences and similarities between hunters and their motivations for and expectations about hunting. There is no truly average deer hunter, and even though such subgroups as guided hunters share many of the same motivations, the term "average guided hunter" remains a statistical construct of questionable meaning.

Individuals hunt for personal reasons, but this does not preclude many individuals from sharing similar reasons for hunting. As pointed out by Allen (1987), research suggests that there are several methods available for identifying different "types" of hunters within a sample. By identifying what "type" a hunter is it becomes possible to attach dollar values not just to deer hunting but to various types of deer hunting experiences.

Cluster Analysis Design

The cluster analysis used in this study was meant to isolate subgroups, or "types", of deer hunters who defined their hunting experience similarly. By understanding their collective motivations for hunting we are better able to understand the basis upon which they value their experiences. Cluster analysis attempts to define subgroups of hunters which have significantly different, yet conceptually meaningful characteristics. The application of clustering used in this study follows closely that suggested by Allen (1988) in his cluster analysis of Montana elk hunters.

The Montana deer hunting data had a large number of cases (in excess of 2500) and therefore the SPSSx Quick Cluster program, which efficiently clusters large files, was used. This program sorts cases based on their Euclidean distance from cluster centers which have been chosen from well distanced cases. The clustering was performed on eight questions which asked hunters to rate in importance reasons for hunting and factors which influenced where they decided to hunt. These questions were

chosen *a priori* as the most efficient variables in identifying distinct hunter types. Reasons which a majority of hunters rated similarly were not used in the clustering since these variables provide little help in drawing distinctions between hunter groups.

The SPSSx Quick Cluster program does not select a specific number of clusters statistically. The programmer must pick the desired number. Allen (1988) discussed three criteria for determining the optimal number of clusters.

(1) The number of observations in each cluster must be large enough to allow economic analysis (about 100 observations).
(2) The clusters should be different enough to define distinct hunter subgroups, yet they must conceptually make sense.
(3) The smallest number of clusters which does not mask important differences between types of hunters is preferred.

Both in his study of Montana anglers (1987) and that of Montana elk hunters (1988) Allen chose to use four clusters for grouping recreationists. For this study, clusters of 2, 3, 4, and 5 were run and since sample size criteria were met in all cases an optimal number of clusters was first selected based on maximum average distance between cluster centers. This basis also yielded a cluster size of four. These clusters were then analyzed to determine whether the groupings made conceptual sense. It was found that two of the four hunter groupings were very distinct and easily labeled. These were Meat Hunters and Trophy Hunters. Two questions which asked respondents to rank the importance of taking a trophy deer were included in the clustering process. Respondents consistently ranked these two questions similarly. This suggests that respondents took the clustering questions seriously. Meat Hunters and Trophy Hunters responded in opposite ways to the trophy and meat questions making their basic motivations easy to identify. The remaining two clusters could perhaps best be termed as two Generalist types of hunters. One cluster which we termed the Generalist-Enthusiast ranked the importance of all reasons for hunting highly. This group seemed motivated by nearly all aspects of the hunt (meat, trophies, testing skills, easy access). The second Generalist class which we termed the Generalist-Meat hunter seemed most motivated by good access to the hunt and the fact that they had a special permit to hunt an area. Besides these factors they ranked meat as a major motivation and trophies as relatively unimportant.

One source of validation for the clustering process lies in examining how the different cluster groups compare in regard to characteristics not used in the clustering process. If the clusters were indeed distinct subgroups we would expect that

differences would exist between the groups in many areas. Our

Table 18

Montana Deer Hunting
Comparison of Hunter Characteristics Across Clusters

	CLUSTER			
	1	2	3	4
Total dollars spent on hunting trip	$ 238.73	95.65	239.85	610.19
Average income	$ 30,151	27,043	32,784	41,421
Percent hunting on guided trips	4.2 %	1.0 %	2.2 %	14.6 %
Percent who rate hunting as their favorite activity	13.4 %	8.4 %	9.1 %	20.6 %
Percent who belong to a sportsmans organization	31.3 %	20.7 %	32.9 %	44.6 %

Note: Cluster 1 = Generalist-Enthusiast Hunter
Cluster 2 = Meat Hunter
Cluster 3 = Generalist-Meat Hunter
Cluster 4 = Trophy Hunter

analysis showed significant variation between clusters on several of the characteristics which we examined. Table 18 shows how clusters compare across several hunter characteristics.

