

THESIS

FACTORS PREDICTING FERAL SWINE MANAGEMENT PREFERENCES AND  
WILLINGNESS TO PAY

Submitted by

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## ABSTRACT

### FACTORS PREDICTING FERAL SWINE MANAGEMENT PREFERENCES AND WILLINGNESS TO PAY

The population increase and spread of feral swine across the United States is of increasing concern to agricultural producers, land managers, and government. Feral swine cause extensive damage to property, carry several diseases, and are generalist that will eat anything. This study explores how aspects of the cognitive hierarchy and demographics influence management preferences and willingness to pay for management. Extension offices at Land-Grant Universities participated in a survey of limited resource farmers. The overall response rate for the offices that were able to provide such information was 46%. Statistical analysis revealed that a domination wildlife value orientation, negative attitudes toward feral swine, and income had an effect on respondents' support for all five management actions (hunting, hunting with the assistance of dogs, aerial sharpshooting, trapping and removing, and the use of poison) inquired about ( $p < .05$ ). A mutualism wildlife value orientation and gender had an effect for two of the management actions ( $p < .05$ ) and age had no effect on any actions. The amount farmers were willing pay for feral swine management on their lands was analyzed for two groups of farmers; those who had feral swine on their land and did not want them and those who did not have feral swine and wanted to continue to have none. Those with feral swine on their land were more willing to pay to manage feral swine. The amount farmers were willing to pay for both groups was influenced by gender, a negative attitude toward feral swine, and a domination wildlife value orientation. A mutualism wildlife value orientation also had an influence; however, income and

age did not. As landowners and government agencies continue efforts to manage feral swine and mitigate the damages they cause the preferences of the landowners should be taken into account. The management actions chosen should reflect the actions supported by farmers in conjunction with cost considerations. If farmers are unwilling or unable to pay for management, then less costly yet also supported management strategies will need to be formulated.

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## Influences on acceptance of various management options for feral swine

### **Introduction**

Domesticated pigs (*Sus scrofa domestica*) were first introduced to the continental United States in the 1500s by explorers who used the pigs as a food source and trade item (Castañeda de Najera, 1907; US Department of Agriculture [USDA] – Animal Plant Health Inspection Service [APHIS], 2013). The trade of pigs and movement of settlers led to the spread of pigs across the southern United States (Hanson & Karstad, 1959). Feral (wild) populations of swine became established due to the practice of free-range feeding and from pigs escaping from enclosures (Towne & Wentworth, 1950). Wild Eurasian hogs (*Sus scrofa*) were first brought to the northeastern United States in the late 1800s. Eurasian hogs were transported throughout the Appalachians and neighboring states for hunting opportunities (Towne & Wentworth, 1950). The original feral pigs and Eurasian hogs have interbred and are widely considered a hybrid wild pig (*Sus scrofa*) (hereafter referred to as feral swine). Reports from USDA APHIS suggest pig populations have increased and are believed to be present in 42 states (Slootmaker, Harper, Anderson, Holderiath, & Shwiff, 2016). The recent range expansion of feral swine throughout the United States was stimulated through anthropogenic means. The main motivation for relocating feral swine is for hunting purposes. When swine are introduced to a new part of the landscape, they reproduce and spread quickly, especially in agricultural areas with abundant food sources.

The spread of feral swine across the United States is of increasing concern to rural and urban residents, farmers, ranchers, and municipalities. Feral swine cause extensive ecological impact on account of their wallowing in the dirt and rooting with their snout for food below the

soil surface. These activities increase soil erosion leading to excess runoff, decreased crop productivity, and levee failure; which in turn lead to continued water quality degradation and agricultural crop damage. Feral swine eat three to five percent of their body weight per day and are generalists, meaning they will feed on anything: agricultural crops, trees, shrubs, insects, ground nesting birds, reptiles, amphibians, and mammals (Tolleson, Rollins, Pinchak, Ivy, & Heirman, 1993; Taylor & Hellgren, 1997; Jolley et al., 2010; Timmons, Cathey, Rollins, Dictson, & McFarland, 2011). In addition to consuming large amounts of food, feral swine degrade the habitat and decrease food availability for other species (Wood & Lynn, 1977). Feral swine also carry diseases and parasites harmful to humans, pets, wildlife, and livestock (Hutton, DeLiberto, Owen, & Morrison, 2006; Schley, Dufrene, Krier, & Frantz, 2008).

