



University of Tennessee, Knoxville  
**TRACE: Tennessee Research and Creative  
Exchange**

---

Masters Theses

Graduate School

---

8-2000

## Landowners' perceptions of deer damage to crops in Tennessee

Dawn L. Johnson

Follow this and additional works at: [https://trace.tennessee.edu/utk\\_gradthes](https://trace.tennessee.edu/utk_gradthes)

---

### Recommended Citation

Johnson, Dawn L., "Landowners' perceptions of deer damage to crops in Tennessee. " Master's Thesis, University of Tennessee, 2000.

[https://trace.tennessee.edu/utk\\_gradthes/6633](https://trace.tennessee.edu/utk_gradthes/6633)

This Thesis is brought to you for free and open access by the Graduate School at TRACE: Tennessee Research and Creative Exchange. It has been accepted for inclusion in Masters Theses by an authorized administrator of TRACE: Tennessee Research and Creative Exchange. For more information, please contact [trace@utk.edu](mailto:trace@utk.edu).

To the Graduate Council:

I am submitting herewith a thesis written by Dawn L. Johnson entitled "Landowners' perceptions of deer damage to crops in Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Wildlife and Fisheries Science.

J. Mark Fly, Major Professor

We have read this thesis and recommend its acceptance:

Craig Harper, Lisa Muller, Randol Waters

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

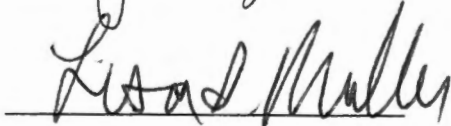
To the Graduate Council:

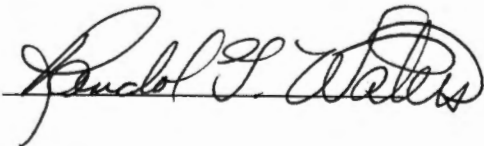
I am submitting herewith a thesis written by Dawn L. Johnson entitled "Landowners' Perceptions of Deer Damage to Crops in Tennessee." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Wildlife and Fisheries Science.

  
J. Mark Fly, Major Professor


We have read this thesis  
and recommend its acceptance:







Accepted for the Council:

  
Associate Vice Chancellor and  
Dean of The Graduate School

**LANDOWNERS' PERCEPTIONS OF  
DEER DAMAGE TO CROPS IN TENNESSEE**

A Thesis  
Presented for the  
Master of Science  
Degree  
The University of Tennessee, Knoxville

Dawn L. Johnson  
August 2000

AG-VET-MED.

Thesis  
2000  
.J62

## ACKNOWLEDGMENTS

There are many people to whom I am grateful for their support and encouragement during my time at the University of Tennessee. I wish to thank Dr. Mark Fly, my major professor, for his guidance and for giving me the opportunity to study at the University of Tennessee. I also wish to thank Dr. Craig Harper, Dr. Lisa Muller, and Dr. Randol Waters for their input and assistance while serving on my committee. I would like to acknowledge the Tennessee Agricultural Experiment Station and the Tennessee Wildlife Resources Agency for supporting this project.

I am indebted to Becky Stephens for her help with tasks too numerous to mention and for her statistical knowledge, but most of all for her friendship. I am grateful to my fellow graduate students, past and present, in the Department of Forestry, Wildlife, and Fisheries for their friendship and understanding.

I am especially grateful to my family for their support. My parents, Linda and Jim Williams, have been a constant source of encouragement throughout my graduate studies. Most of all, I wish to thank my husband, Keith Gemeinhart, for his never-ending patience and understanding.

## ABSTRACT

The objectives of this research were to determine landowners' perceptions of deer damage to crops and their tolerance for deer damage. Additional objectives were to examine landowners' perceptions of the effectiveness of deer damage control methods, wildlife management activities on their land, and to examine regional differences in deer damage to crops and related variables.

A mail survey was sent to landowners in eight Tennessee counties representing four areas of the state with high levels of soybean production and deer populations. A total of 2,110 survey participants were randomly selected to obtain a 95% confidence interval for the four county groups. The confidence interval for individual counties ranged from 92% to 94%. The survey was administered using the Dillman four-wave method resulting in a useable response rate of 59%. A comparison of early and late respondents to determine non-response bias revealed that early respondents were more likely to have deer damage to their crops. About half of the participants (54%) were classified as full- or part-time farmers.

The majority of participants wanted deer populations in their area to decrease (49%) or stay the same (32%). Many participants enjoyed deer (48%), while others enjoyed deer but worried about crop damage (38%), and a few participants considered deer to be a nuisance (15%).

Forty-seven percent of all landowners sustained deer damage, while 60% of farmers had deer damage. Many participants (55%) experienced some type of wildlife

damage, compared to 68% of farmers. Most participants (54%) estimated the value of their loss from deer damage at \$500 or less. Approximately one quarter of all participants (26%) reported deer damage that exceeded their tolerance level. Participants with deer damage were more likely to consider deer a nuisance and want a decrease in deer populations. Farmers were more likely to have deer damage than non-farmers.

One quarter of participants had taken measures to prevent deer damage with hunting being the most commonly used method. Shooting deer outside of the hunting season with a depredation permit was rated the most effective method of controlling deer damage. The majority of participants (79%) allowed hunting on their land and 42% reported that they manage their land for wildlife.

The fact that many landowners manage their land for wildlife is encouraging, given the importance of private lands as wildlife habitat. Private landowners' support of wildlife management may be eroded, however, if wildlife damage increases because participants who considered deer a nuisance were less likely to manage their land for wildlife.

Although many landowners experienced deer damage, it was not a serious problem for most of them. Landowners with severe deer damage, however, are likely to have negative attitudes about wildlife and may need assistance to deal with their deer damage problems. There are several options for assisting landowners with deer damage, such as more effective damage control methods, increasing landowners' awareness of the availability of depredation permits, and cash payments.



## TABLE OF CONTENTS

CHAPTER	PAGE
I.	INTRODUCTION .....1
	Importance of Research .....2
	Objectives .....3
	Research Approach .....4
II.	LITERATURE REVIEW .....5
	Field Research.....5
	Survey Research.....7
III.	METHODS .....13
	Study Area .....13
	Survey Participants .....13
	Questionnaire Design.....16
	Survey Administration .....17
	Data Analysis .....18
IV.	RESULTS .....20
	Response Rate.....20
	Analysis of Non-response Bias .....20
	Farming Status .....22
	Descriptive Statistics.....22
	Participants' Open-ended Comments .....45
	Comparisons between County Groups.....50
	Relationships between Variables .....52
V.	DISCUSSION .....56
	Methodology .....56
	Extent and Nature of Crop Damage.....57
	Landowners' Tolerance for Deer Damage.....58
	Effectiveness of Damage Control Methods .....59
	Landowners Managing for Wildlife.....60
	Comparisons between County Groups.....61
	Future Research .....62
	Management Implications.....63
VI.	SUMMARY .....66
	Methods.....68

Results.....	69
Discussion.....	71
Management Implications.....	72
LITERATURE CITED .....	74
APPENDIX.....	79
VITA .....	94

## LIST OF TABLES

<b>TABLE</b>	<b>PAGE</b>
1. Soybean yields and deer harvest numbers from Tennessee counties selected for the study area .....	15
2. Number of questionnaires mailed and survey response rates by county.....	21
3. Landowners' education levels.....	23
4. Farm products managed for by landowners.....	27
5. Types of crop damage incurred by landowners .....	29
6. Main species reported by landowners as causing crop damage.....	29
7. Landowners' ratings of deer damage to crops .....	30
8. Landowners' descriptions of deer damage to crops.....	30
9. Landowners' ratings of the effectiveness of deer damage control measures .....	34
10. Education level of farmers .....	41
11. Farm products managed for by farmers .....	41
12. Farmers' ratings of the effectiveness of deer damage control measures .....	46
13. Distribution of participants' experience with deer damage by county group .....	51
14. Distribution of participants' experience with wildlife damage (any species) by county group .....	51
15. Distribution of participants' preferences for deer populations by county group .....	53

16.	Distribution of participants' attitudes toward deer by county group .....	53
17.	Distribution of participants' who allowed deer hunting by county group .....	54
18.	Distribution of participants' who manage for wildlife by county group .....	54

## LIST OF FIGURES

<b>FIGURE</b>	<b>PAGE</b>
1. Tennessee counties selected for the study area.....	14
2. Landowners' annual household incomes .....	24
3. Landowners' percentage of household income from farming .....	26
4. Landowners' estimates of dollar value of loss from deer damage.....	31
5. Maximum amount of wildlife damage considered tolerable by landowners .....	31
6. Deer damage control measures used by landowners .....	33
7. Groups that landowners allowed to hunt deer on their property.....	33
8. Wildlife species managed for by landowners .....	36
9. Wildlife management practices used by landowners.....	37
10. Landowners' reasons for not managing their land for wildlife.....	38
11. Landowners' preferred forms of assistance for wildlife management on their land.....	38
12. Farmers' percent of household income from farming .....	40
13. Farmers' annual household incomes.....	40
14. Farmers' estimates of dollar value of loss from deer damage .....	43
15. Maximum amount of wildlife damage considered tolerable by farmers .....	43
16. Deer damage control measures used by farmers.....	44
17. Wildlife species managed for by farmers .....	47

# CHAPTER I

## INTRODUCTION

Many Tennessee farmers and landowners experience wildlife damage to crops and property. The financial repercussions of wildlife damage can be substantial, especially for farmers whose livelihood is affected. Although farmers expect a certain amount of damage from wildlife, incidents of white-tailed deer (*Odocoileus virginianus*) damage appear to be increasing. Growing deer herds, changing land use practices, and urbanization are contributing to an apparent trend of increasing deer damage. Increasing deer damage on farms and other private land may result in landowners having less positive attitudes toward wildlife. Landowners' attitudes are important because the majority of wildlife habitat in the U.S. is on private agricultural land (Carlson 1985) and the future of wildlife is largely dependent on the attitudes and actions of private landowners (Kellert 1981).

Tennessee's deer herd has grown steadily since the early 1900's. The Tennessee Wildlife Resources Agency (TWRA) estimates the state's deer population was 1000 or less at the beginning of the 20th century (Tennessee Wildlife Resources Agency 1991). In 1992, TWRA estimated there were 750,000 deer in Tennessee (Tennessee Wildlife Resources Agency 1999). The restoration and growth of deer herds in Tennessee and throughout the eastern U.S. has been a tremendous success, however, it has resulted in increased conflicts between humans and deer.

Changing land use patterns also have promoted human-deer conflict. Agricultural land in Tennessee has decreased from 18 million acres in 1950 (Tennessee Department of Agriculture 1995) to 11.9 million acres in 1998 (Tennessee Department of Agriculture 1999). As more Americans move from cities to subdivisions and rural residences, farmland gives way to urban sprawl and development. Many city dwellers have moved to the country in search of peace and quiet. However, they are often unprepared for the reality of living closer to nature as deer and other wildlife cause damage to trees, shrubs, and plants around suburban and rural residences.

### **Importance of Research**

Wildlife managers are responsible for balancing the needs of various groups that have a stake in how wildlife resources are managed. The preferences of different groups often are contradictory, making the task of managing wildlife more difficult. While many sportsmen would like an increase in the deer herd to enhance hunting opportunities, many farmers want a decrease to ease the financial burden of deer damage. Since the majority of wildlife habitat is on private lands, the interests of agricultural producers are one of the most important factors to be taken into consideration when managing wildlife resources (Brown et al. 1978). Farmers control 11.9 million acres of land in Tennessee (Tennessee Department of Agriculture 1999); thus, farmers' decisions concerning land management can impact wildlife substantially.

Farmers' perceptions of wildlife damage to their crops can affect their attitudes toward wildlife in general. Previous studies have found that farmers who sustained losses from deer were more likely to prefer a decrease in deer populations than farmers who had

not had damage (Decker et al. 1984b, Craven et al. 1992). Experience with wildlife damage also may influence farmers' willingness to manage their land for wildlife. Therefore, the support and involvement of farmers and other private landowners is crucial to wildlife management in the U.S.

### **Objectives**

Wildlife managers need to understand how wildlife damage affects farmers and other private landowners in order to gain their support and involvement. Wildlife managers also need a system for monitoring wildlife damage and farmers' tolerance for damage as these factors change over time. This research provides an initial step towards developing a monitoring system and increasing understanding of landowners experiences with wildlife damage. The objectives of this research were:

1. To determine landowners' perceptions of the extent and nature of deer damage to crops in Tennessee.
2. To assess landowners' perceptions of deer and their tolerance for crop damage.
3. To determine landowners' perceptions of the effectiveness of deer damage control methods.
4. To evaluate landowners' actions concerning wildlife on their land.
5. To examine regional differences in deer damage levels and landowners' attitudes toward wildlife.



**Research Approach**

To meet these objectives, a survey was conducted in selected Tennessee counties with high levels of crop production and high deer population levels. Deer damage was expected to be a potential problem in these areas.

## CHAPTER II

### LITERATURE REVIEW

In the past forty years, researchers have conducted numerous studies on wildlife damage. Studies have been both national and regional in scope. Some studies have taken in-field measurements of wildlife damage while others have examined perceptions of wildlife damage.

#### **Field Research**

There have been many studies designed to quantify wildlife damage to crops, however, most studies have covered a limited geographical area or have focused on one species of wildlife. Wywialowski (1996) conducted one of the more comprehensive studies of wildlife damage in the United States, which quantified the amount of wildlife damage to ripening field corn in the top 10 corn-producing states. Wywialowski (1996) estimated that \$113 million of ripening field corn was lost to wildlife damage in the United States in 1993. Although this amount constitutes less than 1% of the value of the harvested corn crop, damage was unevenly distributed among states and fields. Other studies have documented uneven patterns of wildlife damage (Heisterburg 1983) and several have found that damage is often greater in fields that are in close vicinity to woodlands or water (DeCalesta and Schwendeman 1978, Thomas 1954, Bollinger and

Caslick 1985). The majority of farmers in an area may experience little or no damage while a few sustain a great deal of damage from wildlife.

Deer are often perceived as the species of wildlife causing the greatest amount of crop damage. Farmers and wildlife agencies have named deer as the main species causing damage in a number of studies (McDowell and Pillsbury 1957, Conover and Decker 1991, Wywialowski 1994, Conover 1998). Indeed, studies have found that deer can cause significant damage to crops. A number of studies have found that deer damage can cause 20% to 37% reductions in crop yields by comparing yields inside and outside fenced exclosures (Harrison 1979, Vecellio et al. 1994, Conner and Forney 1997). Conner and Fournery (1997) found deer depredation resulted in an average loss of \$115/acre in study plots where corn and soybeans were grown. However, results from studies showing substantial damage in localized areas should be regarded cautiously since areas with high levels of damage are studied more often than other areas.

In contrast, Garrison and Lewis (1987) found that damage to soybeans rarely caused a significant decrease in yield. This study found that plants could sustain a certain amount of browsing without decreasing yields and that depredation by deer rarely reached a level that resulted in lower yields. They estimated that deer damage resulted in an average loss of \$0.42/acre. Westmoreland and Woolf (1984) also found that deer did not cause significant damage to field corn; however, much of the damage could not be attributed to one species. Deer are much more visible than other wildlife species that damage crops, such as blackbirds and raccoons (*Procyon lotor*) and may be blamed for more damage than they actually cause. In fact, some studies have found that birds cause

more crop damage than other species (Kelly et al. 1982, Wywialowski 1996).

Bird damage to corn in Ohio has been studied extensively since 1966. Kelly et al. (1982) found blackbird damage to field corn in Ohio totaled between \$3.9 and \$6.8 million. They also reported that mammal damage to corn, principally from raccoons, was negligible, although a few sample plots incurred significant damage. Stickley et al. (1978) found damage to corn from blackbirds in Kentucky and Tennessee totaled approximately \$1.6 million.

### **Survey Research**

Quantification of wildlife damage helps wildlife managers understand the actual extent of damage, but farmers' perceptions of damage are also important and may not be directly related to actual damage. Wywialowski (1996) found farmers were good at predicting which fields would sustain significant wildlife damage. Fields where farmers predicted damage had twice the damage of fields where damage was not predicted. In contrast, other studies have found that farmers were not able to predict damage (Wakely and Mitchell 1981, Gabrey et al. 1993).