Description of Hunter Types

Generalist-Enthusiast Hunters These hunters seemed to enjoy nearly every aspect of the deer hunting trip. The three highest rated reasons which they gave for hunting were "for the meat", "for a chance at a big trophy", and "to test my hunting skills". Lowest of importance to this group was having a special permit to hunt an area.

Meat Hunters Hunters in this cluster seemed most interested in "getting in the meat", and doing this as cheaply and easily as possible. These hunters rated hunting for the meat as their most important motivation and hunting close to home as second in importance. Table 19 shows that on the average this group spent less than half of what the two generalist clusters spent on their trips and less than one sixth what Trophy Hunters spent. This supports the suggestion that this group views meat as a major goal of their trips. Meat Hunters rate hunting for trophies and permit hunting as of low importance .

Generalist-Meat Hunters This group seems to be somewhat opportunistic in their reasons for hunting. The two highest rated reasons given by this group were good road access to the area and because they had a special permit to hunt the area. Also important to this group was hunting for meat. The Generalist-Meat Hunters rated distance from home and trophy hunting as their least important motivations for taking the trip.

Trophy Hunters These hunters were most interested in bagging a trophy buck and testing their skills along the way. This was the only group of hunters to rate bagging a trophy as more important than hunting for meat. Access, hunting close to home, and having a special permit were all relatively unimportant to this group.

Economic Analysis of Cluster Groupings

The SPSSx clustering procedure attaches a variable to each observation which indicates to which cluster it belongs. The sample sizes of the final cluster groupings were as follows: Generalist-Enthusiast = 699 (27%), Meat Hunters = 923 (35.6%), Generalist-Meat Hunters = 363 (14%) and Trophy Hunters = 606 (23.4%). It must be pointed out that the resulting cluster sizes and types are highly dependent on the selection of variables used in the clustering process. To regroup the hunters using different variables or different data would no doubt change the

cluster makeup.

Multivariate logit equations were estimated for each of the four clusters as well as for each of the CVM questions. Tables 19-22 present the results of these estimations. Table 19 shows the estimated equations for the current conditions CVM question. All included variables in the estimated equations are significant at the 95% level of confidence. Additionally, with the exception of LHUNTER, all have the expected sign. the coefficient on LTRIPS, where included in the models, meets the requirements necessary for consistency with economic theory. The equations for the "double chance of a large buck" models are shown in table 20. All included variables in those models are significant at the 90% level with most significant at the 95% level. With the exception of the dummy variable PURPOSE all show the expected signs. Table 21 shows the estimated models for the "good chance of a doe or small buck" CVM question. Fewer variables were significant in these models. The ones that were, with the exception of PURPOSE, showed significance at the 90% level and with the exception again of PURPOSE had the expected signs. The estimated equations for the final CVM question "chance of an extra deer" are shown in Table 22. Again, all variables are significant at the 90% level or higher and all except PURPOSE have the expected signs.

The bivariate forms of these logit equations were also estimated and net economic values were calculated as the LOGIT-MEANs and MEDIAN statistics (Table 23). The hunters in different clusters placed very different values on the Montana deer hunting experience. Trophy hunters value their trips the highest with a MEAN-LOGIT value of $ 470.70 for the current trip estimation. On the other end of the spectrum are the Meat hunters who value their current trip at only $ 181.92. The values of the remaining two hunter groups fall between these two figures.

As was found with the other aggregation schemes, respondents consistently placed a lower value on the improved condition questions than on the current trip question. As was discussed before, this may be indicative of an "elk hunter bias" in the sample responses.

Table 19

Montana Deer Hunting
Current Trip Estimation by Cluster

Variable	Enthusiast	Meat	Genrl.-Meat	Trophy
Constant	3.7650	3.5914	3.5512	.3644
(T-Stats)	(8.34)	(10.43)	(5.53)	(.209)
LBIDTRIP	-.8647	-.9258	-.9129	-.8654
	(-11.64)	(-13.39)	(-8.06)	(-10.53)
LINCOME	--	--	--	.4021
				(2.47)
LTRIPS	-.3423	--	--	-.3867
	(-2.82)			(-2.98)
LDRSEEN	.1450	--	.1873	--
	(2.36)		(2.08)	
LHUNTERS	--	.0449	--	--
		(2.25)		
LYRSHNT	--	--	--	--
PURPOSE	--	--	--	--
DRKILL	--	.2446	--	.2781
		(2.24)		(2.49)
CLUB	.3832	--	--	.2726
	(3.30)			(2.46)
LAGE	--	--	--	--
Sample Size	**583**	**743**	**300**	**523**