For agriculture producers in the United States, feral swine are of great concern. Although many large-scale farmers have crop insurance that covers wildlife damage, smaller farmers often lack such insurance. As a result, if they lose their crops to feral swine, they may face financial ruin. Farmers and ranchers may also lose livestock due to attack or disease from feral swine. The total agricultural damage caused by feral swine in the United States is unknown because this damage is hard to identify, the magnitude of the spread of the feral swine population is largely unknown, and there is a lack of reporting of damages by agriculture producers. However, Texas Parks and Wildlife Department estimates agricultural damage across the state to total \$52 million (Southeastern Association of Fish and Wildlife Agencies (SEAFWA), 2014). For northern Florida, the estimated row crop damage for one year is over \$1.8 million (SEAFWA, 2014).

A variety of methods are available to mitigate the impact of feral swine, including aerial shooting, baiting and shooting, hunting with dogs, sport hunting, and trapping followed by lethal removal. Some of these lethal control methods, however, may be more acceptable to some

people than to others. To manage feral swine effectively, agencies, state and federal, require an understanding of the public's opinion on the acceptability of the various management efforts. State and federal agency employees may need access to a person's land to carry out management techniques or may enlist the help of residents in management efforts. Additionally, because feral swine move freely on the landscape it is important to have consensus of landowners to accomplish management goals.

### ***Conceptual Approach***

This study employs a social psychological theory that has been adapted for use in wildlife management (Manfredo, 2008). The cognitive hierarchy model links values, value orientations, beliefs and attitudes, and behaviors (Homer & Kahle, 1988). This framework lays the foundation for predicting human behavior. However, it is important to acknowledge that other factors can influence behavior and that people with similar values or value orientations may not always choose the same behavior. This is in part because attitudes vary depending on the context or situation in question (Ajzen & Fishbein, 1980). For example, wildlife value orientations (WVOs) should predict a person's attitude toward hunting on a broad scale. However, that person's attitude toward hunting a specific species may be different from the predicted attitude because of personal experiences with the species (Whittaker, Vaske, & Manfredo, 2006). The cognitive hierarchy along with demographics is often used in studies to inform wildlife management decisions (Fulton, Manfredo, & Lipscomb, 1996; Manfredo, 2008; Bruskotter, Vaske, & Schmidt, 2009). Figure 1 is an illustration of the cognitive hierarchy.

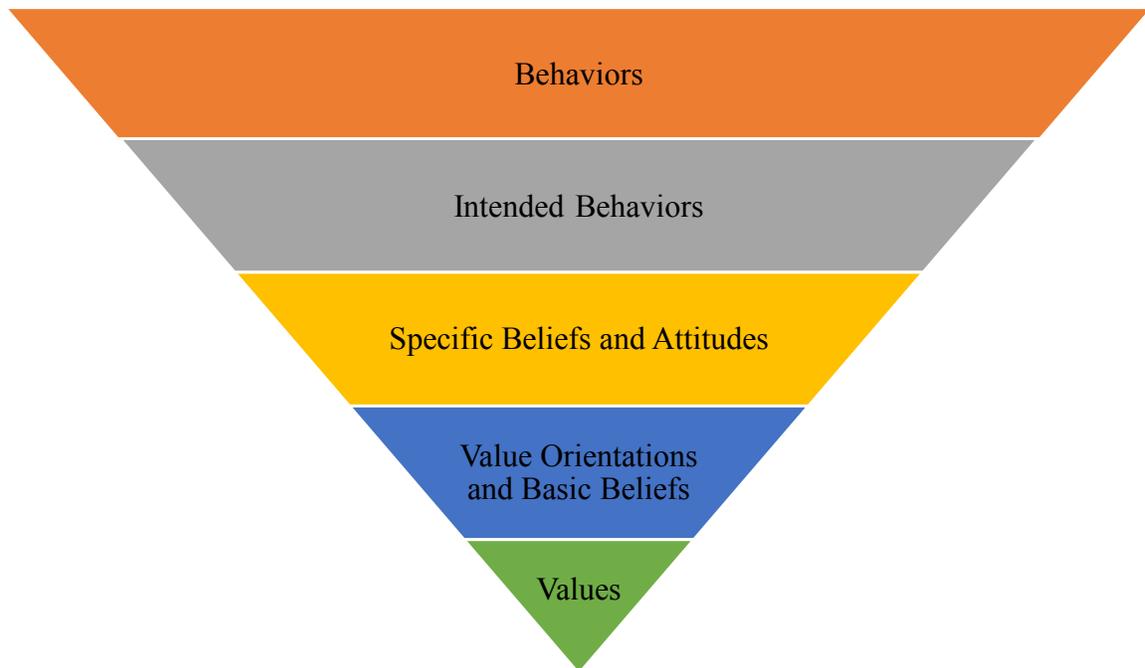


Figure 1. The cognitive hierarchy (adapted from Manfredi, 2008).