Wywialowski (1994) points out that agricultural producers who perceive they have sustained losses from wildlife damage are more likely to want lower wildlife populations. Craven et al. (1992) found that past experience with damage may influence farmers' perceptions of current wildlife populations and levels of damage. Conover (1994) stated, "Although it is unclear what the relationship is between perceived and actual levels of wildlife damage on America's farms and ranches, a farmer's perceptions

are important because they influence his or her attitudes about wildlife.” Understanding farmers’ perceptions of wildlife damage can help wildlife managers make better, more equitable decisions.

McDowell and Pillsbury (1959) gathered information from wildlife management agencies and conducted the first national survey of wildlife damage to crops in the 1950’s. Deer were the most common species reported to cause damage to crops, while grains and orchards were the most common crops damaged by wildlife. Thirty years later, Conover and Decker (1991) conducted a similar study with input from wildlife managers and agricultural professionals. Results from this study were similar to those of the previous study. For example, deer were the main species causing damage. However, this study revealed that the perspectives of agricultural and wildlife professionals often differed. Fifty-four percent of the Farm Bureaus responding felt that wildlife damage had increased greatly in the past thirty years. In contrast, only 10% of the wildlife agencies felt that wildlife damage had increased greatly in the past thirty years with the majority indicating it had increased moderately.

Recent nationwide studies of farmers’ perceptions of wildlife damage have contributed greatly to our understanding of this issue. The first nationwide survey of agricultural producers found 55% of participants reported wildlife damage to crops or livestock (Wywialowski 1994), estimating that wildlife damage cost producers between \$461 million and \$1.26 billion in 1989. A survey of farmers in the eastern United States found 58% of participants reported damage to crops from wildlife (Wywialowski and Beach 1992). Another nationwide study found higher levels of damage, with 80% of

participants reporting wildlife damage on their farms or ranches and 53% reporting deer damage (Conover 1998). Fifty-three percent of participants reported the damage they received exceeded their tolerance. The results of this study are consistent with Conover (1994), which reported that 89% of participants incurred wildlife damage. The higher levels of damage reported in these two studies may be explained by the fact that they surveyed farmers and ranchers in all western states, where Wywialowski (1994) and Wywialowski and Beach (1992) did not. Perceived levels of wildlife damage may be higher in western states, as evidenced by the finding that 81% of Montana farmers and ranchers report deer damage (Irby et al. 1997).

Farmers' perceptions of deer damage have been studied extensively in New York. Brown et al. (1980) found 35% of the farmers surveyed incurred damage to their crops from deer, with fruit and corn producers reporting the most damage. However, most farmers reported deer damage classified as light. Only 2% of the farmers in this study felt that deer were a nuisance. Study participants reported deer damage to crops was intolerable when it reached an average of \$1000 per year. Other studies conducted in New York reported similar findings (Brown et al. 1977, 1978; Decker et al. 1984a). Decker et al. (1984a) found 56% of the farmers wanted deer populations to remain the same, while 25% wanted an increase in deer populations, and 19% wanted a decrease.

Deer damage is a serious issue for many Tennessee farmers. In the early 1980's, Tanner and Dimmick (1983) surveyed farmers in west Tennessee selected from a Cooperative Extension Service list. They found 59% of study participants had crop damage from deer. Thirty-seven percent of the farmers wanted deer populations in their

area to remain the same, and 15% reported that they felt deer were a nuisance. In contrast, King (1993) found 33% of the farmers in a statewide survey of Farm Bureau members had experienced deer damage, and only 13% of those with damage felt the amount of damage was unreasonable. Forty-five percent of the participants wanted deer populations to remain the same and 10% felt that deer were a nuisance. This study also reported groundhogs (*Marmota monax*) (31%) were named more often than deer (27%) as the species causing the most damage. Fly et al. (1998) in a statewide survey found that 17% of Tennessee landowners sustained wildlife damage, while 34% of full-time farmers had damage. Farmers had a median of \$400 of damage from wildlife and deer was the most common species causing damage. Although many Tennessee farmers experience wildlife damage, the level of damage appears to be comparable to other areas of the nation.

Farmers' perceptions of damage incurred from wildlife are important because they affect farmers' attitudes toward wildlife. Many studies have found that farmers who experienced wildlife damage were more likely than those with no damage to want deer populations to remain the same or decrease (Brown et al. 1980, Decker et al. 1984b, Craven et al. 1992, Wywialowski 1994). In addition, Decker et al. (1984b) found areas reporting an increase in the average dollar value of crops damaged by deer had an accompanying increase in the proportion of farmers who wanted a decrease in deer population levels. The authors of this study did not believe that increases in losses were the sole factor accounting for this rise in intolerance. They hypothesized that the increased threat of potential for crop damage may have influenced attitudes.

Experience with deer damage may also affect farmers' perceptions of current population levels. Craven et al. (1992) found that farmers who experienced deer damage were not as likely as farmers who did not have deer damage to correctly assess changes in deer populations. Farmers' history with deer damage influenced their perceptions of population levels. Human perceptions of carrying capacity, which often differ from biological carrying capacity, are important factors when managing wildlife populations (Brown and Decker 1979).

Factors other than past experience with wildlife damage can influence farmers' attitudes toward wildlife as well. Tanner and Dimmick (1983) found farmers who derived a higher percentage of their income from farming were more likely than part time farmers to want a decrease in deer populations and to feel that deer were a nuisance. Conversely, farmers who hunted were more likely than farmers who did not hunt to favor an increase in deer populations and have positive opinions of deer.

Although many farmers suffer financial losses as a result of wildlife damage, the majority of them continue to maintain positive attitudes toward deer and other wildlife. Brown et al. (1980) found farmers in their study "generally held a custodial attitude toward deer and appreciated the presence of deer for hunting and aesthetic purposes." Eighty percent of the participants in this survey stated that they enjoyed deer for aesthetic value, while only 2% considered deer a nuisance.

Many farmers report that they manage their land for wildlife, providing further evidence of farmers' positive attitudes toward wildlife. Conover (1998) found 80% of study participants suffered wildlife damage, however, the majority (51%) purposely



managed their land for wildlife. Farmers in this study provided cover (39%), provided water (38%) or left crop residue in the field (36%). They spent an average of \$223 a year to enhance wildlife habitat on their land. Approximately one third of Ohio farmers surveyed managed for wildlife (Morrow 1997) and 54% of Missouri farmers surveyed provided grain for wildlife during severe winters (Kirby et al. 1981). Despite the financial repercussions of wildlife damage, many farmers appreciate and enjoy wildlife.

In summary, in-field studies have shown that deer can cause significant damage in localized areas, while others have found that deer did not cause significant damage to crops. Survey research has found levels of deer damage varying from one third to nearly two thirds of farmers in different areas of the U.S. Survey research has also demonstrated the importance of farmers' experience with deer damage because it often influences their attitudes toward deer.

Previous research on wildlife damage gives wildlife managers a more accurate picture of the extent and nature of wildlife damage. Without such research, the complaints of a vocal minority may mislead wildlife managers into believing damage to be worse than it actually is. Conversely, a lack of communication between farmers and wildlife agencies could leave managers unaware of serious problems that exist. Future research will assist wildlife managers in balancing the needs of various interest groups and addressing the most serious problems.

## **CHAPTER III**

### **METHODS**

#### **Study Area**

The survey was conducted in eight Tennessee counties where high levels of deer and other wildlife damage were expected. Counties surveyed were grouped into four groups of two adjacent counties: Weakley and Henry; Lincoln and Franklin; Robertson and Montgomery; and Hardeman and Fayette (Figure 1). These counties were selected based on 1997 deer harvest numbers (Tennessee Wildlife Resources Agency 1998) and 1997 soybean production (Tennessee Dept. Agriculture 1998) (Table 1). Counties with high levels of soybean production and high deer harvest numbers as an indicator of high deer populations were chosen. These counties were selected to target farmers who were more likely to experience wildlife damage and were not intended to be representative of the state as a whole.

#### **Survey Participants**

Survey participants were selected from a list of names and addresses provided by the USDA Farm Services Agency. The list consisted of landowners who had participated in a Farm Services program. A total of 2,110 landowners were selected from the eight counties surveyed. The number of landowners selected from each county was distributed to obtain a 95% confidence interval for each of the four county groups, with a confidence



**Figure 1. Tennessee counties selected for the study area.**

**Table 1. Soybean yields and deer harvest numbers from Tennessee counties selected for the study area.**

<b>County</b>	<b>1997 soybean production (in millions of bushels) <sup>1</sup></b>	<b>1997 deer harvest (in hundreds) <sup>2</sup></b>
Weakley	1.3	37
Henry	2.7	42
Montgomery	0.6	29
Robertson	1.5	19
Fayette	1.7	25
Hardeman	0.6	44
Lincoln	0.6	34
Franklin	0.5	37

<sup>1</sup> Tennessee Department of Agriculture. 1998. Tennessee agriculture. Tennessee Department of Agriculture, Nashville, Tennessee, USA.

<sup>2</sup> Tennessee Wildlife Resources Agency. 1998. Big game harvest data and range surveys, 1997-1998. TWRA Wildlife Research Report No. 98-2.

interval between 92% and 94% for each county. An anticipated response rate of 60% was used to determine how many surveys needed to be mailed to obtain an adequate sample of completed questionnaires. The sample size ( $n$ ) needed to obtain these confidence intervals was calculated from the following equation:

$$n = \frac{Npq}{(N-1)D + pq}$$

where  $N$  represents the total population;

$$D = \frac{B^2}{4}$$

$B$  represents the bound on the error (0.05 for county groups and 0.06 to 0.08 for individual counties);

$p$  represents the portion of participants that possess a particular characteristic;

and  $q = 1-p$ .

Since  $p$  was unknown, an estimate of 0.5 was used to give the largest and most conservative sample size (Schaeffer et al. 1990).

### **Questionnaire Design**

A 9-page questionnaire with 43 questions was mailed to each selected landowner (Appendix 1). Most of the questions were closed-ended and related to landowners' attitudes toward deer, experiences with wildlife damage and wildlife damage control, and landowners' farming activities.

The questionnaire was developed using input from several sources. The first draft of the questionnaire was developed using questions modified from previous survey

instruments (Tommy Brown, pers. comm.; King 1993) as well as original questions. Personnel within the Department of Forestry, Wildlife, and Fisheries at the University of Tennessee, at the Tennessee Wildlife Resources Agency (TWRA), and the Tennessee Conservation League reviewed drafts. Input from these sources was used in developing the final draft of the questionnaire.

### **Survey Administration**

The survey was administered, with a few modifications, using the four-wave mail survey method described by Dillman (1978). The four-wave method is effective in achieving higher response rates in mail surveys.

#### ***First Wave***

The first mailing was sent out on February 23-24, 1999. Participants received a cover letter describing the study (Appendix 2), a questionnaire booklet and a postage-paid return envelope. Each participant was assigned an identification number, which was written on his or her questionnaire. Identification numbers were necessary to send follow-up mailings to non-respondents and avoid further inconvenience to participants. Identification numbers also were used to determine the county from which the surveys were returned.

#### ***Second Wave***

On March 11, 1999, approximately two weeks after the original mailing, postcards reminding participants to return their surveys were mailed to all non-respondents. This timing differs slightly from the four-wave method described by Dillman (1978), which recommends sending the first follow-up mailing after one week.

Reminder postcards were not sent out until two weeks after the original mailing because of heavy response within the first week and the size of the mailing.

### *Third Wave*

On April 5, 1999 a second copy of the questionnaire was mailed to non-respondents. A cover letter (Appendix 4) stressing the importance of the study and a postage-paid return envelope were included with the questionnaire.

### *Fourth Wave*

The final mailing was sent out on April 23, 1999. Reminder postcards, similar to those sent out in the second wave of the survey, were mailed to all non-respondents (Appendix 5). This differs from Dillman's four-wave method, which recommends that the final mailing consist of a questionnaire and a cover letter, sent by certified mail. Sending the final mailing by certified mail was not financially practical because of the large size of the mailing; therefore, a reminder postcard was used. In addition, the expense would have been unnecessary as an acceptable response rate was achieved using the methods described.

### **Data Analysis**

Non-response bias was evaluated by comparing early and late respondents' answers to selected questions (Miller and Smith 1983). Since it is not known how non-respondents would answer questions, non-response bias could not be measured directly in this survey. Late respondents were assumed to be more similar to non-respondents than early respondents, so early and late respondents were compared to determine potential for non-response bias. The first 351 (28%) questionnaires returned, those returned between

February 25 and March 6, 1999, were classified as early responses. The last 351 questionnaires returned, those returned after April 5, 1999, were classified as late responses. Pearson's Chi-square analysis was used to compare early and late respondents' answers to questions 1 through 5 and their farming status. One-way ANOVA was used to compare early and late respondents' answers to questions 7 and 32. All comparisons were made at a significance level of 0.05.

This survey was originally intended to be answered by Tennessee farmers, and it was assumed that the majority of the names on the list obtained from Farm Services were farmers. However, the data showed that a significant portion of participants earned less than 10% of their income from farming. Therefore, we created a variable to separate farmers and non-farmers, using answers to selected questions. Participants who earned 10% or more of their household income from farming were classified as farmers. Those who earned less than 10% of their household income from farming were classified as non-farmers. If participants did not disclose percent of household income from farming, then whether or not they farmed their own land and the amount of land they owned was used to classify them as farmers or non-farmers. Participants who farmed their own land or leased their farmland and who farmed 50 acres or more were classified as farmers. Participants who leased their land to someone else to farm or who farmed less than 50 acres were classified as non-farmers.

Questionnaire responses were analyzed using descriptive statistics (frequencies and means) to summarize data. Pearson's chi-square test was used to test for relationships between variables. All relationships were tested at a significance level of 0.05.



## CHAPTER IV

### RESULTS

#### **Response Rate**

Nine of the 2,110 questionnaires were returned by the post office as undeliverable, leaving 2,101 eligible questionnaires. A total of 1,295 questionnaires were returned for a raw response rate of 62%. Sixty-two questionnaires were eliminated from the data set because they were not complete enough to be used, leaving 1,233 useable questionnaires, or a useable response rate of 59%. Response rates for each county group and county were also calculated (Table 2). A 95% confidence interval was achieved for Groups 1, 2 and 4 and a 95% confidence interval was achieved for Group 3.

#### **Analysis of Non-response Bias**

One of the eight questions analyzed showed a difference between early and late respondents. Early respondents (52%) were more likely than late respondents (42%) to have experienced deer damage to their crops in the last year (question 5). No difference was found between early and late respondents' perceptions of deer populations in their area (question 1) or of deer damage in their area (question 2). No difference was found between what early and late respondents would like to see happen with deer populations in their area (question 3) or in their attitudes toward deer (question 4). Finally, there was

**Table 2. Number of questionnaires mailed and survey response rates by county.**

<b>County Group or County</b>	<b>N<sup>1</sup></b>	<b>Questionnaires Sent</b>	<b>Questionnaires Returned</b>	<b>Raw Response Rate (%)</b>	<b>Useable Questionnaires</b>	<b>Useable Response Rate (%)</b>
<i>Group 1</i>	<i>2,265</i>	<i>566</i>	<i>360</i>	<i>63.6</i>	<i>340</i>	<i>60.1</i>
Weakley	1,329	333	200	60.1	188	56.5
Henry	936	233	160	68.7	152	65.2
<i>Group 2</i>	<i>1,789</i>	<i>545</i>	<i>343</i>	<i>62.9</i>	<i>329</i>	<i>60.4</i>
Montgomery	672	204	133	65.2	124	60.8
Robertson	1,117	341	210	61.6	205	60.1
<i>Group 3</i>	<i>1,434</i>	<i>519</i>	<i>301</i>	<i>58.0</i>	<i>283</i>	<i>54.5</i>
Fayette	824	298	172	57.7	159	53.4
Hardeman	610	221	129	58.4	124	56.1
<i>Group 4</i>	<i>960</i>	<i>471</i>	<i>291</i>	<i>61.8</i>	<i>281</i>	<i>59.7</i>
Lincoln	491	240	158	65.8	152	63.3
Franklin	469	231	133	57.6	129	55.8
<b>Totals</b>	<b>6,448</b>	<b>2,101</b>	<b>1,295</b>	<b>61.6</b>	<b>1,233</b>	<b>58.7</b>

<sup>1</sup>N=number of names available on original Farm Services list.

no difference in early and late respondents' farming status, the mean rating of their damage (question 7) or mean number of acres owned (question 32).

### **Farming Status**

Over half of the participants (665) were classified as farmers and 537 were classified as non-farmers. The remaining 31 participants could not be classified as farmers or non-farmers because of insufficient data. Although this survey was intended for farmers, responses from both farmers and non-farmers provided relevant and useful data. The first half of Section 1 presents data from all 1,233 participants (farmers, non-farmers and unclassified participants). Since farmers' answers to many questions were different from non-farmers, data from farmers were analyzed separately and are presented in the second half of Section 1.