Table 20

Montana Deer Hunting
Double Chance of Buck Estimation by Cluster

Variable	Enthusiast	Meat	Genrl.-Meat	Trophy
Constant	4.5708	3.7246	3.0443	-1.1089
(T-Stats)	(9.94)	(9.74)	(4.61)	(-.586)
LBIDTRIP	-.8953	-.9710	-.8733	-1.1152
	(-12.01)	(-13.79)	(-8.06)	(-10.53)
LINCOME	--	--	--	.6902
				(3.79)
LTRIPS	-.2166	-.2339	-.3461	-.2828
	(-1.88)	(-1.95)	(-1.73)	(-2.10)
LDRSEEN	--	.1024	.2384	--
		(2.15)	(1.97)	
LHUNTERS	--	--	--	--
LYRSHNT	--	--	--	--
PURPOSE	-.4295	--	--	--
	(-2.15)			
DRKILL	--	--	--	.2637
				(2.24)
CLUB	--	.2362	--	.3142
		(1.93)		(2.67)
LAGE	--	--	--	--
Sample Size	**586**	**748**	**300**	**523**

Table 21

Montana Deer Hunting
Good Chance of Doe Estimation by Cluster

Variable	Enthusiast	Meat	Genrl.-Meat	Trophy
Constant	3.3492	.4166	3.4127	1.9352
(T-Stats)	(8.72)	(.25)	(7.11)	(5.08)
LBIDTRIP	-.8643	-.9638	-.9301	-.5629
	(-11.64)	(-13.47)	(-8.85)	(-8.69)
LINCOME	--	.3137	--	--
		(1.94)		
LTRIPS	-.3876	-.2354	--	-.3018
	(-2.86)	(-1.86)		(-2.26)
LDRSEEN	--	--	--	--
LHUNTER	--	--	--	--
LYRSHNT	--	--	--	--
PURPOSE	--	--	--	-.3349
				(-1.66)
DRKILL	--	--	--	--
CLUB	--	--	--	--
LAGE	--	--	--	--
Sample Size	**575**	**747**	**301**	**521**

Table 22

Montana Deer Hunting
Chance of Extra Deer Estimation by Cluster

Variable	Enthusiast	Meat	Genrl.-Meat	Trophy
Constant	4.7536	.9167	4.514	-1.4406
(T-Stats)	(7.96)	(.54)	(7.47)	(-.75)
LBIDTRIP	-1.0593	-.9874	-1.0897	-.8820
	(-12.29)	(-13.53)	(-8.99)	(-11.10)
LINCOME	--	.4598	--	.5281
		(2.81)		(2.93)
LTRIPS	-.3921	--	--	-.4803
	(-2.89)			(-3.37)
LDRSEEN	.1640	--	--	--
	(1.84)			
LHUNTER	--	--	--	--
LYRSHNT	--	--	--	--
PURPOSE	-.4795	--	--	--
	(-2.16)			
DRKILL	--	--	--	.3700
				(3.05)
CLUB	.3221	--	--	--
	(2.49)			
LAGE	--	-.5645	--	--
		(-1.93)		
Sample Size	576	740	302	517

Table 23

Montana Deer Hunting
Net Economic Trip Values by Cluster

CURRENT TRIP

Method	Enthusiast	Meat	Genrl.-Meat	Trophy
MEAN-LOGIT	$ 297.44	181.92	315.08	470.70
MEDIAN	$ 68.75	48.76	83.89	145.32

DOUBLE CHANCE OF MATURE BUCK

Method	Enthusiast	Meat	Genrl.-Meat	Trophy
MEAN-LOGIT	$ 287.41	138.17	229.63	441.43
MEDIAN	$ 80.80	37.67	48.75	193.02

GOOD CHANCE OF DOE OR SMALL BUCK

Method	Enthusiast	Meat	Genrl.-Meat	Trophy
MEAN-LOGIT	$ 163.65	120.42	150.52	211.86
MEDIAN	$ 30.97	27.96	33.13	16.02