Values are the foundation for an individual's thoughts and actions (Rokeach, 1973). A person's values are few in number, slow to change, and cover a broad scope. However, a person's fundamental values are not specific enough to inform management decisions (Fulton et al., 1996). According to the cognitive hierarchy, in order to utilize the public's values to inform management decisions their value orientations must be measured (Bright, Manfredi, & Fulton, 2000). Value orientations are a measure of how a person's values inform their basic beliefs as they relate to a more specific, yet still broad, subject (e. g., wildlife). These basic beliefs, combined with personal experiences or information gathering inform specific beliefs and attitudes (Fishbein & Ajzen, 1975). Specific beliefs and attitudes lead to intended behaviors and actual behaviors (Ajzen & Fishbein, 1980).

Wildlife value orientations are measured using a series of belief statements that were developed based on eight basic belief dimensions related to wildlife (Fulton et al., 1996). These eight basic beliefs then come together further to form the WVOs. The WVO scale consists of

four basic belief categories. These groups are appropriate use beliefs and hunting beliefs, which come together to form the domination orientation, and social affiliation beliefs and caring beliefs which form the Mutualism orientation (Teel & Manfredi, 2010). Those who have a domination orientation hold a value suggesting humans have dominion over nature; the mutualism orientation suggests values of equality between humans, fish, and, wildlife. WVOs of rural landowners, farmers, and livestock producers are generally more domination-oriented than those of the general public (Vaske, Jacobs, & Sijtsma, 2011; Gamborg & Jensen, 2016). People expressing more domination-oriented values also tend to be older and male (Teel et al., 2005; Vaske et al., 2011; Gamborg & Jensen, 2016).

Previous studies utilizing aspects of the cognitive hierarchy specifically in relation to feral swine management have occurred. However, these studies did not follow the full value-attitude-behavior model, as does this study. In some cases the studies simply asked for acceptance or opposition for management actions with no explanatory variables included. Studies measuring attitudes toward feral swine and acceptable management actions include an urban public survey in Berlin, Germany, a survey of rural residents and farmers in Jiangxi Province, China, and a study of Farmers in western Uganda (Hill, 1997; Kotulski & Konig, 2008; Li et al., 2010). Other studies have taken place in India, Australia, Canada, and the United States. These and other studies overwhelmingly find attitudes toward feral swine to be negative and for some control measures to be acceptable. The studies in the United States have been on the county or the state level. In order for feral swine management to be successful, it must occur simultaneously across a whole landscape. Therefore, there is a need for a multi-state study on opinions of farmers toward feral swine management actions.

### ***Study Purpose and Objectives***

The purpose of this paper is to identify characteristics of those who support or oppose various lethal management options for feral swine. The target population for this study was limited-resource farmers (farmers who make less than the national poverty level; see full definition in Methods section) in the southeastern United States. The specific research objective for this study was as follows.

*Research Objective. To determine the impact of wildlife value orientations, attitudes, gender, age, and income on support or opposition of feral swine lethal management actions.*

### **Methods**

Tuskegee University facilitated administration of the survey through extension services at the 1890 Land-Grant Universities (historically Black colleges and universities). The survey utilized a questionnaire designed by researchers at the USDA/APHIS/WS National Wildlife Research Center. The National Feral Swine Damage Management Program funded this study.

### ***Data Collection***

Extension offices from 13 of the 19 1890 Land-Grant Universities participated in the survey<sup>1</sup>. Surveys were administered in two “rounds”, which took place during the spring and summer of 2015. Not all of the extension offices maintained records of the number surveys distributed or the number of people asked to participate (sample size), making it impossible to calculate a precise response rate for the entire sample. Table 1 provides the sample size, number of completed questionnaires, and subsequent response rate of those extension offices that were

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<sup>1</sup> These included: Alcorn State University in Mississippi, Florida A&M University, Fort Valley State University in Georgia, Kentucky State University, Langston University in Oklahoma, Lincoln University in Missouri, North Carolina A&T State University, Prairie View A&M University (Texas), South Carolina State University, Southern University (Louisiana), Tuskegee University (Alabama), University of Maryland Eastern Shore, and Virginia State University.

able to provide both types of data (Group A) and the extension offices that were not able to provide sample size (Group B). The response rate for Group A was 46%.

Table 1.1. Survey responses: Survey of limited resource farmers in the southeastern US during 2015

	Surveys Distributed	Surveys Completed	Response Rate
Group A	694	316	46%
Group B	unknown	280	N/A

All survey participants were presented with the same questionnaire, see Appendix A. Most often, the questionnaire was delivered in person and filled out immediately, some cases were delivered in person and mailed back in, others were contacted by phone and asked to participate and then a questionnaire was hand delivered, mailed out, or emailed. The processes of selecting survey participants varied by extension office. These processes were decided upon independently by each Extension service due to varying characteristics among states and specific relationships between the Extension service members and the producers they work with. While sample selection is likely to have varied across the schools, a common intention was to sample limited resource farmers, which make up the population of producers working with extension officers associated with this project. Limited resource farmers are defined as:

1. A person with direct or indirect gross farm sales not more than \$176,800 in each of the previous two years, and
2. A person with a total household income at or below the national poverty level for a family of four or less than 50 percent of county median household income in each of the previous two years.