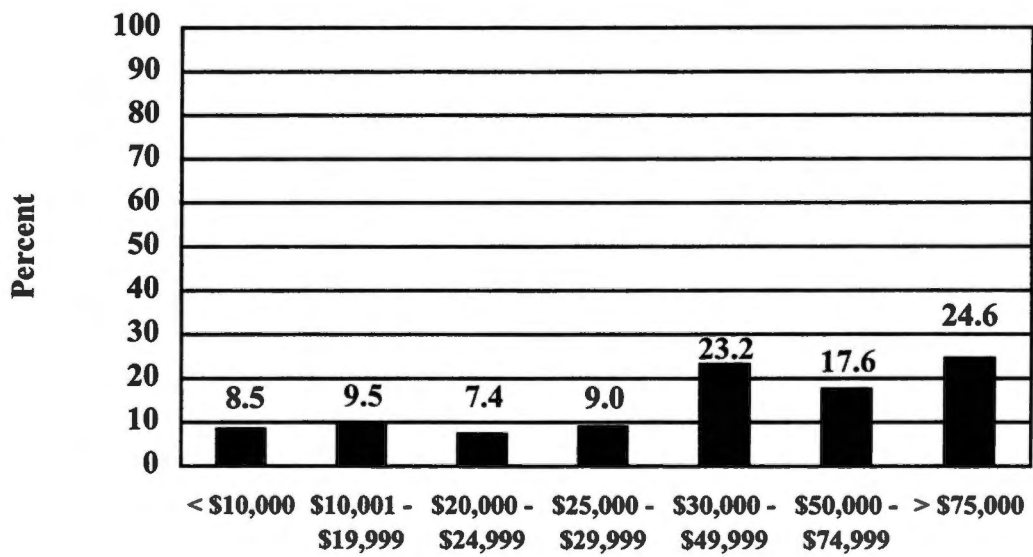
### **Descriptive Statistics**

#### ***All Participants (Farmers and Non-farmers)***

*Demographics.*--Survey participants ranged in age from 19 to 98 years old. The mean age was 59.4 years old with a standard deviation of 14.5 years (n=1,183). The majority of participants (84%) were male. Nearly half of all participants (48%) had a high school education or less (Table 3), while 26% were college graduates or higher. Annual incomes ranged from less than \$10,000 to more than \$75,000 and were skewed toward higher levels, with 42% earning more than \$50,000 per year (Figure 2). Many participants (42%) reported they earned less than 10% of their household income from

**Table 3. Landowners' education levels (n=1,020).**

<b>Education level</b>	<b>Percentage</b>
Less than high school graduate	15.4
High school graduate	32.8
Some college	15.2
Trade or vocational school	10.3
College graduate	15.8
Post graduate	10.5
Total	100



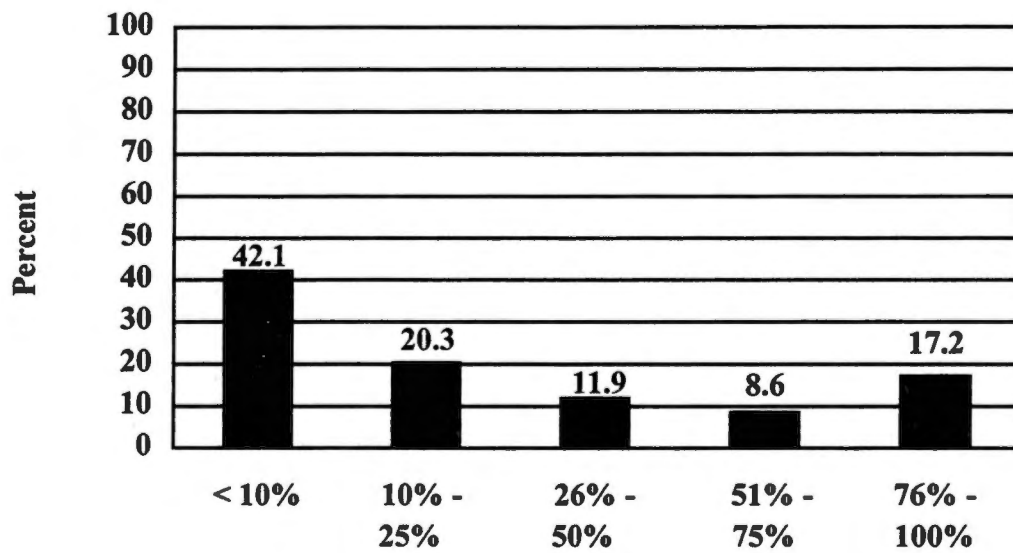
**Figure 2. Landowners' annual household incomes (n=796).**

farming, although 26% earned more than 50% of their household income from farming (Figure 3). The majority of participants (96%) were Caucasian (n=1,071).

*Farm Information.*--The number of acres owned or farmed ranged from 3 to 17,000 (n=1,180) with a mean of 442 acres. This average was skewed, however, by a few outliers with very large farms, which resulted in a standard deviation of 1,050 acres. A more accurate description of acres owned is the median of 154 acres. Participants managed their land for a variety of products (Table 4) with the majority being field crops (44%) and livestock (16%) or a both (11%). The majority of producers (58%) owned and farmed their own land and 45% owned land that they leased to someone else. Some producers (23%) leased land from someone else. Answers in the land ownership category overlap because participants could check more than one answer on this question. Most producers (71%) lived on their farm and 70% were members of the Tennessee Farm Bureau.

*Perceptions of Deer Populations.*--Most participants thought deer populations in their area had increased greatly (39%) or increased slightly (37%) (n=1,198). The remainder thought deer populations had stayed the same (16%), decreased slightly (7%), or decreased greatly (2%). Many participants reported they would like to see deer populations in their area decrease greatly (24%), decrease slightly (25%), or stay the same (32%). A few participants wanted to see deer populations increase slightly (13%) or increase greatly (7%).

Most participants thought deer damage in their area had increased greatly (29%) or increased slightly (35%). Only a few thought deer damage had decreased slightly (5%) or decreased greatly (2%) and 31% thought damage had stayed the same. When



**Figure 3. Landowners' percentage of household income from farming (n=1,020).**

**Table 4. Farm products managed for by landowners (n=1,192).**

<b>Product</b>	<b>Percentage</b>
Field crops	44.0
Livestock	16.3
Forest products	3.4
Vegetables	1.3
Orchard crops	0.3
Field crops and livestock	10.5
Combination of farm products	16.2
Other	8.0
Total	100



asked to describe their attitude toward deer, 48% of participants reported they enjoyed deer, while 38% enjoyed deer but worried about crop damage. A few participants (15%) felt deer were a nuisance.

*Experience with Deer Damage.*--Forty-seven percent of participants reported deer damage to crops and 30% reported damage from wildlife other than deer (Table 5). About half of all participants (55%) had crop damage from deer or other wildlife.

The vast majority of participants (78%) said deer was the main species causing damage, followed by groundhogs and raccoons (Table 6). When asked to rate their damage, slightly over two thirds reported light or moderate damage (Table 7). Slightly less than one third reported substantial (20%) or severe damage (9%). When asked to describe their damage, the largest percentage (40%) described it as "moderate damage around edges, light damage across field" (Table 8). A few participants (8%) said they had "severe damage across entire field."

About half of the participants who experienced damage (54%) estimated their loss at \$500 or less (Figure 4). However, about a quarter (26%) estimated that they had damage of \$1,000 or more. Some participants considered any amount of damage intolerable (17%), while 36% would consider \$100 or less tolerable (Figure 5). To determine the percentage of participants who had damage that exceeded their tolerance, the estimated value of damage was compared to the maximum amount tolerated. Each participant's estimated value of damage was subtracted from the maximum amount they considered tolerable, with negative values representing participants whose damage exceeded their tolerance. This comparison revealed that 56% of participants who reported damage (or 26% of all participants) had damage that exceeded their tolerance.

**Table 5. Types of crop damage incurred by landowners.**

Type of damage	Percentage of participants with damage <sup>1</sup>	n
Deer	47.0	1,211
Other wildlife	29.8	1,175
Deer or other wildlife	55.2	1,196

<sup>1</sup> Participants could indicate more than one option.

**Table 6. Main species reported by landowners as causing crop damage (n=581).**

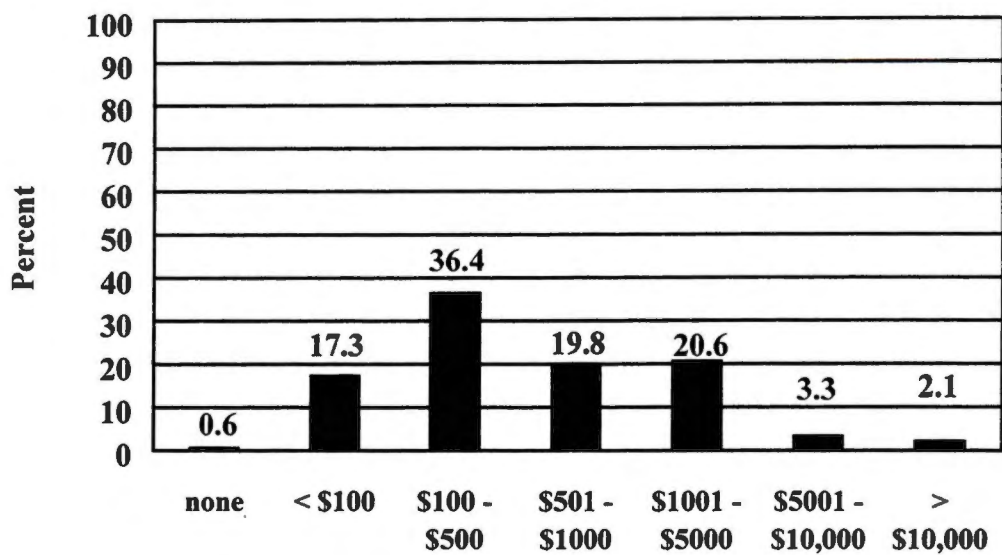
Species	Percentage
Deer ( <i>Odocoileus virginianus</i> )	78.0
Groundhog ( <i>Marmota monax</i> )	6.5
Raccoon ( <i>Procyon lotor</i> )	6.2
Beaver ( <i>Castor canadensis</i> )	4.3
Coyote ( <i>Canis latrans</i> )	1.9
Other	3.1
Total	100

**Table 7. Landowners' ratings of deer damage to crops (n=554).**

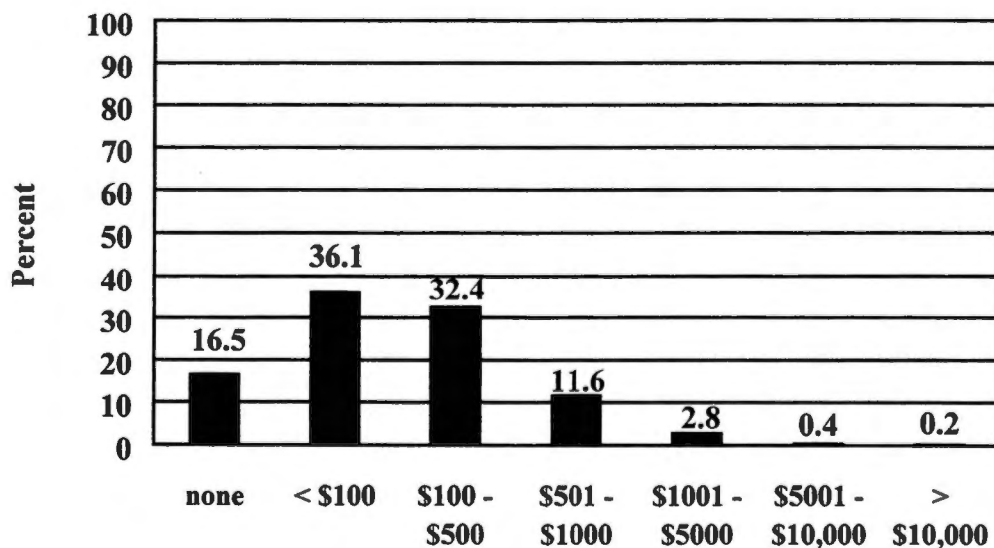
<b>Damage rating</b>	<b>Percentage</b>
Light	38.8
Moderate	31.8
Substantial	20.2
Severe	9.2
Total	100

**Table 8. Landowners' descriptions of deer damage to crops (n=541).**

<b>Description of damage</b>	<b>Percentage</b>
Light damage around edges of field only	23.8
Moderate damage around edges, light damage across field	39.6
Severe damage around edges, moderate damage across field	23.3
Severe damage across entire field	7.9
Other	5.4
Total	100



**Figure 4. Landowners' estimates of dollar value of loss from deer damage (n=481).**

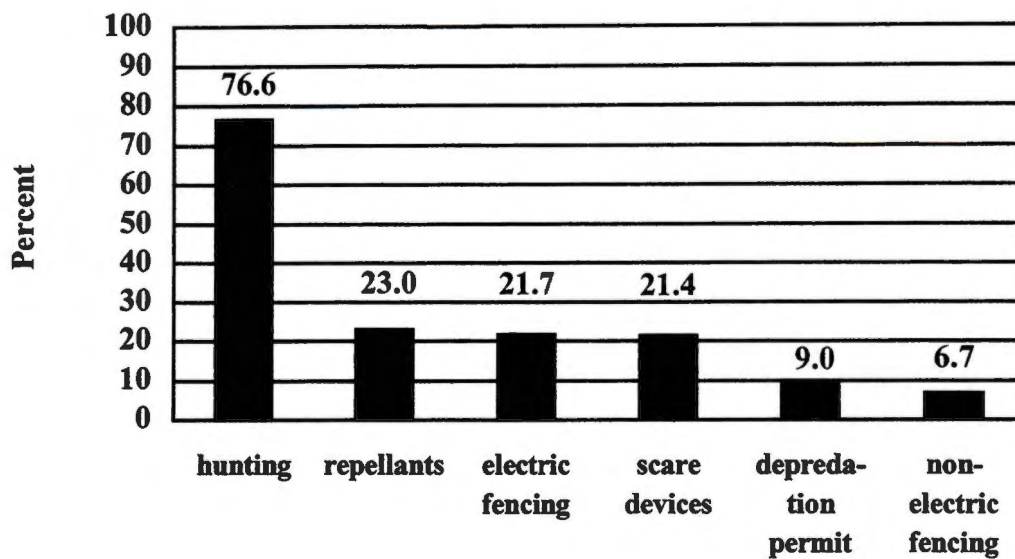


**Figure 5. Maximum amount of wildlife damage considered tolerable by landowners (n=935).**

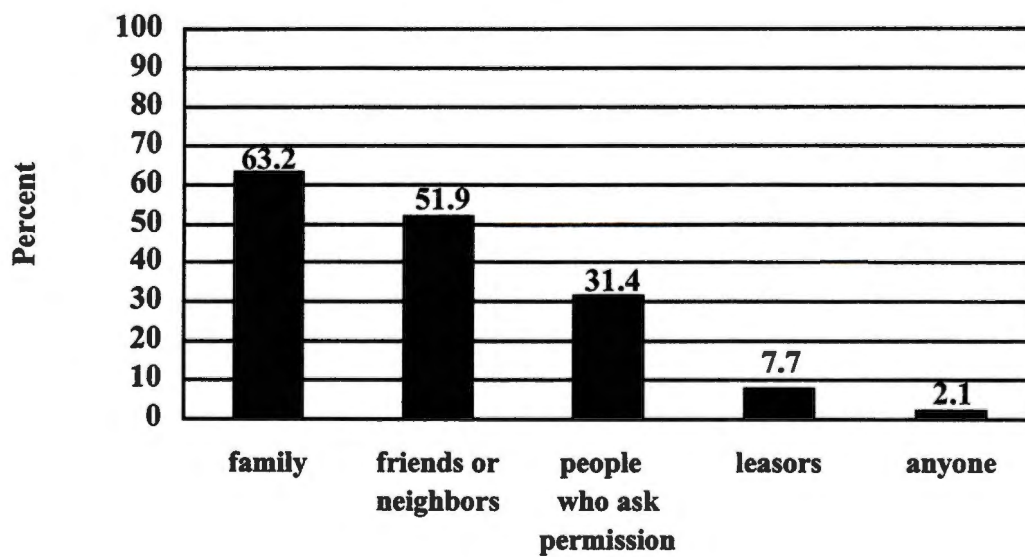
*Deer Damage Control Measures.*--One quarter of the participants (25%) had taken measures to control deer damage (n=1,182). Among participants who had taken action to prevent deer damage, the overwhelming majority (77%) had used hunting to control damage on their land. They also used repellants, electric fencing and scare devices to control deer damage (Figure 6). Those who used a particular damage control method were asked to rate its effectiveness on a scale of 1 to 5 (1=not very effective; 5=very effective). Shooting outside of the hunting season with a depredation permit was rated as the most effective method of controlling deer damage, with a mean score of 3.0, followed by electric fencing (2.8) and in-season hunting (2.5) (Table 9). Most participants (80%) reported they were not aware that TWRA offers assistance with crop damage problems. Of the 234 participants who were aware, 20% had contacted TWRA about wildlife damage.