CHANCE OF AN EXTRA DEER

Method	Enthusiast	Meat	Genrl.-Meat	Trophy
MEAN-LOGIT	$ 211.75	127.94	183.24	298.87
MEDIAN	$ 61.32	31.59	60.07	80.15

CHAPTER VII

CONCLUSIONS

The basic conclusion of this report is that there are significant recreation values associated with deer hunting in Montana. Specific major findings are as follows:

- 5000 questionnaires were mailed to resident and nonresident holders of deer hunting tags with an overall response rate of 66.5 percent

- of the 2950 returned questionnaires 2395 were from residents and 555 were from nonresidents

- of the 2950 returned questionnaires 2786 hunters hunted on their own and 164 hunters hired guides

- average expenditures per trip were $112.64 for residents, $1006.12 for nonresidents, $1591.95 for guided hunters and $217.47 for nonguided hunters

- average expenditures per day were $25.08 for residents, $146.23 for nonresidents, $242.67 for guided hunters and $45.21 for nonguided hunters

- the mean net economic value of a Montana deer hunting trip is $301.51

- the mean net economic value of a Montana deer hunting day is $61.40

- per trip net economic values varied widely between hunter subgroups with values of $208.74 for residents, $705.85 for nonresidents, $799.99 for guided hunters and $269.05 for nonguided hunters

- hunters consistently ranked alternative hunting conditions with the chance for a large buck valued highest, the chance for an extra deer valued slightly lower and a good chance for a doe or small buck valued lowest

- current trip values were not statistically different for the seven DFWP administrative regions

- when hunters were clustered according to their motivations for hunting they showed significantly different net economic values for their deer hunting trips

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APPENDIX A:
SURVEY INSTRUMENT

I. FIRST, WE HAVE SOME GENERAL QUESTIONS ABOUT YOUR HUNTING.

1. How many years have you been hunting deer? _____ Years

2. About how many days per year do you hunt deer? _____ Days

3. How many of these were spent deer hunting in Montana? _____ Days

4. How would you rate deer hunting compared to your other outdoor recreation activities? (please check one)

_____ It's my favorite outdoor recreation activity

_____ It's one of my favorite outdoor recreation activities

_____ It's just one of several outdoor recreation activities that I do

_____ I prefer other outdoor recreation activities

II. THE NEXT QUESTIONS ASK ABOUT YOUR MOST RECENT DEER HUNTING TRIP IN MONTANA DURING THE GENERAL SEASON.

1. Approximate date (s) of this last trip: _____
(A trip could be anything from an hour to several or more days)

2. Use the map provided to show what HUNTING DISTRICT you visited on this trip. (If you hunted in more than one district, write the number of the ONE district where you spent the most time)

Number of hunting district: _____
(from map on back of the cover letter)

IN ALL OF THE FOLLOWING QUESTIONS, "THIS AREA" MEANS THE DISTRICT WHOSE NUMBER YOU JUST LISTED.

3. On this trip, how many days did you hunt in this area? _____ Days

4. About how many hours per day did you hunt? _____ Hours

5. About how many deer did you see while hunting in this area?

___ Deer seen in this area

6. Did you kill a deer in this area? ___ Yes ___ No

7. If yes, what kind did you get?

___ Antlered ___ Antlerless

If your deer was antlered, how many points did it have on each side?

Points on side 1 : ____ Points on side 2 : ____

8. Did you get any other big game in this hunting area?

___ Yes ___ No

9. If yes, what species did you shoot?

___ Elk ___ Bear ___ Other : _____

10. Was this area the only place you hunted on this trip, or did you hunt in other areas listed on the map? (Please check one)

___ This area was the main or only one I hunted on this trip.

___ This area was one of several areas I hunted in on this trip.

11. If you did hunt in other areas on this trip, please list the area numbers from the map :

_____

12. What type of equipment did you use in this area? (please check all that apply)

___ Muzzle loader ___ Rifle ___ Bow and arrow

___ Handgun ___ Shotgun

13. How many deer did you shoot at during this last trip?

___ Deer shot at.

___ How many times did you shoot?

14. How many deer did you hit? ___ Number hit

15. Did you hire a hunting guide or outfitter in this area?

___ Yes ___ No

16. Was hunting the main purpose of your trip away from home when you hunted in this area or did you make the trip for other reasons such as business or a family vacation? (please check one)