## ***Measurement***

### *Wildlife Value Orientations*

WVOs were measured by asking respondents the extent to which they agreed or disagreed with 19 statements: 10 domination statements (humans have control over nature) and nine mutualism statements (humans and wildlife should live in harmony) (Table 1.2). Examples of the domination statements included (a) humans should manage fish and wildlife populations so that humans benefit and (b) fish and wildlife are on earth primarily for people to use. The mutualism statements included (a) I care about animals as much as I do other people and (b) animals should have rights similar to the rights of humans. The wildlife value orientation statements were measured on a scale of “strongly disagree” (1) to “strongly agree” (7). These statements have been used and validated by previous studies (Manfredo, Teel, & Henry, 2009; Teel & Manfredo, 2010).

The internal consistency of the belief statements for the Wildlife Value Orientation scales (Domination and Mutualism) was examined using reliability analysis. Reliability analysis allows for the determination that hypothesized groupings of items into value orientations provided a good fit for the data collected. Further, it assesses the extent to which consistent results were obtained across multiple items measuring a given value orientation.

### *Attitudes*

Attitudes toward feral swine were measured using 11 belief statements on a five-point scale from “strongly disagree” (1) to “strongly agree” (5). These statements were borrowed from previous studies that examined stakeholder attitudes toward controversial wildlife, including feral swine (Agee & Miller, 2009; Mengak, 2012; Harper, Miller, Vaske, Mengak, & Bruno, 2016). The items included nine statements that suggested a negative connotation (e.g., wild pigs

are a nuisance) and two that suggested a positive connotation (e.g., it is important to me that wild pigs exist) (Table 1.3). After reverse coding the positive statements, the internal consistency of the belief statements for the Attitude scale was examined using reliability analysis.

### *Demographics*

Survey respondents were asked to self-identify as male (1) or female (0). They were also asked to write in their age; age was a continuous variable. Household income was self-reported. This variable was categorical with the options (a) less than \$10,000, (b) \$10,000 to \$24,999, (c) \$25,000 to \$49,999, (d) \$50,000 to \$74,999, (e) \$75,000 to \$99,999, (f) \$100,000 to \$124,999, (g) \$125,000 to \$149,999, (h) \$150,000 to \$174,999, (i) \$175,000 to \$199,999, (j) \$200,000 to \$224,999, (k) \$225,000 to \$249,999, and (l) \$250,000 and higher.

### *Support or Opposition to Feral Swine Management Actions*

Survey participants were asked to agree or disagree (seven-point scale from “strongly disagree” (1) to “strongly agree” (7)), with statements structured as “I feel that [management action] is ethical.” The management actions people were asked to agree or disagree with were (a) hunting wild pigs without dogs, (b) hunting wild pigs with dogs, (c) sharpshooting wild pigs from a helicopter, (d) trapping and removing wild pigs, and (e) if legal poison became available for wild pigs that caused minimal suffering and little harm to other wildlife, it would be ethical to use. The agree or disagree responses for each management action were condensed to a dichotomous variable; oppose ( $m < 4.00$  on the seven-point scale) and support ( $m \geq 4.00$  on the seven-point scale) for purposes of the logistic regression.

### *Analysis*

Logistic Regressions were computed with support or opposition of a feral swine management action as the dependent variable and Domination, Mutualism, Attitudes, Age,

Gender, and Income as the independent variables. This was performed separately for each of the five management options.

## **Results**

### ***Developing Study Indices***

The reliability tests revealed high internal consistency for the latent variables (Cronbach's alpha  $\geq .60$ ). A Cronbach's alpha can range from 0.00 to 1.00. An alpha of .770 indicates that the scale is 77% reliable. In human dimensions research, an alpha of  $\geq .65$  is considered adequate; some researchers are more strict (Cronbach's alpha  $> .80$ ) and some more lenient (Cronbach's alpha  $> .60$ ) (Vaske, 2008). The overall latent scales were created from the measured variables. The basic belief statements about wildlife were averaged into four subcategory scales (appropriate use beliefs, hunting beliefs, social affiliation beliefs, and caring beliefs) then further reduced to the two main WVOs: Domination and Mutualism (Table 1.2).

The reliability test resulted in a Cronbach's alpha of .870 indicating these beliefs have a high internal consistency for the attitude toward feral swine (Table 1.3). The Attitude scale was computed as the mean of the belief statements.