*Hunting on Property.*--Many participants (43%) reported they had hunted in the last five years, while about one quarter (26%) reported they had hunted in the past but not recently (n=1218). About one-third (31%) had never hunted. Most participants (79%) allowed deer hunting on their land, particularly by family members, friends, and neighbors (Figure 7). A few participants (10%) reported that they leased their land for hunting (n=983) and charged an average of \$3/acre for the lease (n=53).

Half of all participants (50%) reported they had experienced problems with hunters in the past and 51% had posted their land with "No Trespassing" signs. Those who had experienced problems with hunters in the past were asked to describe those



**Figure 6. Deer damage control measures used by landowners (n=299).**



**Figure 7. Groups that landowners allowed to hunt deer on their property (n=988).**

**Table 9. Landowners' ratings of the effectiveness of deer damage control measures.**

<b>Control method</b>	<b>Mean score<sup>1</sup></b>	<b>n</b>
Depredation permit	3.0	27
Electric fencing	2.8	60
Hunting (in-season)	2.5	221
Repellants	2.1	60
Non-electric fencing	2.0	18
Scare devices	1.9	58

<sup>1</sup> mean scores: 1=very ineffective; 5=very effective

problems. Comments from participants about relatively minor problems with hunters included:

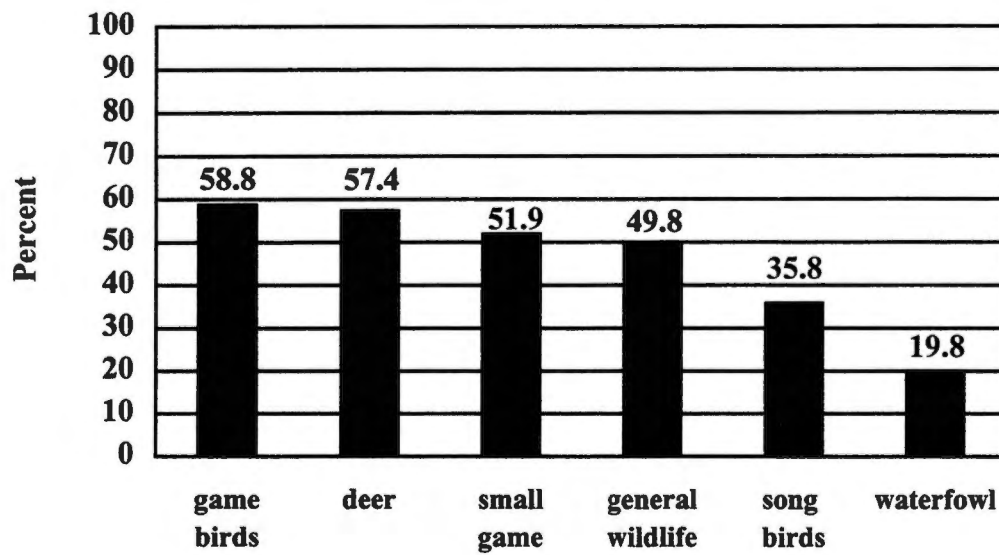
- “People coming on land without permission.”
- “Put up unauthorized tree stands.”

More serious problems with hunters included:

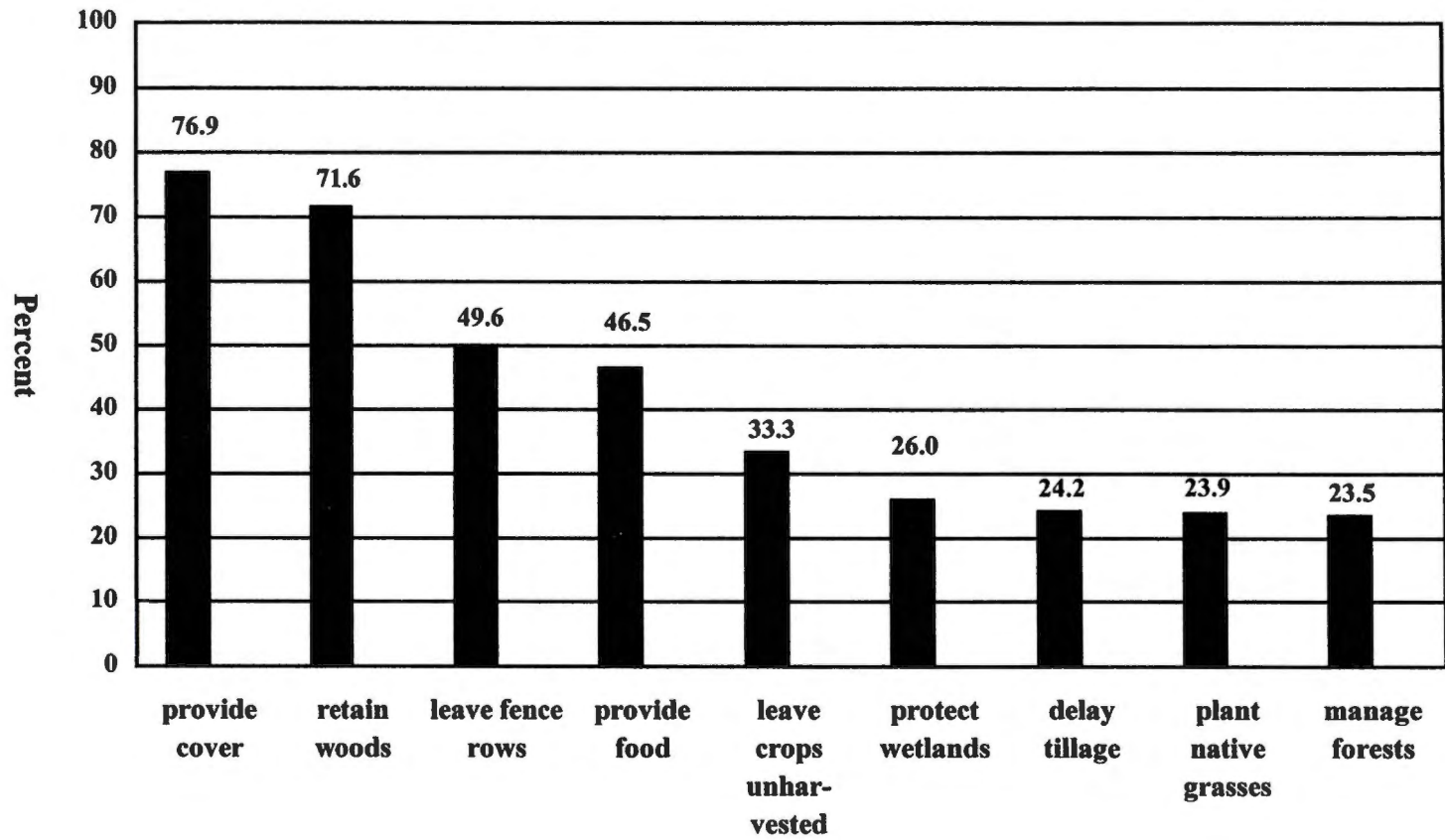
- “People just cut your fences and make themselves at home.”
- “Threatening to shoot you, curse at you.”
- “Hunters coming on property without permission and shooting within 200 feet of my house.”

*Wildlife Habitat on Property.*--Although only 6% of the participants were members of conservation organizations, 42% reported that they did something to manage their land for wildlife. Of the 495 participants who do manage their land for wildlife, 59% managed for game birds, followed closely by deer (57%) and small game (52%) (Figure 8). The most common wildlife management practice used by participants who manage for wildlife was providing cover (77%), retaining wooded areas (72%), and letting fence rows grow (50%) (Figure 9). Time and money were the biggest constraints keeping participants from managing their land for wildlife (Figure 10). Many participants reported that they would accept cash payments (42%), seed for food plots (37%), tax incentives (36%), or information or technical advice (31%) to assist them in managing their land for wildlife (Figure 11). Approximately one third (35%) said they would not accept any means of assistance to manage their land for wildlife.

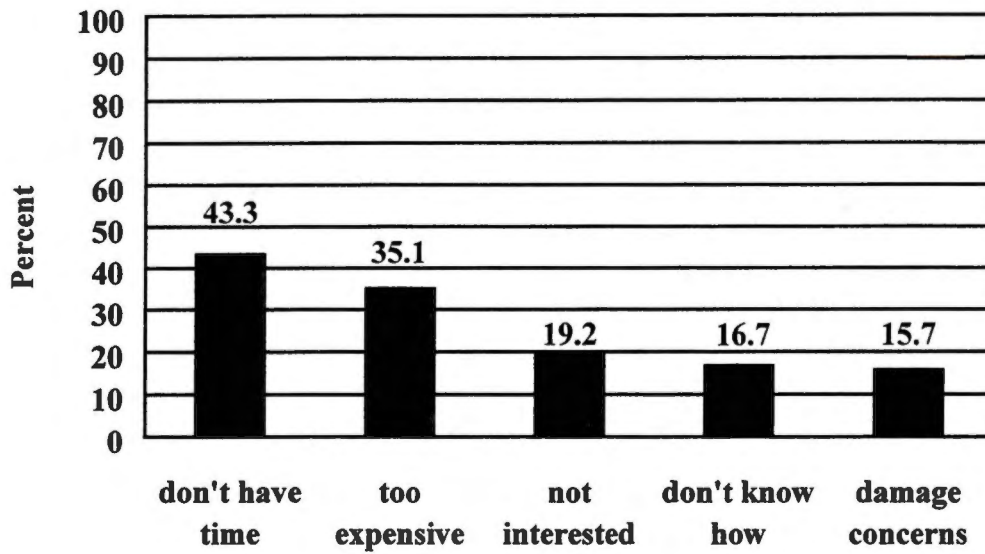




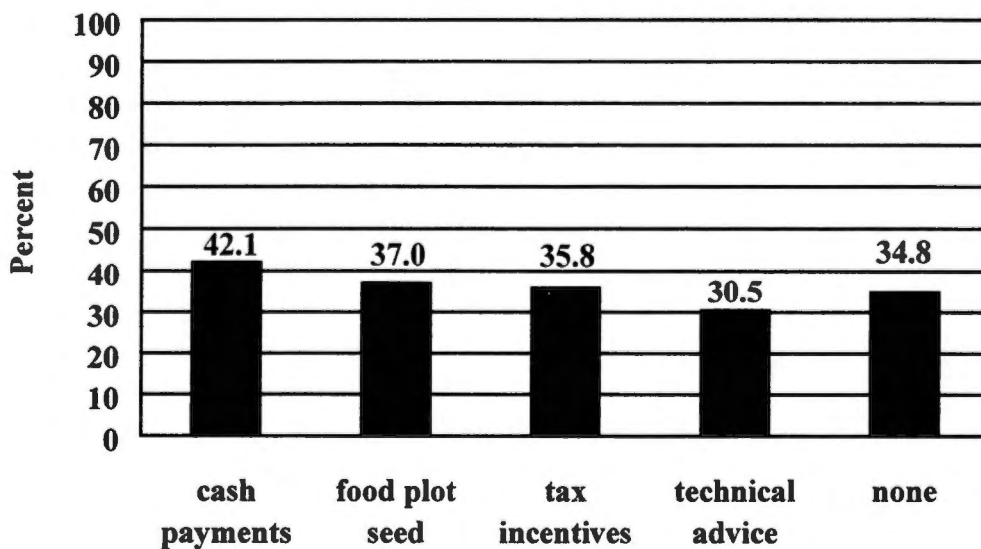
**Figure 8. Wildlife species managed for by landowners (n=495).**



**Figure 9. Wildlife management practices used by landowners (n=493).**



**Figure 10. Landowners' reasons for not managing their land for wildlife (n=1,119).**



**Figure 11. Landowners' preferred forms of assistance for wildlife management on their land (n=1,124).**

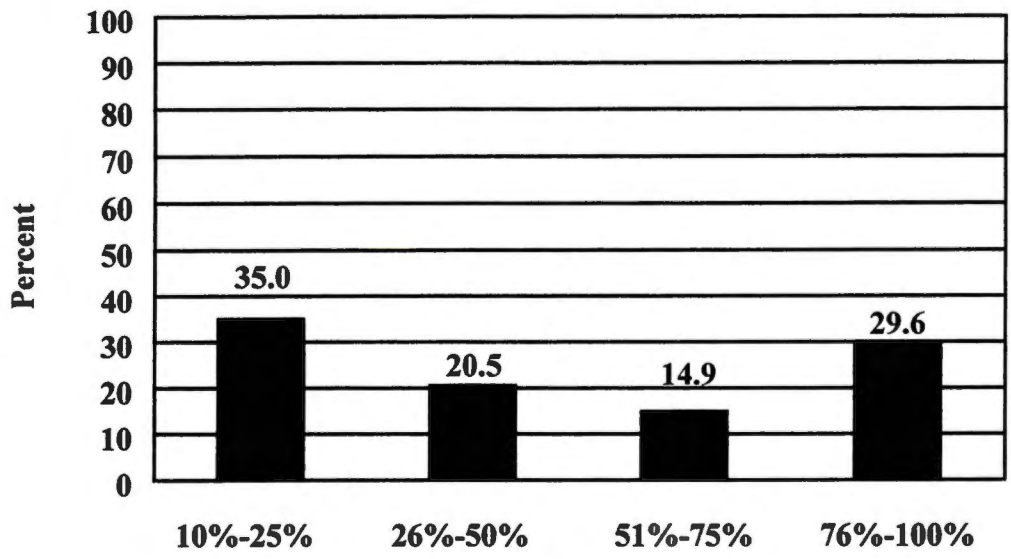
### *Farmers Only*

Participants were identified as farmers if they earned 10% or more of their household income from farming or, for those who did not disclose percent of income from farming, said they farmed 50 acres or more. Approximately half of the study participants (54%) were full- or part-time farmers (n=1233).

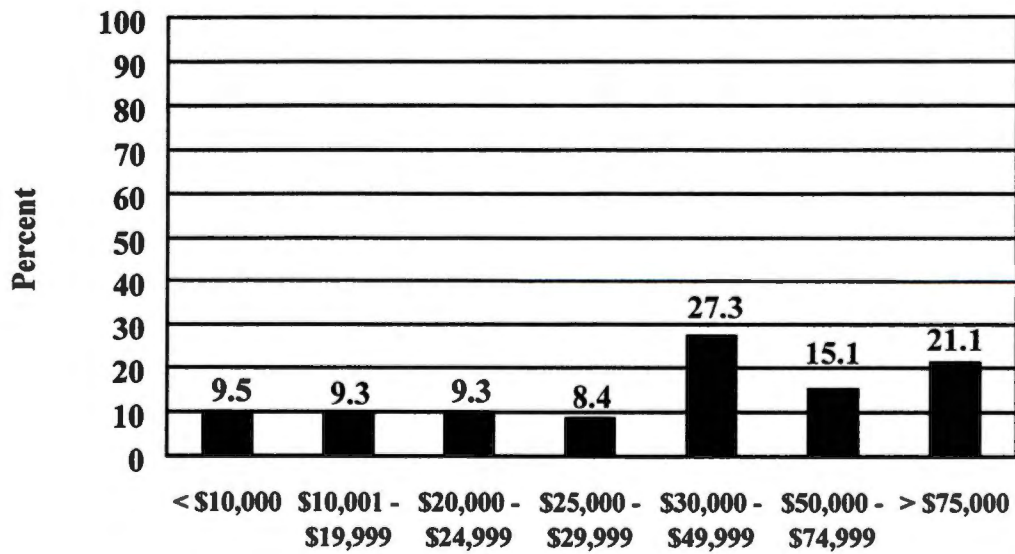
*Demographics.*--Slightly less than half of the farmers (46%) earned more than half of their household income from farming (Figure 12). Farmers' annual household incomes ranged from less than \$10,000 to more than \$75,000, with 64% earning more than \$30,000 per year (Figure 13). About half of the farmers (53%) had a high school education or less, while 21% were college graduates or higher (Table 10).