___ Hunting was the main purpose of this trip

___ Hunting was one of several reasons for making the trip

17. Which of the following items did you use while hunting in this area? (please check all items you used)

___ Dirt bike or ATV
___ Horse
___ Binoculars
___ Topographic map
___ Backpacking tent
___ Trailer
___ Wall tent
___ Snowmobile
___ Camera
___ Spotting scope
___ Motor home

18. About how far did you walk while you were hunting in this area? (please use an average if you hunted more than a day)

___ Miles / Day

19. About how many other hunters (not in your party) did you see while you were hunting this area on this trip?

___ Other hunters

20. Was this number of hunters : (please check one)

___ More than I expected to see

___ About as many as I expected to see

___ Fewer than I expected to see

___ I didn't have any expectations

21. Did the other hunters present affect your enjoyment of the hunting in this area?

___ Yes ___ No

22. If yes, please explain how :

_____

23. Was this the first time you hunted in this particular area?

___ Yes ___ No, I've hunted here before

24. If no, how many years have you been hunting in this area?

____ Years

25. How does this area rate compared to other areas in Montana? (please check one)

___ It's my favorite place to hunt deer

___ It's one of my favorite places to hunt deer

___ It's one of many places where I hunt deer

___ I prefer to hunt deer other places

26. For hunting purposes, do you feel the number of roads for vehicle use in this area is : (please check one)

___ Too few

___ About right

___ Too many

27. In the last few years, has the number of open roads in this area increased, decreased, or stayed the same? (check one)

___ Number of open roads in this area has increased

___ Number of open roads in this area has decreased

___ Number of open roads in this area is the same

___ I'm not sure

28. For game retrieval purposes, how do you feel the existing roads in this area should be managed? (please check one)

___ Hunters should be allowed to use only open roads to retrieve game with a vehicle

___ Hunters should be allowed to use closed roads to retrieve game with a vehicle

___ Hunters should be allowed to use vehicles off roads to retrieve game

29. What are the most important factors you consider when deciding where to go deer hunting? (please check the box that best reflects the importance of each item.)

	Very Important	Important	Not Important	Not at all important
a. Good public access	☐	☐	☐	☐
b. High deer numbers	☐	☐	☐	☐
c. Close to home	☐	☐	☐	☐
d. Because I had a special deer permit for the area	☐	☐	☐	☐
e. Chances of bagging a trophy	☐	☐	☐	☐
f. To hunt with family or friends	☐	☐	☐	☐
g. Familiarity with the area	☐	☐	☐	☐

30. How many separate trips did you make from you home to this hunting area this season?

___ Separate trips from home this year

31. About how frequently do you plan to hunt in this area in the future? (please check one)

___ As frequently as I do now

___ More frequently than I do now

___ Less frequently than I do now

32. Are there any other hunting areas in Montana that you feel provide a hunting experience comparable to this particular area?

___ Yes ___ No

33. If yes, please list the numbers of any other comparable hunting districts from the map :

_____

34. Suppose you were told you could not hunt deer in this district on this trip. What other district might you have hunted instead?

Please specify hunting district number from map : _____

35. About how far is it from your home to this alternative hunting location?

___ Miles

36. How does it compare to hunting where you did?

_____

37. People hunt for many reasons. We'd like to know some of the reasons you hunted this area on this trip, to help us understand different types of hunters and their preferences.

Following is a list of possible reasons for hunting. Please check the box that says whether that reason was very important, important, not important, or not at all important a reason you hunted in this particular area on this trip.

	Very Important	Important	Not Important	Not at all important
a. For the solitude	☐	☐	☐	☐
b. To test my hunting skills	☐	☐	☐	☐
c. To bag a trophy deer	☐	☐	☐	☐
d. To be outdoors	☐	☐	☐	☐
e. For the meat	☐	☐	☐	☐
f. To be in a natural setting	☐	☐	☐	☐
g. To learn more about deer	☐	☐	☐	☐

38. Could you please look back over this list and circle the letters of the **three** most important reasons you hunted in this area on this trip?

III. THE NEXT FEW QUESTIONS WILL HELP US TO UNDERSTAND THE VALUE YOU PLACE ON HUNTING IN THIS AREA.

WE REALIZE YOU AREN'T USED TO CONSIDERING HUNTING THIS WAY, BUT PLEASE THINK ABOUT IT AND GIVE US YOUR BEST ESTIMATE!