### ***Descriptive Statistics***

The mean scores for the Mutualism scale was 3.93 on a 7-point scale with a standard deviation of 1.189 and a variance of 1.414. The Domination scale was further from the neutral point with a mean score of 5.23, a standard deviation of .905, and a variance of .312. The Attitude scale, measured on a 5 point scale, had a mean of 3.84 with a standard deviation of .668 and a variance of .446. Seventy-two percent of respondents were male and the mean age was 56 years old (minimum = 20, maximum = 91). The two highest categories for income were US\$25,000 – US\$49,999 and US\$50,000 – US\$74,999 with 26 percent and 27 percent,

Table 1.2. Basic beliefs toward wildlife: Survey of limited resource farmers in the southeastern US during 2015

Wildlife value orientations, basic belief dimension, and basic belief item	Cronbach's alpha
<b>Domination</b>	<b>.770</b>
Appropriate use beliefs	.726
Humans should manage fish and wildlife population so that humans benefit.	
The needs of humans should take priority over fish and wildlife protection.	
Fish and wildlife are on earth primarily for people to use.	
It is acceptable for people to kill wildlife if they think it poses a threat to their life.	
It is acceptable for people to kill wildlife if they think it poses a threat to their property.	
It is acceptable to use fish and wildlife in research even if it may harm or kill some animals.	
<b>Hunting beliefs</b>	<b>.617</b>
We should strive for a world where there's an abundance of fish and wildlife for hunting and fishing.	
Hunting is cruel and inhumane to animals.*	
Hunting does not respect the lives of animals.*	
People who want to hunt should be provided the opportunity to do so.	
<b>Mutualism</b>	<b>.849</b>
Social affiliation beliefs	.723
We should strive for a world where humans and wildlife and fish can live side by side without fear.	
I view all living things as part of one big family.	
Animals should have rights similar to the rights of humans.	
Wildlife are like my family and I want to protect them.	
<b>Caring beliefs</b>	<b>.766</b>
I care about animals as much as I do other people.	
I feel a strong emotional bond with animals.	
I value the sense of companionship I receive from animals.	
It would be more rewarding to me to help animals rather than people.	
I take great comfort in the relationships I have with animals.	

respectively. The mean income fell within the US\$50,000 – US\$74,999 category and there was a normal distribution.

Table 1.3. Beliefs about feral swine: Survey of limited resource farmers in the southeastern US during 2015

Beliefs Statements about Feral Swine	Cronbach's alpha
Negative Statements	<b>.870</b>
Wild pigs are a nuisance.	
Wild pigs should be eliminated wherever possible.	
Wild pigs might cause damage to my property.	
Wild pigs are a threat to the safety of people.	
Wild pigs destroy native wildlife.	
I am concerned that wild pigs are a source of disease to livestock a threat to their life.	
I am concerned that wild pigs will be a source of disease to people.	
Wild pigs harm wildlife habitat.	
Wild pigs impact songbird populations.	
Positive Statements	
Problems related to wild pigs are exaggerated.	
It is important to me that wild pigs exist.	

Table 1.4 presents the percent of respondents who either supported or opposed use of the management actions. Trapping and removing feral swine was the management action that had the greatest support (Table 1.4). A strong majority also supported hunting feral swine with and without dogs. Shooting feral swine from helicopters and using poison to lethally remove feral swine both had a more even distribution between supporters and those who oppose the action.

Table 1.4. Agreement toward management options for feral swine in the southeastern United States.\*

	Oppose %	Support %
Hunting wild pigs without dogs is ethical	32	68
Hunting wild pigs with dogs is ethical	39	61
Sharpshooting wild pigs from a helicopter is ethical	47	53
Trapping and removing wild pigs is ethical	20	80
If a legal poison became available for wild pigs that caused minimal suffering and little harm to other wildlife, it would be ethical to use.	58	42

\* Survey participants were asked to agree or disagree (seven-point scale from “strongly disagree” (1) to “strongly agree” (7). The agree or disagree responses for each management action were condensed to a dichotomous variable; oppose ( $m < 4$  on the seven-point scale) and support ( $m \geq 4$  on the seven-point scale) for purposes of the logistic regression.

### ***Analysis of Research Objective***

The research objective for this study was *to determine the impact of wildlife value orientations, attitudes, gender, age, and income on support or opposition of feral swine lethal management actions*. Greater than 67 percent of the responses were correctly classified by the models (Table 1.5). The best model overall was for the management action of trapping and removing feral swine (82.1 % correctly classified). However, for predictions of opposition for the action of trap and remove were the lowest at 11%. Seventy-two people actually opposed this management strategy but our model predicted only eight of those. Additionally, the model predicted eight people who supported trap and remove as a management action actually opposed it. Sharpshooting feral swine from helicopters and using poison to lethally remove feral swine had the most even distributions of correctly classified responses into the disagree and agree categories. This is related to the original distribution of those responses. These two management actions had the most even distribution of agree and disagree responses; whereas the other three management options were strongly skewed toward agree.