*Farm Information.*--The number of acres owned or managed by farmers surveyed ranged from 5 to 17,000, with a mean of 636 acres (n=653). A few outliers with very large farms, resulting in a standard deviation of 1,320 acres, skewed this distribution. The median number of acres owned by farmers was 250 acres. Farmers managed their land for a variety of products (Table 11). The majority managed for field crops (49%) or livestock (16%) or a combination of the two (15%). Seventy-one percent of farmers owned and farmed their own land, while 31% owned land that they leased to someone else and 34% leased farmland from someone else. Responses overlap because farmers could check more than one answer in the land ownership category. Most farmers (81%) lived on their farm and 79% were members of the Tennessee Farm Bureau. Farmers were more likely than non-farmers to be members of the Tennessee Farm Bureau.

*Farmers' Perceptions of Deer Populations.*--The majority of farmers reported that they would like to see deer populations in their area decrease (57%) (n=634). About a



**Figure 12. Farmers' percent of household income from farming (n=591).**



**Figure 13. Farmers' annual household incomes (n=451).**

**Table 10. Education level of farmers (n=639).**

<b>Education level</b>	<b>Percentage</b>
Less than high school graduate	15.1
High school graduate	37.7
Some college	15.6
Trade or vocational school	10.3
College graduate	14.6
Post graduate	6.7
Total	100

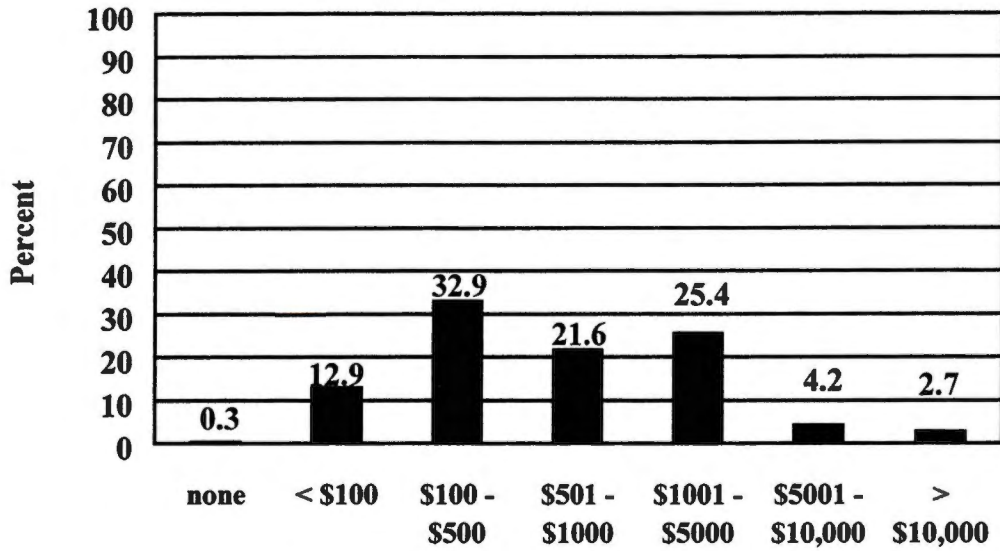
**Table 11. Farm products managed for by farmers (n=655).**

<b>Product</b>	<b>Percentage</b>
Field crops	48.7
Livestock	16.2
Forest products	0.8
Vegetables	0.9
Field crops and livestock	14.5
Combination of crops	15.9
Other	3.1
Total	100

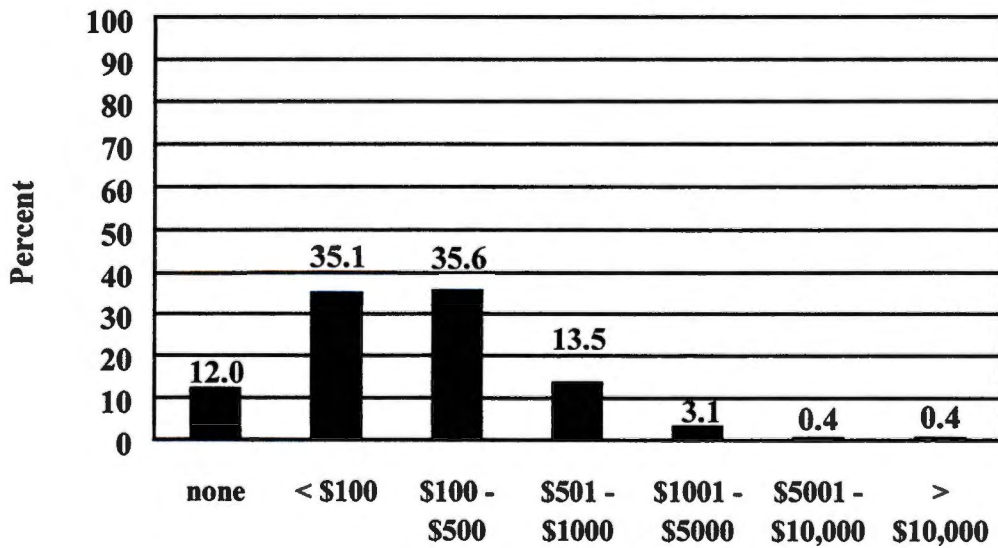
quarter of farmers (28%) would like populations to stay the same, while 15% would like to see an increase in deer populations. When asked to describe their attitude toward deer, 40% of farmers reported that they enjoyed deer, while 42% enjoyed deer, but worried about crop damage. A few farmers (19%) felt that deer were a nuisance. Farmers were more likely to have felt that deer were a nuisance than non-farmers.

*Farmers' Experience with Deer Damage.*--Approximately two thirds of the farmers (68%) sustained crop damage from wildlife (n=650). The majority of farmers (60%) reported deer damage to crops while 40% reported damage from other wildlife. Farmers were more likely to have experienced deer damage than non-farmers (32%). When asked to estimate the dollar value of their loss from wildlife damage, 46% estimated their loss at \$500 or less, although 7% estimated their loss at over \$5,000 (Figure 14). Some farmers considered any amount of damage intolerable (12%), while 35% would consider less than \$100 tolerable (Figure 15). Comparing the estimated dollar value of damage reported by farmers to the maximum amount considered tolerable showed that 63% of farmers who reported damage had damage that exceeded their tolerance level.

*Deer Damage Control Measures.*--About one third of farmers (31%) had taken measures to prevent deer damage (n=642) and hunting was the most commonly used method of deer damage control (Figure 16). Repellants, electric and non-electric fencing, scare devices and depredation permits each were used by less than 23% of farmers using damage control measures. Farmers rated shooting outside of the hunting season with a depredation permit as the most effective method of controlling deer damage, with a mean

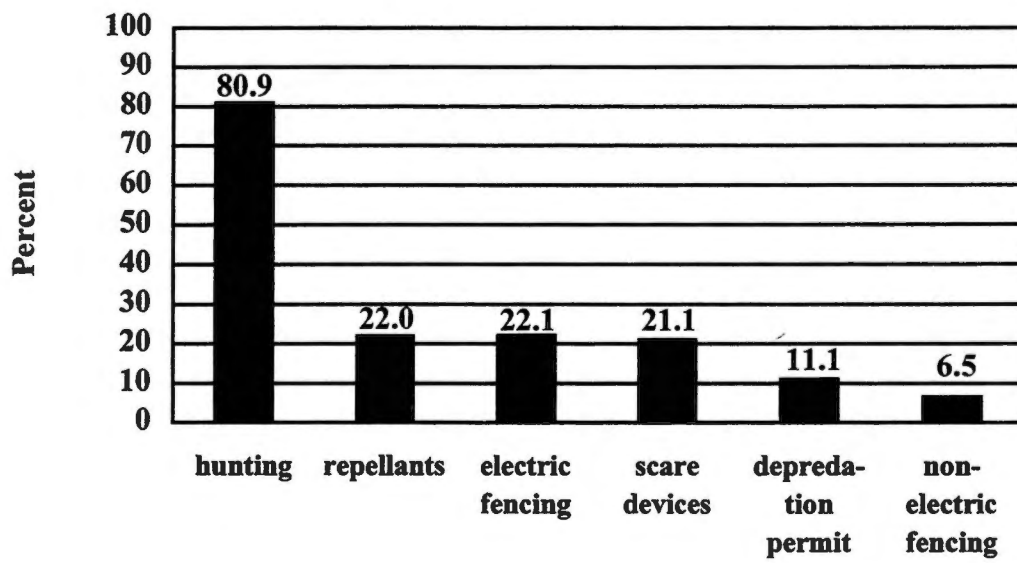


**Figure 14. Farmers' estimates of dollar value of loss from deer damage (n=334).**



**Figure 15. Maximum amount of wildlife damage considered tolerable by farmers (n=542).**





**Figure 16. Deer damage control measures used by farmers (n=199).**

score of 3.2 (Table 12). The majority of farmers (78%) reported that they were not aware that TWRA offers assistance with crop damage problems.

*Hunting on Property.*--The majority of farmers (86%) allowed deer hunting on their land (n=658) and 72% hunted themselves. A few farmers (12%) leased their land for hunting (n=574) and over half (54%) had experienced problems with hunters in the past (n=644). Farmers were more likely to have hunted recently than non-farmers.

*Wildlife Habitat on Property.*—Many farmers (43%) reported they manage their land for wildlife. Most of the farmers who attempted to manage their land for wildlife managed for game birds (65%), followed closely by deer (54%) and small game (54%) (Figure 17). Many farmers reported they would accept cash payments (44%), while two thirds of farmers said they would not accept any means of assistance to manage their land for wildlife (n=613). A small number of farmers (5%) were members of conservation organizations.

### **Participants' Open-ended Comments**

Participants were provided with space at the end of the survey to write comments on wildlife and wildlife damage in Tennessee. Participants used this space to write comments about their experiences with wildlife damage and their opinions about wildlife management in their area.

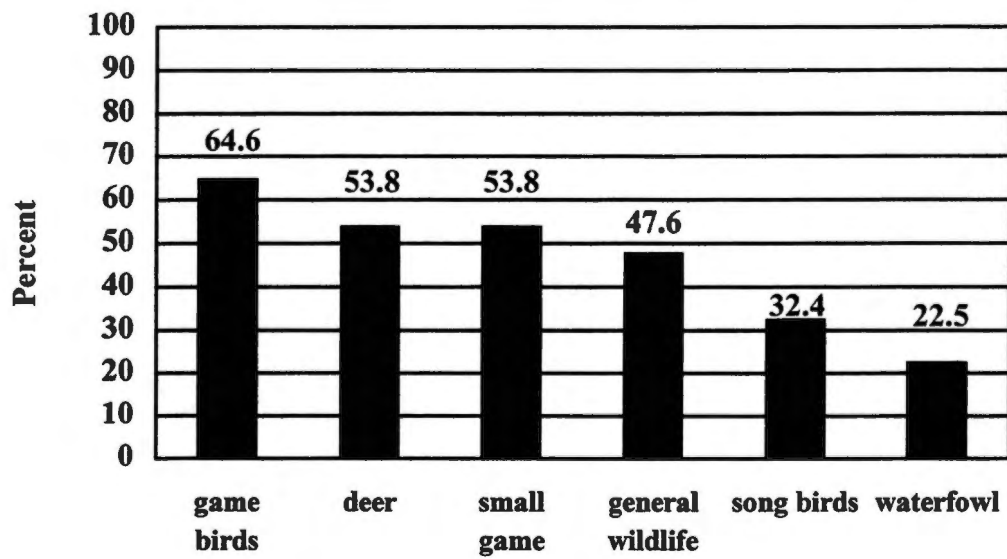
#### **Deer damage:**

- “As long as I raise cotton, I have no problems. I have some problems with soybean damage in early stages. Deer wreak havoc when we raise corn or wheat! I don't plan on raising anything but cotton next year.”

**Table 12. Farmers' ratings of the effectiveness of deer damage control measures.**

<b>Control method</b>	<b>Mean score<sup>1</sup></b>	<b>n</b>
Depredation permit	3.2	27
Electric fencing	2.5	60
Hunting (in-season)	2.4	221
Repellants	2.0	60
Non-electric fencing	2.0	18
Scare devices	1.9	58

<sup>1</sup> mean scores: 1=very ineffective; 5=very effective



**Figure 17. Wildlife species managed for by farmers (n=275).**

- “Deer destroy field peas and tear down fences. They have destroyed oats I sow for hay year after year.”
- “On the family farm there are several small fields, and due to deer totally destroying my last soybean crop in those fields, I have decided to quit planting those fields to soybeans.”
- “Deer damage on the farms I operate is increasing every year. Many of the smaller fields that are planted to soybeans are severely damaged across the entire field. Many of these fields are not harvested due to the deer damage.”

#### Deer populations:

- “The deer population in southern middle Tennessee is out of control. Some action must be taken now to decrease the deer population.”

#### Deer/vehicle collisions:

- “My husband and I have experienced car damage on three separate occasions. The loss of life is far more fearful than the loss of crops.”
- “I have had six family members involved in accidents with deer on the road where we live.”
- “There are a lot of deer in our area. A lot of them get hit by cars. They cause a lot of damage to people’s cars.”
- “I think deer are more damaging to vehicles than crops, and the state should be held responsible.”

Problems with hunters:

- “I have more damage from hunters than wildlife. I truly love to see the deer and turkeys on my farm, but it would be a blessing if they all would die because of the overbearing hunters.”
- “What about damage that is caused by ‘deer’ hunters?”

Damage from other wildlife:

- “Coyote packs are increasing drastically. They need to be brought under control. They have almost depleted deer, quail, rabbits, and other small wildlife in my area. There are at least 4 packs in hearing distance of my house.”
- “Beavers cause damage also.”
- “The big problem we have is with beavers, coyotes, and hawks. The hawks and coyotes get all our chickens.”
- “Coyotes, beavers, and black birds: these are what gives us more trouble than anything. Beavers are stopping the creek up, and that causes the water to get over the fields and roads and are making the trees die.”

Appreciation for wildlife:

- “I love the deer. It would take a lot of crop damage for me to attempt to limit their numbers.”
- “I have minor damage by wildlife. I get enough enjoyment out of hunting deer, rabbits, and quail to offset the damage.”
- “I like what TWRA is doing. The wild turkeys that have been established in Fayette County are really a treasure.”

Participants' open-ended comments provide valuable qualitative information and offer a detailed picture of how participants are affected by wildlife. Many participants have been affected by wildlife and deer damage to crops and property. Despite the effects of wildlife damage, many participants have positive attitudes toward wildlife and enjoy it for its aesthetic value.

### **Comparisons between County Groups**

Study participants were selected from eight counties grouped in four groups of two adjacent counties (Figure 1): County Group 1 (Weakley and Henry), County Group 2 (Montgomery and Robertson), County Group 3 (Fayette and Hardeman), and County Group 4 (Lincoln and Franklin). Although the four groups of counties had relatively high levels of soybean production and deer harvest numbers, there was variation in these and other socio-economic and physiographic characteristics. To determine if there were regional differences, we compared responses to several key questions across the four county groups.

Chi-square analysis showed that county groups differed in the percentage of participants who reported deer damage (Table 13). County Group 1 had the highest frequency of participants reporting deer damage (55%), while County Group 3 had the lowest (37%). County groups also differed in the percentage of participants who had wildlife damage from any species (Table 14). County Groups 1 and 4 had the highest percentage of participants reporting wildlife damage (60%), while County Group 3 again had the lowest (47%).

**Table 13. Distribution of participants' experience with deer damage by county group.**

	County Group				Total
	County Group 1	County Group 2	County Group 3	County Group 4	
Had deer damage	54.8%	43.7%	37.0%	51.6%	53.0%
Did not have deer damage	45.2%	56.3%	63.0%	48.4%	47.0%
Total	100%	100%	100%	100%	100%

$X^2 = 23.2$

$p < 0.05$

$n = 1211$

**Table 14. Distribution of participants' experience with wildlife damage (any species) by county group.**

	County Group				Total
	County Group 1	County Group 2	County Group 3	County Group 4	
Had wildlife damage	59.9%	53.9%	46.6%	59.9%	55.2%
Did not have wildlife damage	40.1%	46.1%	53.4%	40.1%	44.8%
Total	100%	100%	100%	100%	100%

$X^2 = 13.8$

$p < 0.05$

$n = 1196$



County groups differed in the distribution of participants' preferences for future deer population trends (Table 15). County Group 4 had the highest frequency of participants who wanted a decrease in deer populations (55%). County Group 3 had the lowest percentage of participants who wanted a decrease (30%). County groups also differed in the distribution of participants' attitudes toward wildlife (Table 16). County Groups 2 and 4 had the highest percentage of participants who felt deer were a nuisance (20%), while County Group 3 had the lowest percentage of participants who felt deer were a nuisance (5%).