1. About how far is it from your home to where you hunted in this area on this trip?

___ Miles (one-way)

2. How long did it take to travel from your home to this area?

___ Hours (include any stops made en route)

3. If you drove, how many other hunters were in the vehicle?

___ Number of other hunters

4. About how much did you personally spend on this trip? If you can't recall the exact amount, please give your best estimate for each of the following three types of expenses.

_____ Amount I spent for transportation (gas, car rental, airfare and any other transportation costs)

_____ Amount I spent on food, beverages, and lodging

_____ Amount I spent on equipment purchased just for this trip, access or guide fees, and all other expenses

_____ TOTAL AMOUNT I SPENT ON THIS HUNTING TRIP

5. Suppose that everything about this last hunt was the same except your trip costs had been _____ more, would you still have made the trip?

___ Yes, I would still have made the trip.

___ No. If no, would you have made the trip if your share of the expenses had been only $1.00 more?

_____ Yes

_____ No. If no, could you briefly explain why not.

_____

6. Imagine that everything about this last trip was the same, except that your chances of bagging a mature buck were twice as great AND your trip costs to visit this site increased by $ _____, would you still have made the trip?

___ Yes, I would still have made the trip.

___ No. If no, would you have made the trip if your share of the expenses had been only $1.00 more?

___ Yes

___ No. If no, could you briefly explain why not.

_____

7. Imagine everything about this last trip was the same except your chances of killing a doe or small buck were really good and your trip costs increased by $ _____. Would you still have made the trip?

___ Yes, I would still have made the trip.

___ No. If no, would you have made the trip if your share of the expenses had been only $1.00 more?

___ Yes

___ No. If no, could you briefly explain why not.

_____

8. On your most recent hunting trip to this area, about how many deer did you see?

___ Number of deer seen.

9. Now imagine that everything about your last trip was the same except that you would be able to bag an additional deer and your trip costs increased by $ _____, would you still make the hunting trip to this area?

___ Yes, I would still have made the trip.

___ No. If no, would you have made the trip if your share of the expenses had been only $1.00 more?

___ Yes

___ No. If no, could you briefly explain why not.

_____

IV. THE NEXT FEW QUESTIONS ASK YOUR OPINION ON DIFFERENT HUNTING MANAGEMENT OPTIONS.

1. Do you feel there are too many hunters where you hunt?

___ No

___ Yes, If yes, would you please rank the following options to reduce the number of hunters:

_____ Choose time period to hunt _____ Permit hunting

_____ Restrict vehicular traffic _____ Choose your weapon

_____ General deer license (A Tag) valid for only one species (Mule Deer or Whitetail)

_____ Other _____

2. For the following question access is defined as: The opportunity to hunt deer where you want.
Does access restrict your deer hunting opportunities?

_____ No

_____ Yes, If yes why? (Please Rank)

_____ Not enough public hunting allowed on privat land.

_____ Too many raod closures

_____ Not enough public land available

_____ Not enough access to public land

_____ Other _____

3. Do you perceive the **NUMBER** of bucks in your hunting area to be:

_____ Good? _____ OK? _____ Poor?

If you feel the number of bucks is poor, please rank the following strategies to improve the situation:

_____ Permit hunting only

_____ Antler point restrictions

_____ Improve or maintain hiding cover

_____ Reduce vehicular traffic

_____ Limit hunting during rut

_____ Shorten seasons

V. THESE LAST FEW QUESTIONS WILL HELP US UNDERSTAND YOUR RESPONSES BY KNOWING SOME BASIC INFORMATION ABOUT YOU.

1. Where are you from? City: _____ State : _____

2. What is your age? _____ Years

3. Are you: ___ Male ___ Female

4. Are you a member of any hunting, conservation, or sport organizations?

___ Yes ___ No

5. If so, which ones? _____

6. What is the highest year of formal education you completed?

___ Some grade school ___ Some college

___ Finished grade school ___ Finished college

___ Finished junior high school ___ Some postgraduate work

___ Finished high school ___ Finished postgraduate

7. If you had not gone hunting this trip, would you have been working instead?

___ Yes ___ No

8. During the hunting season this year, were you ? (check one)

___ Employed full time ___ Retired

___ Employed part time ___ Homemaker

___ Unemployed ___ Other : _____

9. Please check your household's income before taxes last year :

___ Under 5,000 ___ 20,000 - 24,999 ___ 40,000 - 49,000

___ 5,000 - 9,999 ___ 25,000 - 29,999 ___ 50,000 - 74,999

___ 10,000 - 14,999 ___ 30,000 - 34,999 ___ 75,000 - 100,000

___ 15,000 - 19,999 ___ 35,000 - 39,999 ___ over 100,000

Thank you for your help. Is there anything else you'd like to tell us about hunting in this area? We would appreciate any comments