Table 1.6 presents the results of logistic regressions for the research objective. The Nagelkerke  $R^2$  is provided for each of the five models. The Nagelkerke  $R^2$  is similar to  $R^2$  and approximates the variance that can be predicted by the independent variables. The traditional  $R^2$  does not exist for logistic regression. The Nagelkerke  $R^2$  is one of several pseudo  $R^2$  measures developed. Overall, the Nagelkerke  $R^2$  indicates the independent variables in these models explain 18% to 33% of the variance of the dependent variable (Vaske, 2008).

Domination was a significant ( $p < .05$ ) predictor for all five management actions (Table 1.6). The support of all management actions increases as the Domination score increases. This is the strongest predictor for four of the five management options (not the strongest predictor for

Table 1.5: Classification table for logistic regression predicting acceptance of feral swine management strategies in the southeastern United States

		Predicted		Percent Correctly Classified
	Observed	Disagree ( <i>n</i> )	Agree ( <i>n</i> )	
Hunting	Disagree	34	91	27.2
	Agree	20	260	92.9
	Overall %			72.6
Hunting with Dogs	Disagree	81	71	53.3
	Agree	35	216	86.1
	Overall %			73.7
Aerial Sharpshooting	Disagree	115	66	63.5
	Agree	54	166	75.5
	Overall %			70.1
Trap and Remove	Disagree	8	64	11.1
	Agree	8	323	97.6
	Overall %			82.1
Poison	Disagree	175	52	77.1
	Agree	66	110	62.5
	Overall %			70.7

acceptance of the use of poison to lethally remove feral swine); the strongest is for sharpshooting feral swine from helicopters ( $\text{Exp}(\beta) = 2.548, p < .001$ ) and lowest for using poison to lethally remove feral swine ( $\text{Exp}(\beta) = 1.499, p = .003$ ). Attitude was also a significant ( $p < .05$ ) predictors for all five management actions and was the strongest predictor for the use of poison

( $\text{Exp}(\beta) = 3.663, p < .001$ ). Although Income was also significant ( $p < .05$ ) it was not the strongest predictor for any of the models.

Mutualism had positive effects on support of the use of dogs to hunt feral swine ( $\text{Exp}(\beta) = 1.246, p = .039$ ) and the action of trapping and removing feral swine ( $\text{Exp}(\beta) = 1.321, p = .038$ ).

Therefore as the Mutualism score increases so does the support for those two management actions. Gender was a good predictor for shooting feral swine from helicopters ( $\text{Exp}(\beta) = .570, p = .032$ ) and the use of poison for the lethal removal of feral swine ( $\text{Exp}(\beta) = .594, p = .050$ ). The odd ratio ( $\text{Exp}(\beta)$ ) indicates males are more accepting of these two management options than are females. Age was not significant in any of the models. **Discussion**

The management of feral swine in the United States has become increasingly important over the past few decades, as the feral swine population has rapidly increased. To slow the spread of feral swine and reduce their economic impact managers must work with landowners, farmers, ranchers, and municipalities to create management plans. It is important for managers to have an understanding of various characteristics that may influence a person's acceptance of a specific management action. The cognitive hierarchy suggests that a combination of WVOs and attitudes are strong predictors of support or opposition toward management actions. Other research has shown gender, age, and income to be predictors of beliefs and behaviors (Tsalikis and Ortiz-Buonafina 1990; Dougherty et al. 2003; Thompson 2015).

This study identified a domination wildlife value orientation and a negative attitude toward feral swine to be key identifiers of support for lethal management of feral swine. A mutualism wildlife value orientation led to support of the management options that could be perceived as more humane and gender came into play on harsher, extreme management strategies. The models in this study identify different aspects of past theory and research as

Table 1.6: Logistic regression evaluating factors influencing ethical beliefs of management options for feral swine in southeastern United States