County groups differed in the percentage of participants who allowed deer hunting on their land (Table 17). County Group 1 had the highest percentage of participants who allowed hunting (85%), while County Group 2 had the lowest (76%). County groups also differed in the percentage of participants who manage for wildlife (Table 18). County Group 3 had the highest frequency of participants who said they manage for wildlife (54%). Approximately one third of participants in County Groups 2 and 4 manage for wildlife.

### **Relationships between Variables**

Participants' experience with deer damage to crops was related to several variables. Not surprisingly, participants who experienced deer damage were more likely to consider deer a nuisance and want a decrease in deer populations. Those who sustained deer damage also were more likely to allow hunting on their land and to lease their land for hunting. In addition, those with deer damage were more likely to take measures to control deer damage on their property.

**Table 15. Distribution of participants' preferences for deer populations by county group.**

	County Group				Total
	County Group 1	County Group 2	County Group 3	County Group 4	
Decrease	53.8%	54.3%	29.6%	54.9%	19.9%
Stay the same	29.3%	33.2%	33.9%	29.9%	31.6%
Increase	16.9%	12.5%	36.5%	15.2%	48.5%
Total	100%	100%	100%	100%	100%

$\chi^2 = 79.0$

$p < 0.05$

$n = 1165$

**Table 16. Distribution of participants' attitudes toward deer by county group.**

	County Group				Total
	County Group 1	County Group 2	County Group 3	County Group 4	
Enjoyed deer	45.0%	41.1%	65.0%	40.2%	47.5%
Enjoyed deer, but worried	41.3%	39.2%	30.5%	40.2%	38.0%
Felt deer were nuisance	13.7%	19.7%	4.5%	19.6%	14.5%
Total	100%	100%	100%	100%	100%

$\chi^2 = 58.4$

$p < 0.05$

$n = 1171$

**Table 17. Distribution of participants' who allowed deer hunting by county group.**

	County Group				Total
	County Group 1	County Group 2	County Group 3	County Group 4	
Allowed deer hunting	85.2%	76.2%	79.7%	75.8%	79.4%
Did not allow deer hunting	14.8%	23.8%	20.3	24.2%	20.6%
Total	100%	100%	100%	100%	100%

$$X^2 = 11.0$$

$$p < 0.05$$

$$n = 1219$$

**Table 18. Distribution of participants' who manage for wildlife by county group.**

	County Group				Total
	County Group 1	County Group 2	County Group 3	County Group 4	
Managed for wildlife	44.0%	34.7%	54.1%	33.9%	58.5%
Did not manage for wildlife	56.0%	65.3%	45.9%	66.1%	41.5%
Total	100%	100%	100%	100%	100%

$$X^2 = 30.9$$

$$p < 0.05$$

$$n = 1193$$

Several other variables were related to participants' experience with deer damage. Farmers' likelihood of experiencing deer damage increased as percent of household income from farming increased. In addition, farmers who manage for field crops were more likely than farmers who manage for other products, such as livestock, to experience damage from deer or other wildlife.

Many participants reported having problems with hunters in the past. Those who had problems with hunters were more likely to post their property with "No Trespassing" signs. Participants who had problems with hunters were no more or less likely to consider deer a nuisance.

Many participants managed their land in some respect for wildlife; however, those who considered deer a nuisance were less likely to do so. Farming status and percent of income from farming were not related to the likelihood of managing for wildlife.

## CHAPTER V

### DISCUSSION

#### Methodology

There were two methodological factors that may have influenced the results of this study. These factors are the percentage of survey participants who were farmers and non-response bias. Participants were selected from a list of names and addresses provided by Farm Services Agency. Of the 1,233 participants, 54% were classified as full- or part-time farmers based on survey data. Participants who were classified as farmers were more likely than non-farmers to experience damage from deer and other wildlife. Therefore, surveys where the large majority of participants are full- or part-time farmers may report higher levels of wildlife damage than were found in our overall study.

Non-response bias also may have influenced the results of this study. Early respondents were more likely than late respondents to have experienced deer damage. This indicates that participants with deer damage may be over-represented in the study so the true percentage of farmers and landowners who experience deer damage may be lower than was found in this study. However, the response rate was comparable to many other studies and the influence of non-response bias in this study should be comparable to other studies as non-response bias generally is an issue in mail surveys.

### **Extent and Nature of Crop Damage**

The results of this study suggest that many Tennessee landowners are affected by deer damage. The majority of study participants experienced wildlife damage and slightly less than half incurred deer damage. Many participants with damage rated it as light or moderate but about one quarter of all participants had damage that exceeded their tolerance level. Participants who experienced deer damage were more likely to consider deer a nuisance and want a decrease in deer populations.

Although deer damage was a minor problem for most participants, a few participants with damage had severe damage and estimated the value of their damage at \$5000 or greater. This is a significant amount of damage to be sustained by a single landowner. Landowners with severe deer damage may have more negative attitudes about deer and be more vocal about their concerns. While those with severe damage may be a minority, their problems and concerns are valid issues that need to be addressed by wildlife managers.

Many landowners had damage that exceeded their tolerance and over half of the participants reported that any amount of damage above \$100 was intolerable. This is important because many landowners seem to be intolerant of even small amounts of damage, although the majority of damage incurred may seem minor.

The relationship between real and perceived levels of wildlife damage is not known. Few studies have been done to compare farmers' perceptions of damage and actual damage, and none have directly measured the relationship between real and perceived levels of deer damage. Deer damage to crops may often be overestimated.

However, farmers' perceptions of damage are important regardless of actual levels of damage.

The amount and severity of wildlife damage incurred by Tennessee landowners in this study is moderate in comparison to levels of damage reported in previous studies from other areas of the nation. Lower levels of deer damage were reported in New York, where 35% of farmers experienced deer damage (Brown et al. 1980). In comparison, 47% of all participants and 60% of farmers in this study reported deer damage. Conover (1998) reported that 80% of participants in a nationwide study incurred wildlife damage, in comparison to 55% in this study.

A large majority of participants in this study reported that deer were the main species causing damage. Other studies report similar findings (Mc Dowell and Pillsbury 1959, Conover 1998). King (1993), however, reported groundhogs were causing more damage in Tennessee than deer. The current study was conducted in areas with high deer populations relative to the rest of the state, while King (1993) conducted a statewide survey. Deer damage in the counties included in this study was expected to be higher than throughout the state, where damage from other wildlife species might be higher. These geographic differences may partially explain the difference between this study and King (1993).

### **Landowners' Tolerance for Deer Damage**

Despite the fact that the majority of participants in this study held generally positive attitudes toward deer, only 20% of participants wanted an increase in deer

populations in their area. Nearly half of the participants actually preferred a decrease in deer populations.

The percentage of participants in this study who considered deer a nuisance was similar to previous studies conducted in Tennessee. Tannner and Dimmick (1983) showed that 10% of Tennessee farmers felt that deer were a nuisance and King 1993 reported 15%.

Farmers in New York appear to be more tolerant of deer than farmers in Tennessee. Only 2% of farmers in New York felt that deer were a nuisance (Brown et al. 1980), which may be attributed to lower levels of deer damage. Historic differences in deer populations could explain higher tolerance for deer damage in New York. New York farmers may be more accustomed to dealing with deer damage because New York's deer populations over the past few decades have been higher than Tennessee's. Many Tennessee farmers began farming when deer were scarce or non-existent in Tennessee and deer damage was not a problem.

### **Effectiveness of Damage Control Methods**

About one quarter of participants had taken measures to control deer damage and those who had incurred deer damage were more likely to try some method of damage control. Hunting was the damage control method most commonly used; however, the method that received the highest effectiveness rating was shooting deer outside of the hunting season with a depredation permit, followed by electric fencing. Nevertheless, these two methods were perceived as being only moderately effective although they were rated the highest relative to the other methods.



Some landowners commented that depredation permits were labor intensive and troublesome to use, which may be one reason why only a few participants had actually used a depredation permit. One participant said, "I know permits are given to shoot deer out of your crops in the summer, but who can stay up all night shooting deer and work the next day." Another participant commented that the permits worked well but were "a lot of expense and trouble to the landowner." Although depredation permits may be issued by state wildlife agencies to landowners with deer damage problems, by the time a landowner can obtain a permit, it may be too late to prevent crop losses. In addition, depredation permits are most effective at reducing crop losses if they are used early in the growing season. This is problematic because farmers must take the time to remove the deer during their busiest time of the year.

### **Landowners Managing for Wildlife**

Despite the fact that many participants incurred deer and other wildlife damage, 42% actively managed their land for wildlife. Game birds were the most common species managed for, followed by deer and small game. To manage for wildlife, participants provide cover, retain wood lots, and let fence rows grow.

The percentage of Tennessee landowners who manage their land for wildlife is comparable to those in other studies. In Ohio, Morrow (1997) reported 35% of farmers manage for wildlife (Morrow 1997). Nationwide, 51% of farmers reported they manage their land for wildlife (Conover 1998). A variety of factors, including income and the availability of assistance programs for wildlife management, may influence the number of landowners that manage their land for wildlife.

While many farmers in Tennessee and throughout the nation report that they manage their land for wildlife, the effectiveness of these activities in improving wildlife habitat is not known. Education and assistance programs can encourage more landowners to manage for wildlife and can help them do so more effectively.

The number of Tennessee landowners that manage their land for wildlife is encouraging since private lands are important wildlife habitat. However, increased incidences of wildlife damage may erode private landowners' support of wildlife management. This is evidenced by the fact that landowners who considered deer a nuisance were less likely to manage their land for wildlife. Wildlife damage issues need to be monitored and managed to ensure the continued support of private landowners given that over 90% of the land in Tennessee is privately owned.

### **Comparisons between County Groups**

Differences between county groups in terms of damage levels and participants' perceptions of wildlife were expected as a result of regional differences in crop production and deer populations. While participants' attitudes toward deer were related to their experience with damage, this trend was not necessarily present on a regional level. County Group 1 had the highest levels of deer and other wildlife damage, but County Groups 2 and 4 had the highest percentages of participants who wanted deer populations to decrease and considered deer a nuisance.

In addition, regional damage levels were not always tied directly to deer harvest numbers and soybean production. Although County Group 3 reported the lowest amount of deer damage to crops, County Group 2 had lower deer harvest numbers and County

Group 4 had lower soybean production than County Group 3. Factors such as habitat quality and the relationship between deer harvest numbers and actual deer population size may partially explain this difference.

### **Future Research**

This study revealed valuable information about Tennessee farmers' perceptions of deer damage and their attitudes toward wildlife. However, wildlife damage is an issue that must be monitored continually since changing conditions affect damage levels. Future surveys could be improved by incorporating changes from this study, such as adding questions and considering the source of the address list.

Several questions could be added to this survey that would add valuable information to future research. More accurate information could be obtained by asking participants directly whether they are full-time farmers, part-time farmers or non-farmers. In addition, it would be useful to ask participants with damage whether or not the amount of damage they had was tolerable. Further information could be gathered by rewording question 6 where participants were asked to estimate how many acres of particular crops were damaged. Very few participants answered this question, possibly because they had difficulty making this estimation.

In addition to revising and adding some questions, future studies could be improved by considering the source of the list of participants. Future researchers may want to select study participants from sources other than Farm Services Agency, such as the Farm Bureau or private companies that maintain databases of addresses. This would increase the proportion of farmers included in the study. Selecting participants from a

different source and revising certain questions could improve the effectiveness of future studies.

### **Management Implications**

This study revealed that most Tennessee landowners do not have serious problems with deer damage. However, approximately one quarter of all participants reported damage that exceeded their tolerance. These landowners may need assistance to deal with their wildlife damage problems. There are several options for assisting landowners with wildlife damage, such as more effective damage control methods, increasing landowners' awareness of the availability of depredation permits and possibly cash payments.

About one quarter of study participants had taken measures to control deer damage on their land, the vast majority of which had used hunting as a control method. However, hunting received an effectiveness rating of only 2.5 and was rated as less effective than depredation permits or electric fencing at controlling deer damage. Very few landowners had tried these methods of damage control and only 19.8% of participants were aware that TWRA offers assistance with wildlife damage problems. Making landowners more aware of these more effective methods may help them deal with wildlife damage. Quality Deer Management, which seeks to manage for a balanced deer herd, is one method that may help some landowners reduce crop damage. Development of more effective and cost-efficient damage control methods also will help reduce conflict over damage issues.

Cash payments for wildlife damage are a controversial issue for many wildlife managers and agricultural producers. However, some participants felt that cash payments to compensate for wildlife damage were warranted. One participant stated, “I believe that if the state is going to manage and control the wildlife in this state, in regard to saying when people can hunt and what they can harvest, the state should be financially responsible for [wildlife] damage or find an effective way to lessen the damage caused without costing the farmer.” Although some landowners may favor cash payments for wildlife damage, practical and financial issues may limit the feasibility of this option. Cash payments have been implemented in some states where a portion of the proceeds from hunting licenses is used to reimburse farmers for crop damage caused by deer.

Another area for consideration in future wildlife management decisions is improvement of habitat on private lands. Many Tennessee landowners manage their land for wildlife and 31% said they would accept technical advice or information. Many participants also wrote comments expressing an interest in doing more to enhance wildlife habitat on their land and asking for assistance with wildlife management. One participant wrote, “If you want someone willing to spend some money and effort to improve wildlife, I am your guy. I have had no crop damage, and I want to attract more wildlife. Come help me.” Such comments indicate that there may be many landowners who are willing to manage for wildlife that have not been reached through current landowner assistance programs.

Landowner surveys to assess wildlife damage are a useful tool for wildlife managers. They provide an important communication link between members of the agricultural and wildlife communities. Without some means of objectively measuring

farmers' perceptions of wildlife damage, a vocal minority of producers with serious damage problems may mislead wildlife managers. Conversely, managers may discount the complaints of farmers when a damage problem does exist that needs to be addressed.

While in-field measurements of actual damage provide wildlife managers and farmers with useful information, surveys of farmers' perceptions of damage are equally important. Although farmers may not always correctly assess wildlife damage, their perceptions of damage are important because they influence their attitudes about wildlife. Perceptions of damage can be difficult to predict and are not necessarily directly related to actual levels of damage. Farmers and other private landowners provide habitat for wildlife and they may be more supportive of wildlife managers' decisions if they feel their interests are being considered.

## CHAPTER VI

### SUMMARY

Deer damage is a significant problem for many Tennessee landowners, especially farmers whose livelihood may be affected. While farmers expect a certain amount of wildlife damage, several factors, such as growing deer herds and changing land use practices, have led to an increase in deer damage problems.

In the past forty years, researchers have conducted numerous studies of deer and other wildlife damage. In-field measurements estimate that \$113 million of ripening field corn was lost to wildlife damage in the United States in 1993 (Wywialowski 1996). Wywialowski (1996) also found that damage was often unevenly distributed. A number of studies have found that deer damage can cause 20% to 37% reductions in crop yields by comparing yields inside and outside fenced enclosures (Harrison 1979, Vecellio et al. 1994, Conner and Forney 1997). Other studies, however, found deer did not cause significant damage to crops (Westmoreland and Woolf 1984, Garrison and Lewis 1987).

While studies that quantify wildlife damage help wildlife managers understand its extent, farmers' perceptions of damage also are important. Wywialowski (1994) found 55% of participants in a nationwide study had wildlife damage to crops or livestock. This study estimates that wildlife damage cost producers between \$461 million and \$1.26 billion in 1989. Similarly, Wywialowski and Beach (1992) found that 58% of participants experienced crop damage from wildlife. In contrast, Conover (1998) found

higher levels of damage, with 80% of participants in a nationwide study reporting wildlife damage on their farms or ranches and 53% reporting deer damage. Fifty-three percent of participants in this study reported that the damage they had exceeded their tolerance.

Studies have shown that deer damage is a problem for many Tennessee landowners. King (1993) found 33% of farmers had experienced deer damage, and 10% felt that deer were a nuisance. Fly et al. (1998) found 17% of Tennessee landowners incurred wildlife damage, while 34% of full-time farmers experienced damage. Farmers had a median of \$400 of damage from wildlife and deer was the most common species causing damage.