APPENDIX B:
ESTIMATED BIVARIATE MODELS

Table B-1

Montana Deer Hunting
Estimated Bivariate Models
Current Trip Question

Model	Constant	Log(BID)	N
Entire Sample	3.6007	-.8393	2845
Montana Residents	3.7218	-.9413	2306
Nonresidents	4.8694	-.8340	539
Guided Hunters	5.9726	-.9654	164
Nonguided Hunters	3.6281	-.8691	2681

Table B-2

Montana Deer Hunting
Estimated Bivariate Models
Double Chance of Buck Question

Model	Constant	Log(BID)	N
Entire Sample	3.8440	-.9113	2842
Montana Residents	3.7436	-.9518	2305
Nonresidents	5.8579	-1.082	537
Guided Hunters	8.0949	-1.363	162
Nonguided Hunters	3.8264	-.9317	2680

Table B-3

Montana Deer Hunting
Estimated Bivariate Models
Good Chance of Doe Question

Model	Constant	Log(BID)	N
Entire Sample	2.6928	-.8343	2833
Montana Residents	2.8881	-.9159	2300
Nonresidents	2.2692	-.6249	533
Guided Hunters	1.1705	-.3848	159
Nonguided Hunters	2.8529	-.8821	2674

Table B-4

Montana Deer Hunting
Estimated Bivariate Models
Chance of Extra Deer Question

Model	Constant	Log(BID)	N
Entire Sample	3.6965	-.9494	2810
Montana Residents	3.5815	-.9914	2283
Nonresidents	5.0311	-.9989	527
Guided Hunters	4.2718	-.7846	158
Nonguided Hunters	3.7353	-.9811	2652

Table B-5
Montana Deer Hunting
Estimated Bivariate Models by DFWP Region

Question	Region	Constant	Log(BID)	N
Current Trip	1	4.1367	-.9616	398
	2	3.1894	-.7858	402
	3	3.2487	-.7565	555
	4	3.8784	-.8913	578
	5	3.5708	-.8749	284
	6	4.6196	-1.018	254
	7	3.2246	-.7229	277
Large Buck	1	4.0176	-.9750	397
	2	3.7862	-.9397	405
	3	3.5068	-.8425	554
	4	4.3255	-1.038	579
	5	3.4922	-.8314	284
	6	4.0181	-.8939	248
	7	4.5389	-.9771	280
Doe/Small Buck	1	2.3179	-.7739	393
	2	2.6712	-.8637	408
	3	2.9427	-.8566	546
	4	2.9932	-.8896	575
	5	2.1143	-.7405	286
	6	3.2964	-.9291	248
	7	2.4954	-.8215	280
Extra Deer	1	3.6616	-.9523	389
	2	3.2505	-.9361	405
	3	3.1222	-.8205	540
	4	3.9715	-.9929	574
	5	4.0298	-1.086	283
	6	4.4245	-1.047	246
	7	4.3207	-.9899	278

Table B-6

Montana Deer Hunting
Estimated Bivariate Models
Hunter Clusters

Cluster	Question	Constant	Log(BID)	N
Generalist-Enthusiast				
	Current Trip	3.4834	-.8234	645
	Large Buck	4.0639	-.9253	644
	Doe/Small Buck	2.9964	-.8728	632
	Extra Deer	4.1713	-1.013	633
Meat Hunter				
	Current Trip	3.8929	-1.002	829
	Large Buck	3.8237	-1.054	833
	Doe/Small Buck	3.3228	-.9976	829
	Extra Deer	3.5106	-1.017	822
Generalist-Meat Hunter				
	Current Trip	3.8500	-.8713	346
	Large Buck	3.3111	-.8519	346
	Doe/Small Buck	3.3032	-.9536	346
	Extra Deer	4.5654	-1.115	346
Trophy Hunter				
	Current Trip	3.9568	-.7947	562
	Large Buck	5.7317	-1.089	562
	Doe/Small Buck	1.6588	-.5980	560
	Extra Deer	3.9026	-.8902	554