	Hunting Nagelkerke R <sup>2</sup> = .182			Hunting with Dogs Nagelkerke R <sup>2</sup> = .254			Aerial Sharpshooting Nagelkerke R <sup>2</sup> = .329			Trap and Remove Nagelkerke R <sup>2</sup> = .204			Poison Nagelkerke R <sup>2</sup> = .275		
Independent Variable	Wald	<i>Odds Ratio</i>	<i>p</i>	Wald	<i>Odds Ratio</i>	<i>p</i>	Wald	<i>Odds Ratio</i>	<i>p</i>	Wald	<i>Odds Ratio</i>	<i>p</i>	Wald	<i>Odds Ratio</i>	<i>p</i>
Mutualism	.098	1.034	.755	<b>4.253</b>	<b>1.246</b>	<b>.039</b>	.032	1.019	.857	<b>4.285</b>	<b>1.321</b>	<b>.038</b>	.004	.994	.951
Domination	<b>21.788</b>	<b>1.979</b>	<b>&lt;.001</b>	<b>31.916</b>	<b>2.339</b>	<b>&lt;.001</b>	<b>34.703</b>	<b>2.548</b>	<b>&lt;.001</b>	<b>20.545</b>	<b>2.186</b>	<b>&lt;.001</b>	<b>7.839</b>	<b>1.499</b>	<b>.005</b>
Attitude	<b>7.279</b>	<b>1.673</b>	<b>.007</b>	<b>6.283</b>	<b>1.610</b>	<b>.012</b>	<b>15.397</b>	<b>2.182</b>	<b>&lt;.001</b>	<b>10.721</b>	<b>2.126</b>	<b>.001</b>	<b>38.800</b>	<b>3.663</b>	<b>&lt;.001</b>
Gender	1.392	1.367	.238	1.320	.747	.251	<b>4.620</b>	<b>.570</b>	<b>.032</b>	.075	1.087	.785	<b>3.849</b>	<b>.594</b>	<b>.050</b>
Age	1.258	.990	.262	.039	.998	.844	.000	1.000	.986	.275	.994	.600	1.577	.989	.209
Income	<b>8.029</b>	<b>1.219</b>	<b>.005</b>	<b>15.079</b>	<b>1.327</b>	<b>&lt;.001</b>	<b>11.309</b>	<b>1.256</b>	<b>.001</b>	<b>6.723</b>	<b>1.277</b>	<b>.010</b>	<b>6.404</b>	<b>1.160</b>	<b>.011</b>

having predictive power on different types of management actions. The models presented in this paper do have a predictability that is better than guessing (Nagelkerke  $R^2$  range from .182 to .329), but overall they are not great predictors. However, the information gained from this study on which characteristics are influencing support or opposition for management actions toward feral swine can help managers focus on certain people depending on which management action they wish to deploy.

Aerial sharpshooting has proven to be the most effective eradication technique for feral swine (USDA APHIS 2010). Aerial sharpshooting is only effective; however, if a large open landscape is available. To access large open landscapes (e.g. fallow crop fields) managers may need permission from landowners. Based on the finding from this study, managers should work with landowners who support hunting and who have negative attitudes toward feral swine.

Currently there is no Federal Drug Administration (FDA) approved poison for feral swine. However, Wildlife Service (USDA APHIS) is working to find a substance that would be a lethal toxicant for feral swine but not harm other wildlife and be safe for human consumption. In this study use of a poison for feral swine management was identified as the least acceptable method. However, despite being the least acceptable method, over half of the survey respondents agreed that the use of a humane poison was ethical. Those that agreed with the use of a poison tend to be men with negative attitudes toward feral swine.

The results of this study suggest that hunting feral swine with or without the assistance of dogs and trapping and removing feral swine are the most accepted management strategies. However, governing agencies must also consider if hunting, with or without dogs, should be allowed. Some states have already made feral swine hunting illegal to discourage people from transporting feral swine by truck to new locations to increase hunting opportunities. States that

choose to allow feral swine hunting also tend to allow this hunting to be conducted with the assistance of dogs. Dogs used in the hunting of feral swine can contract diseases or be fatally injured in the hunting process and die an inhumane death.

### ***Future Research***

There is a slight difference in the number of people who believe hunting with and without dogs are appropriate options; fewer people support hunting with dogs. Further research is required to determine what factors contribute to that difference. Are there hunting traditions that lead more people to disagree with the use of dogs? Do people view the use of dogs to be “cheating”? Or, is there concern for the safety of dogs in that scenario?

The mutualism variable had the strongest influence on support for trapping and removing feral swine, suggesting this is viewed as the most humane management option. However, this could be partially due to the perception this statement creates. “Remove” in this case means to terminate. The use of the word “remove” could be interpreted as relocate or some other word that is not lethal. The term “trap and remove” has traditionally been used in studies evaluating stakeholders’ management preferences (Frank et al. 2015). This term should be reevaluated given the likelihood that survey respondents may have misinterpreted it.