Farmers' experience with wildlife damage is important because numerous studies have shown that experience with damage influences farmers' attitudes toward wildlife (Brown et al. 1980, Decker et al. 1984b, Craven et al. 1992, Wywialowski 1994). Farmers control a significant amount of land in the United States and the decisions farmers make about managing their land can impact wildlife substantially. Wildlife managers need to understand how wildlife damage affects farmers and other private landowners to gain the support and involvement of these groups in wildlife management.

The goal of this research was to increase our understanding of the effects of wildlife damage by evaluating Tennessee landowners' experiences with wildlife damage.

The objectives of this research were:

1. To determine landowners' perceptions of the extent and nature of deer damage to crops in Tennessee.



2. To assess landowners' perceptions of deer and their tolerance for crop damage.
3. To determine landowners' perceptions of the effectiveness of deer damage control methods.
4. To evaluate landowners' actions concerning wildlife on their land.
5. To examine regional differences in deer damage levels and landowners' attitudes toward wildlife.

## **Methods**

To meet these objectives, a mail survey was conducted in eight Tennessee counties, grouped in four groups of two adjacent counties: Weakley and Henry; Lincoln and Franklin; Robertson and Montgomery; and Hardeman and Fayette. These counties were selected based on 1997 deer harvest numbers (Tennessee Wildlife Resources Agency 1998) and 1997 soybean yields (Tennessee Dept. Agriculture 1998). A total of 2,110 survey participants were selected from a list of names and addresses provided by the USDA Farm Services Agency. The number of participants selected from each county was distributed to obtain a 95% confidence interval from each county group, with a confidence interval between 92% and 94% for each individual county.

The survey was administered in late February 1999 using a 9-page questionnaire, which was mailed to selected participants along with a cover letter. Subsequent mailings were sent out according to the four-wave mail survey method described by Dillman (1978).

Non-response bias was evaluated by comparing early and late respondents' answers to selected questions. The first and last 351 questionnaires returned were classified as early and late responses, respectively. Early and late respondents' answers to key questions were compared to determine if any non-response bias existed.

Questionnaire responses were analyzed using descriptive statistics, (frequencies and means) to summarize data. Pearson's chi-square test was used to test for relationships between variables. All relationships were tested at a significance level of 0.05.

## **Results**

A useable response rate of 59% was obtained for the survey. A comparison of early and late respondents revealed that 52% of early respondents had deer damage, compared to 42% of late respondents with deer damage, indicating the possibility of non-response bias.

### ***Descriptive Statistics***

About half of the participants (54%) were classified as full- or part-time farmers. Many participants wanted deer populations in their area to decrease (49%) and almost one third wanted them to stay the same (32%). The majority of participants reported that they enjoyed deer (48%) or enjoyed deer, but worried about crop damage (38%). A smaller percentage felt that deer were a nuisance (15%). Those classified as farmers were more likely than non-farmers to feel that deer were a nuisance (19%).

Forty-seven percent of all participants reported deer damage to crops, while 60% of farmers had deer damage. Overall, 55% of participants had wildlife damage and 68%

of farmers had wildlife damage. Deer were the most common species causing damage (78%). Most participants (54%) estimated the value of their loss from deer damage at \$500 or less. A comparison of the estimated dollar value of damage reported and the maximum amount considered tolerable revealed that 56% of participants who reported damage (or 26% of all participants) had damage that exceeded their tolerance level.

About one quarter of participants (25%) had taken measures to prevent deer damage, with hunting being the most commonly used method. Shooting outside of the hunting season with a depredation permit, however, was rated the most effective method of controlling deer damage.

The majority of participants (80%) allowed hunting on their land, although half of them reported that they had experienced problems with hunters. Many participants (42%) managed their land for wildlife in some way. The most common species managed for were game birds and deer.

### ***Comparisons between County Groups***

The county groups surveyed differed from each other on a number of variables. County Group 1 had the highest percentage of participants with deer damage (55%). However, County Group 2 had the highest percentage of participants who felt that deer were a nuisance (20%). County Group 3 had the highest percentage of participants who allowed deer hunting on their land (85%) and the highest percentage of participants who manage their land for wildlife (54%).

### ***Relationships between Variables***

Participants with deer damage were more likely to consider deer a nuisance and want a decrease in deer populations. Furthermore, participants who considered deer a

nuisance were less likely to manage their land for wildlife. Farmers were more likely than non-farmers to report deer damage and were more likely to experience deer damage as their percent of income from farming increased. Participants with deer damage were more likely to allow hunting on their land and those who had problems with hunters in the past were more likely to post their land with “No Trespassing” signs.

## **Discussion**

Over half of all participants (55%) experienced wildlife damage to their crops and 47% had deer damage. Although most participants had light to moderate damage, a few participants did have a serious problem with deer damage. In fact, about a quarter of all participants had damage that exceeded their tolerance.

The majority of participants had positive attitudes toward deer, although 15% considered deer a nuisance. Despite generally positive attitudes toward deer, nearly half wanted a decrease in deer populations and only 20% of participants wanted an increase.

About one quarter of participants had taken measures to control deer damage with hunting being the most commonly used method. The method that received the highest effectiveness rating was shooting deer outside of the hunting season with a depredation permit, followed by electric fencing. Even these two methods, which farmers rated most effective, were perceived as being only moderately effective. Participants commented that depredation permits were effective, but were expensive and labor intensive to use.

Many participants (42%) actively managed their land for wildlife. This figure is encouraging, given the importance of private lands as wildlife habitat. Private landowners’ support of wildlife management may be eroded, however, if wildlife damage

increases because participants who considered deer a nuisance were less likely to manage their land for wildlife. Wildlife damage problems need to be monitored and managed to ensure the continued support of private landowners.

County groups differed in levels of deer and other wildlife damage and perceptions of wildlife. County Group 3 had the lowest levels of damage and the lowest percentage of participants who considered deer a nuisance. County Groups 2 and 4 had the highest percentages of participants who considered deer a nuisance and wanted a decrease in deer populations, although County Group 1 had the highest levels of deer damage.

### **Management Implications**

This study revealed that most Tennessee landowners do not have a serious problem with deer damage. However, some landowners do have a serious problem and may need assistance to deal with this issue. There are several options for assisting landowners with deer damage, such as more effective damage control methods, increasing landowners' awareness of the availability of depredation permits and possibly cash payments.

Another area for consideration in future wildlife management decisions is improvement of habitat on private lands. Many participants wrote comments expressing an interest in doing more to enhance wildlife habitat on their land and 31% said they would accept technical advice or information to help them manage their land for wildlife. This indicates that there may be many landowners who are willing to manage for wildlife that have not been reached through current landowner assistance programs.

Landowner surveys to assess wildlife damage are a useful tool for wildlife managers. They provide an important communication link between members of the agricultural and wildlife communities. Farmers and other private landowners provide habitat for wildlife and they may be more supportive of wildlife management decisions if their interests are being considered.

## **LITERATURE CITED**

## LITERATURE CITED

- Bollinger, E. K., and J. W. Caslick. 1985. Factors influencing blackbird damage to field corn. *Journal of Wildlife Management* 49:1109-1115.
- Brown, T. L., and D. J. Decker. 1979. Incorporating farmers' attitudes into management of white-tailed deer in New York. *Journal of Wildlife Management* 43:236-239.
- Brown, T. L., D. J. Decker, and C. P. Dawson. 1977. Farmer willingness to tolerate deer damage in the Erie-Ontario Lake Plain. *Natural Resources Research and Extension Series No. 8*. Cornell University, Ithaca, New York, USA.
- Brown, T. L., D. J. Decker, and C. P. Dawson. 1978. Willingness of New York farmers to incur white-tailed deer damage. *Wildlife Society Bulletin* 6:235-239.
- Brown, T. L., D. J. Decker, and D. L. Hustin. 1980. Farmers' tolerance of white-tailed deer in central and western New York. *Search: Agriculture No. 7*. Cornell University Agricultural Experiment Station, Ithaca, New York, USA.
- Carlson, C. A. 1985. Wildlife and agriculture: can they coexist? *Journal of Soil and Water Conservation* 40:263-266.
- Conner, M. C. and R. Forney. 1997. Impact of deer on corn and soybean yields and profitability of Chesapeake Farms, Maryland. Presented at the 20th annual Southeast Deer Study Group, February 9-12, 1997, Charleston, South Carolina.
- Conover, M. R. 1994. Perceptions of grass roots leaders of the agricultural community on their farms and ranches. *Wildlife Society Bulletin* 22:94-100.
- Conover, M. R. 1998. Perceptions of American agricultural producers about wildlife on their farms and ranches. *Wildlife Society Bulletin* 26:597-604.
- Conover, M. R., and D. J. Decker. 1991. Wildlife damage to crops: perceptions of agricultural and wildlife professionals in 1957 and 1987. *Wildlife Society Bulletin* 19:46-51.
- Craven, S. R., D. J. Decker, W. F. Siemer, and S. E. Hyngstrom. 1992. Survey use and landowner tolerance in wildlife damage management. *Transactions of the North American Wildlife and Natural Resources Conference* 57:75-88.



- DeCalesta, D. S., and D. B. Schwendeman. 1978. Characterization of deer damage to soybean plants. *Wildlife Society Bulletin* 6:250-253.
- Decker, D. J., G. F. Mattfeld, and T. L. Brown. 1984a. Influence of experience with deer damage on farmers' perceptions of deer population trends. *New York Fish and Game Journal* 31:38-44.
- Decker, D. J., N. Sanyal, T. L. Brown, R. A. Smolka, and N. A. Connelly. 1984b. Reanalysis of farmer willingness to tolerate deer damage in western New York. *Proceedings of the Eastern Wildlife Damage Control Conference* 1:37-45.
- Dillman, D. A. 1978. *Mail and telephone surveys: the total design method*. John Wiley and Sons, New York, New York, USA.
- Fly, J. M., B. Stephens, and P. M. Jakus. 1998. A survey of wildlife damage in Tennessee. Presented at the annual meeting of the Tennessee Chapter of the Wildlife Society, March 11-13, 1998, Chapel Hill, Tennessee.
- Gabrey, S. W., P. A. Vohs, and D. H. Jackson. 1993. Perceived and real crop damage by wild turkeys in northeastern Iowa. *Wildlife Society Bulletin* 21:39-45.
- Garrison, R. L., and J. C. Lewis. 1987. Effects of browsing by white-tailed deer on yields of soybeans. *Wildlife Society Bulletin* 15:555-559.
- Harrison, P. K. 1979. Utilization of field corn by white-tailed deer (*Odocoileus virginianus*) in Crab Orchard National Wildlife Refuge. Thesis, Southern Illinois University, Carbondale, Illinois, USA.
- Heisterberg, J. F. 1983. Bird damage to sprouting corn in Kentucky and Tennessee. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies*. 37:41-48.
- Irby, L. R., J. Saltiel, W. E. Zidack, and J. B. Johnson. 1997. Wild ungulate damage: perceptions of farmers and ranchers in Montana. *Wildlife Society Bulletin* 25:320-329.
- Kellert, S. R. 1981. Wildlife and the private landowner. Pages 18-26 in R. T. Dumke, G. V. Burger, and J. R. March, editors. *Wildlife management on private lands*. LaCrosse Printing, LaCrosse, Wisconsin, USA.
- Kelly, S. T., D. A. Andrews, and D. T. Palmer. 1982. Bird and mammal damage to field corn in Ohio, 1977-1979. *Ohio Journal of Science* 82:133-136.

- King, M. 1993. Tennessee deer population and damage survey report. Tennessee Wildlife Resources Agency Technical Report No. 93-18.
- Kirby, S. B., K. M. Babcock, S. L. Sherriff, and D. J. Witter. 1981. Private lands and wildlife in Missouri: a study of farm operator values. Pages 88-101 *in* R. T. Dumke, G. V. Burger, and J. R. March, editors. Wildlife management on private lands. LaCrosse Printing, LaCrosse, Wisconsin, USA.
- Mc Dowell, R. D., and H. W. Pillsbury. 1959. Wildlife damage to crops in the United States. *Journal of Wildlife Management* 23:240-241.
- Miller, L. E., and K. L. Smith. 1983. Handling nonresponse issues. *Journal of Extension* 21(15):45-50.
- Morrow, K. 1997. The wildlife damage issue. *Wild Ohio Magazine*, Summer: 6-7. Ohio Division of Wildlife, Columbus, Ohio, USA.
- Scheaffer, R. L., W. Mendenhall, and L. Ott. 1990. *Elementary Survey Sampling*. Fourth edition. PWS-Kent, Boston, Massachusetts, USA.
- Stickley, A. R., D. L. Otis, O. E. Bray, J. F. Heisterberg, and T. F. Grandpre. 1978. Bird and mammal damage to mature corn in Kentucky and Tennessee. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 32:228-233.
- Tanner, G., and R. W. Dimmick. 1983. An assessment of farmers' attitudes towards deer and deer damage in West Tennessee. *Proceedings of the Eastern Wildlife Damage Control Conference* 1:195-199.
- Tennessee Department of Agriculture. 1995. *Tennessee agricultural statistics*. Tennessee Department of Agriculture, Nashville, Tennessee, USA.
- Tennessee Department of Agriculture. 1998. *Tennessee agriculture*. Tennessee Department of Agriculture, Nashville, Tennessee, USA.
- Tennessee Department of Agriculture. 1999. *Tennessee agriculture*. Tennessee Department of Agriculture, Nashville, Tennessee, USA.
- Tennessee Wildlife Resources Agency. 1991. *Deer restoration in Tennessee, 1940-1985: a final report*. TWRA Wildlife Research Report No. 91-1.
- Tennessee Wildlife Resources Agency. 1998. *Big game harvest data and range surveys, 1997-1998*. TWRA Wildlife Research Report No. 98-2.

- Tennessee Wildlife Resources Agency. 1999. Tennessee Wildlife. January-February: 33. Tennessee Wildlife Resources Agency, Nashville, Tennessee, USA.
- Thomas, D. W. 1954. An economic analysis of deer damage to farm crops, and income from deer hunters, Potter and Monroe counties, Pennsylvania, 1951. Dissertation, Pennsylvania State University, University Park, Pennsylvania, USA.
- Vecellio, G. M., R. H. Yahner, and G. L. Storm. 1994. Crop damage by deer at Gettysburg Park. *Wildlife Society Bulletin* 22:89-93
- Wakely, J. S., and R. C. Mitchell. 1981. Blackbird damage to ripening field corn in Pennsylvania. *Wildlife Society Bulletin* 9:52-55.
- Westmoreland, D., and A. Woolf. 1984. Wildlife damage to corn in Illinois: assessment and control. *Transactions of the Illinois Academy of Science* 77:3-8.
- Wywialowski, A. P. 1994. Agricultural producers' perceptions of wildlife-caused losses. *Wildlife Society Bulletin* 22:370-382.
- Wywialowski, A. P. 1996. Wildlife damage to field corn in 1993. *Wildlife Society Bulletin* 24:264-271.
- Wywialowski, A. P., and R. H. Beach. 1992. Agricultural producers' estimates of wildlife causing damage in eastern states. *Proceedings of the Eastern Wildlife Damage Control Conference* 5:66.

## **APPENDIX**

## CONTENTS

<b>APPENDIX</b>	<b>PAGE</b>
A1. Wildlife Damage Questionnaire .....	81
A2. Cover Letter for First Mailing of Questionnaire.....	90
A3. First Reminder Postcard.....	91
A4. Cover Letter for Second Mailing of Questionnaire .....	92
A5. Second Reminder Postcard .....	93

Please complete the survey by marking your answers in the appropriate place or by filling in the blanks. This survey is strictly confidential. Thank you again for your cooperation in this research on wildlife damage.

**Deer populations in your area:**

1. In the **past 5 years**, do you think **deer populations** in your area have...?
 

<input type="checkbox"/> Increased greatly	<input type="checkbox"/> Decreased slightly
<input type="checkbox"/> Increased slightly	<input type="checkbox"/> Decreased greatly
<input type="checkbox"/> Stayed the same	<input type="checkbox"/> No opinion
  
2. In the **past 5 years**, do you think that **deer damage** in your area has...?
 

<input type="checkbox"/> Increased greatly	<input type="checkbox"/> Decreased slightly
<input type="checkbox"/> Increased slightly	<input type="checkbox"/> Decreased greatly
<input type="checkbox"/> Stayed the same	<input type="checkbox"/> No opinion
  
3. Would you like to see **deer populations** in your area...?
 

<input type="checkbox"/> Increase greatly	<input type="checkbox"/> Decrease slightly
<input type="checkbox"/> Increase slightly	<input type="checkbox"/> Decrease greatly
<input type="checkbox"/> Stay the same	<input type="checkbox"/> No opinion
  
4. Which of the following statements best describes **your attitude toward deer** in your area?
  - I enjoy having deer in my area.
  - I enjoy having deer in my area, but worry about crop damage.
  - Deer are a nuisance.
  - No opinion

**Deer damage in the past twelve months:**

5. Have you experienced **damage to your crops from deer** in the past year?
 

<input type="checkbox"/> Yes	<input type="checkbox"/> No (If no, go to question 10)
------------------------------	--

**A1. Questionnaire**

6. In column one, please provide the **total number of acres** you had in **each crop in 1998**. In column two, please estimate the **total number of acres** you had **damaged by deer for each crop**.

	1998 Total Crop Acres	1998 Total Acres Damaged by Deer
Corn	_____ acres	_____ acres
Soybeans	_____ acres	_____ acres
Hay	_____ acres	_____ acres
Orchard crops	_____ acres	_____ acres
Vegetable crops	_____ acres	_____ acres
Others (please specify)		
_____	_____ acres	_____ acres
_____	_____ acres	_____ acres
_____	_____ acres	_____ acres

7. Overall, how would you **rate the damage** caused by deer?

- |  |   |
|--|---|
| <input type="checkbox"/> Light damage    | <input type="checkbox"/> Substantial damage |
| <input type="checkbox"/> Moderate damage | <input type="checkbox"/> Severe damage      |

8. Choose the option that best **describes the deer damage** you have experienced.

- Light damage around edges of field only
- Moderate damage around edges, light damage across field
- Severe damage around edges, moderate damage across field
- Severe damage across entire field
- Other (please specify) \_\_\_\_\_

9. Please estimate the **dollar value of your crop loss from deer** in the past twelve months.

- |  |   |
|--|---|
| <input type="checkbox"/> None            | <input type="checkbox"/> \$1,001 - \$5,000  |
| <input type="checkbox"/> Less than \$100 | <input type="checkbox"/> \$5,001 - \$10,000 |
| <input type="checkbox"/> \$100 - \$500   | <input type="checkbox"/> More than \$10,000 |
| <input type="checkbox"/> \$501 - \$1,000 | <input type="checkbox"/> Don't know         |

**A1. (continued)**

10. Have you experienced any **damage** to your crops from wildlife species **other than deer** in the **past twelve months**?  Yes  No  
If yes, please list those species. \_\_\_\_\_

11. Which **one** wildlife species, **including deer**, has caused the **most** damage to your crops in the past year? (If no damage, answer "none") \_\_\_\_\_

12. What is the **maximum** amount of **crop damage** from wildlife that you would consider tolerable?

- |  |   |
|--|---|
| <input type="checkbox"/> None            | <input type="checkbox"/> \$1,001 - \$5,000  |
| <input type="checkbox"/> Less than \$100 | <input type="checkbox"/> \$5,001 - \$10,000 |
| <input type="checkbox"/> \$100 - \$500   | <input type="checkbox"/> More than \$10,000 |
| <input type="checkbox"/> \$501 - \$1,000 | <input type="checkbox"/> Don't know         |

**Deer damage control measures:**

13. Have you taken any **measures to prevent deer damage** to your crops?  
 Yes  No (If no, go to **question 16**)

14. What **measures** have you **taken** to prevent deer damage to your crops?  
(Check **all** that apply)

- |  |   |
|--|---|
| <input type="checkbox"/> Repellants                          | <input type="checkbox"/> Electric fencing                   |
| <input type="checkbox"/> Scare devices                       | <input type="checkbox"/> Non-electric fencing               |
| <input type="checkbox"/> Hunting (yourself or others)        | <input type="checkbox"/> Shooting with a depredation permit |
| <input type="checkbox"/> Other method (please specify) _____ |   |



15. Please rate the effectiveness of these methods on a scale of 1 to 5, with 1 being "Not Effective at All," and 5 being "Very Effective." Please rate only the methods that you have tried, as you indicated in question 14.

	Not Effective at All		————>	Very Effective	
Chemical repellants	1	2	3	4	5
Electric fencing	1	2	3	4	5
Non-electric fencing	1	2	3	4	5
Scare devices	1	2	3	4	5
Hunting	1	2	3	4	5
Shooting in off-season (with permit)	1	2	3	4	5
Other method:	1	2	3	4	5
(please specify) _____					

16. Were you aware that the **Tennessee Wildlife Resources Agency (TWRA)** offers **assistance** with crop damage problems?

Yes                       No (If no, go to **question 18**)

17. If yes, have you ever **contacted** TWRA concerning **crop damage**?

Yes                       No

**Hunting and your property:**

18. Do you **hunt**?

Yes, I have hunted in the past five years.  
 Yes, I have hunted, but not in the past five years.  
 No, I have never hunted.

19. In the past twelve months, did you **allow deer hunting** on your property?

Yes                       No (If no, go to **question 24**)

20. Who do you **allow to hunt deer** on your property?

(Check **all** that apply)

- Yourself
   
  Family members  
 Friends or neighbors
   
  People who ask permission  
 Anyone  
 People who pay for access to your property

21. Do you **lease** your land to others for hunting?

- Yes
                                 
  No (If no, go to **question 24**)

22. How many **acres do you lease** for hunting? \_\_\_\_\_ acres

23. How much do you **charge** for the hunting lease? \$\_\_\_\_\_

24. Have you had **problems with hunters** on your property in the past?

- Yes
                                 
  No (If no, go to **question 26**)

25. If you **have had problems** with hunters on your property, could you please **describe those problems**. \_\_\_\_\_  
 \_\_\_\_\_

26. Is your **land posted** with "No Trespassing" signs?     Yes     No

**Wildlife habitat and your property:**

27. Do you do anything to **improve the quality of wildlife habitat** on your property?

- Yes
                                 
  No (If no, go to **question 30**)

28. Which of the following kinds of **wildlife do you manage for?** (Check **all** that apply)

- Deer
   
  Game birds  
 Small game
   
  Songbirds  
 Waterfowl
   
  General wildlife  
 Other (please specify) \_\_\_\_\_

**A1. (continued)**

29. Which of the following things do you do to **improve the quality of wildlife habitat** on your property? (Check **all** that apply)

- |  |   |
|--|---|
| <input type="checkbox"/> Provide general cover                               | <input type="checkbox"/> Protect wetland areas                |
| <input type="checkbox"/> Plant warm season grasses                           | <input type="checkbox"/> Retain wooded areas                  |
| <input type="checkbox"/> Provide food plots                                  | <input type="checkbox"/> Manage forested areas for wildlife   |
| <input type="checkbox"/> Delay tillage of fall harvested fields until spring | <input type="checkbox"/> Leave some rows of crops unharvested |
| <input type="checkbox"/> Provide fence rows                                  |   |
| <input type="checkbox"/> Other (please specify) _____                        |   |

30. What keeps you from **managing or doing more to manage your land for wildlife**? (Check **all** that apply)

- |  |   |
|--|---|
| <input type="checkbox"/> Don't have time   | <input type="checkbox"/> Don't know how |
| <input type="checkbox"/> Too expensive   | <input type="checkbox"/> Not interested |
| <input type="checkbox"/> Concerned about wildlife damaging crops or other property |   |
| <input type="checkbox"/> Other reasons (please specify) _____                      |   |

31. Which of the following **types of assistance** would you be willing to accept to **improve your property for wildlife habitat**? (Check **all** that apply)

- |  |   |
|--|---|
| <input type="checkbox"/> None                            | <input type="checkbox"/> Tax incentives               |
| <input type="checkbox"/> Technical advice or information | <input type="checkbox"/> Cash payments                |
| <input type="checkbox"/> Seed for food plots             | <input type="checkbox"/> Other (please specify) _____ |

**About your farm:**

32. How many **acres** do you own or manage? \_\_\_\_\_ acres

33. Do you **manage your farm** primarily for... (please check **only one**)

- |  |   |
|--|---|
| <input type="checkbox"/> Field crops     | <input type="checkbox"/> Vegetable crops              |
| <input type="checkbox"/> Livestock       | <input type="checkbox"/> Orchard crops                |
| <input type="checkbox"/> Forest products | <input type="checkbox"/> Other (please specify) _____ |

34. Do you... (Check **all** that apply)
- Own and farm your own land
- Lease the land you farm from someone else
- Own land and lease it to someone else to farm
35. Do you **live** on your farm?  Yes  No
36. Are you a member of the **Tennessee Farm Bureau**?  Yes  No
37. Are you a member of any **wildlife conservation organizations**?
- Yes  No
- If yes, please list \_\_\_\_\_

#### **Background Information**

The following information will help us understand who is being affected by deer damage. Answering these questions is **voluntary**. Your answers are **confidential and will not be associated with your name**.

38. What is your **age**? \_\_\_\_\_
39. **Gender** (circle): Male Female
40. What is the **highest grade of school** you have completed?
- Less than high school graduate  College graduate
- High school graduate  Post graduate
- Some college  Don't wish to answer
- Trade or vocational school
41. Approximately what **percent** of your household **income is from farming**?
- Less than 10%  51% to 75%
- 10% to 25%  76% to 100%
- 26% to 50%  Don't know / don't wish to answer

**A1. (continued)**

42. What was your **total annual household income for 1998**, before taxes? (If you don't know yet, please estimate.)

- |   |  |
|---|--|
| <input type="checkbox"/> Under \$10,000       | <input type="checkbox"/> \$30,000 to \$49,999              |
| <input type="checkbox"/> \$10,001 to \$19,999 | <input type="checkbox"/> \$50,000 to \$74,999              |
| <input type="checkbox"/> \$20,000 to \$24,999 | <input type="checkbox"/> More than \$75,000                |
| <input type="checkbox"/> \$25,000 to \$29,999 | <input type="checkbox"/> Don't know / don't wish to answer |

43. What is your **ethnic origin**?

- |  |   |
|--|---|
| <input type="checkbox"/> African-American          | <input type="checkbox"/> Hispanic                     |
| <input type="checkbox"/> American Indian           | <input type="checkbox"/> Other (please specify) _____ |
| <input type="checkbox"/> Asian or Pacific Islander | <input type="checkbox"/> Don't wish to answer         |
| <input type="checkbox"/> Caucasian                 |   |

Please use this space to write any **additional comments** you may have regarding wildlife or wildlife damage in Tennessee.

Depending on the results of the survey, we may want to continue our research in the future by contacting those producers with significant damage. If you indicated that you had wildlife damage, **may we contact you** in the future to discuss the possibility of a farm visit to assess wildlife damage?     Yes                       No

**If you answered yes**, please fill in the following information so that we can contact you. This page will be separated from the rest of the survey. Your answers are **strictly confidential** and **will not be associated with your name** in any written report.

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_

Zip Code: \_\_\_\_\_

February 23, 1999

Dear Landowner,

The Governor's Council on Agriculture and Forestry, the Tennessee Farm Bureau and the Tennessee Wildlife Resources Agency have expressed concerns about wildlife damage to crops and other farm commodities in Tennessee. In response to these concerns, the Human Dimensions Research Lab in the Department of Forestry, Wildlife and Fisheries is conducting a study to evaluate wildlife damage to crops in selected counties in Tennessee. Your county was one of eight selected from four regions of the state with significant crop production and deer harvest numbers. Your name was randomly selected from a list of producers from your county. We are interested in your experiences with wildlife damage, your opinions about wildlife, and other related information about your farming activities. As an agricultural producer, even if you do not have wildlife damage, your opinions and experiences can provide valuable input toward addressing the overall issue.

We are asking you to assist us with this research by completing the enclosed questionnaire, which should take about fifteen minutes. Please use the enclosed prepaid envelope to return the questionnaire. For our results to be valid, we need to hear from everyone, including those who do not have any wildlife damage.

You may notice that your questionnaire is marked with an identification number. This number is to provide a way by which reminders can be sent, if necessary, without further imposing on those who have completed and returned their questionnaire. When your questionnaire is returned, we will use the identification number to remove your name from the mailing list. Your name will never be placed on the questionnaire. Depending on the results of the survey, we may want to continue our research in the future by contacting those producers with significant wildlife damage. Therefore, on the final page of the questionnaire, there is an opportunity for you to volunteer your name and address if you have wildlife damage. This page will be separated from the rest of the survey. All the information you give us is strictly confidential. Completing this questionnaire is voluntary and you may refuse to participate at any time.

If you have any questions, please feel free to contact me at the address or telephone number above. Thank you for assisting us in addressing the wildlife damage issue in Tennessee.

Sincerely,

Dawn Johnson  
Graduate Research Assistant

J. Mark Fly  
Associate Professor

**A2. Cover letter for first mailing of questionnaire.**

March 11, 1999

A few weeks ago, you should have received a questionnaire seeking your help in evaluating wildlife damage in Tennessee.

If you have already completed and returned the questionnaire, please accept our sincere thanks. If you have not completed and returned the questionnaire, please do so today. It is important that we hear from everyone for the results of this research to be valid.

If by some chance you did not receive the questionnaire, or it was misplaced, please contact me and another questionnaire will be sent out to you. If you are unable to complete the questionnaire for any reason, you may send it back blank in the envelope provided.

Thanks again,

Dawn Johnson  
Graduate Research Assistant  
The University of Tennessee  
Department of Forestry, Wildlife and Fisheries  
P. O. Box 1071  
Knoxville, TN 37901-1071  
(423)974-5497



April 5, 1999

Dear Landowner,

A few weeks ago, you should have received a questionnaire seeking your help in evaluating wildlife damage in Tennessee. This survey is being conducted by the Human Dimensions Research Lab in the Department of Forestry, Wildlife and Fisheries in **cooperation with the Mr. Charles Dixon, Wildlife Extension Specialist with the Tennessee Agricultural Extension Service in Jackson, Tennessee.**

If you have already completed and returned the questionnaire, please accept our sincere thanks. If you have not completed and returned the questionnaire, please do so today. We are asking you to assist us with this research by completing the enclosed questionnaire, which should take about fifteen minutes. Please use the enclosed prepaid envelope to return the questionnaire. **For our results to be valid, we need to hear from everyone, including those who do not have any wildlife damage.**

You may notice that your questionnaire is marked with an identification number. This number is to provide a way by which reminders can be sent, if necessary, without further imposing on those who have completed and returned their questionnaire. When your questionnaire is returned, we will use the identification number to remove your name from the mailing list. Your name will never be placed on the questionnaire. Depending on the results of the survey, we may want to continue our research in the future by contacting producers with significant wildlife damage. Therefore, on the final page of the questionnaire, there is an opportunity for you to volunteer your name and address if you have wildlife damage. This page will be separated from the rest of the survey. All the information you give us is strictly confidential. Completing this questionnaire is voluntary and you may refuse to participate at any time.

If you have any questions, please feel free to contact me at the address or telephone number above. Thank you for assisting us in addressing the wildlife damage issue in Tennessee.

Sincerely,

Dawn Johnson  
Graduate Research Assistant

J. Mark Fly  
Associate Professor

**A4. Cover letter for second mailing of questionnaire.**

April 23, 1999

A few weeks ago, you should have received a second copy of questionnaire seeking your help in evaluating wildlife damage in Tennessee.

If you have already completed and returned the questionnaire, please accept our sincere thanks. If you have not completed and returned the questionnaire, please do so today. It is important that we hear from everyone for the results of this research to be valid.

If by some chance you did not receive the questionnaire, or it was misplaced, please contact me and another questionnaire will be sent out to you. If you are unable to complete the questionnaire for any reason, you may send it back blank in the envelope provided.

Thanks again,

Dawn Johnson  
Graduate Research Assistant  
The University of Tennessee  
Department of Forestry, Wildlife and Fisheries  
P. O. Box 1071  
Knoxville, TN 37901-1071  
(423)974-5497

**A5. Second reminder postcard.**

## VITA

Dawn L. Johnson was born in Cuba City, Wisconsin in 1970. She grew up in Bay City, Michigan, where she graduated from Western High School in 1988. She continued her education at Purdue University in West Lafayette, Indiana. She earned a Bachelor of Arts degree with a major in History and a minor in Political Science in May 1993.

In August 1997, Dawn began her graduate studies at the University of Tennessee, Knoxville. She received a Master of Science degree in Wildlife and Fisheries Science in August of 2000. She is a member of the Wildlife Society and Gamma Sigma Delta.

8105 1217 8

10\*11\*00

u

MRB