The public’s interpretation of wildlife may also be influencing their acceptance for management. The theories and past research cited in this study were measuring WVOs and beliefs toward wildlife and how those influence behavior or behavioral intentions toward a specific wildlife species. If society does not consider feral swine to be wildlife these constructs may not be useful in predicting acceptance of management strategies. However, stakeholders tend to support control or eradication of various species of invasive species (Bremner & Park 2007; Larson 2007; Weeks & Packard 2009). Therefore, if society considers feral swine to be an

invasive species it could support the skewness of the findings of this study (the majority of respondents agreed with all five of the potential management options for feral swine). Further, it would explain why attitudes toward feral swine have been found to be negative regardless of stakeholder demographics and types of damages (Adams et al. 2005, Li et al. 2010).

Direct economic damages to stakeholders may also be influencing their willingness to accept lethal management of feral swine. In order to assess and estimate current and future feral swine economic impacts several biological factors need to be gathered. The range of impact of a sounder (group of feral swine) on various landscapes, crops, and ecosystems needs to be evaluated. We need better population, density, and growth estimates of feral swine. We need to know home range size. In order to build an economic model for the entire United States future researchers across the country need to work together. If managers know where the highest economic damage is occurring they will be better able to focus efforts and achieve management goals.

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Do value orientations, attitudes, and demographics influence willingness to pay for feral swine control?

## **Introduction**

Domesticated pigs (*Sus scrofa domestica*) were first introduced to the continental United States in the 1500s by explorers who used the pigs as a food source and trade item (Castañeda de Najera, 1907; US Department of Agriculture [USDA] – Animal Plant Health Inspection Service [APHIS], 2013). The trade of pigs and movement of settlers led to the spread of pigs across the southern United States (Hanson & Karstad, 1959). Feral (wild) populations of swine became established due to the practice of free-range feeding and from pigs escaping from enclosures (Towne & Wentworth, 1950). Wild Eurasian hogs (*Sus scrofa*) were first brought to the northeastern United States in the late 1800s. Eurasian hogs were transported throughout the Appalachians and neighboring states for hunting opportunities (Towne & Wentworth, 1950). The original feral pigs and Eurasian hogs have interbred and are widely considered a hybrid wild pig (*Sus scrofa*) (hereafter referred to as feral swine). Reports from USDA APHIS suggest pig populations have increased and are believed to be present in 42 states (Slootmaker, Harper, Anderson, Holderieth, & Shwiff, 2016). The recent range expansion of feral swine throughout the United States was stimulated through anthropogenic means. The main motivation for relocating feral swine is for hunting purposes. When swine are introduced to a new part of the landscape, they reproduce and spread quickly, especially in agricultural areas with abundant food sources.

The spread of feral swine across the United States is of increasing concern to rural and urban residents, farmers, ranchers, and municipalities. Feral swine cause extensive ecological impact on account of their wallowing in the dirt and rooting with their snout for food below the

soil surface. These activities increase soil erosion leading to excess runoff, decreased crop productivity, and levee failure; which in turn lead to continued water quality degradation and agricultural crop damage. Feral swine eat three to five percent of their body weight per day and are generalists, meaning they will feed on anything: agricultural crops, trees, shrubs, insects, ground nesting birds, reptiles, amphibians, and mammals (Tolleson, Rollins, Pinchak, Ivy, & Heirman, 1993; Taylor & Hellgren, 1997; Jolley et al., 2010; Timmons, Cathey, Rollins, Dictson, & McFarland, 2011). In addition to consuming large amounts of food, feral swine degrade the habitat and decrease food availability for other species (Wood & Lynn, 1977). Feral swine also carry diseases and parasites harmful to humans, pets, wildlife, and livestock (Hutton, DeLiberto, Owen, & Morrison, 2006; Schley, Dufrene, Krier, & Frantz, 2008).

For agriculture producers in the United States, feral swine are of great concern. Although many large-scale farmers have crop insurance that covers wildlife damage, smaller farmers often lack such insurance. As a result, if they lose their crops to feral swine, they may face financial ruin. Farmers and ranchers may also lose livestock due to attack or disease from feral swine. The total agricultural damage caused by feral swine in the United States is unknown because this damage is hard to identify, the magnitude of the spread of the feral swine population is largely unknown, and there is a lack of reporting of damages by agriculture producers. However, Texas Parks and Wildlife Department estimates agricultural damage across the state to total \$52 million (Southeastern Association of Fish and Wildlife Agencies (SEAFWA), 2014). For northern Florida, the estimated row crop damage for one year is over \$1.8 million (SEAFWA, 2014).

A variety of methods are available to mitigate the impact of feral swine, including aerial shooting, baiting and shooting, hunting with dogs, sport hunting, and trapping followed by lethal removal. Some of these lethal control methods, however, may be more acceptable to some

people than to others. To manage feral swine effectively, agencies, state and federal, require an understanding of the public's opinion on the acceptability of the various management efforts. State and federal agency employees may need access to a person's land to carry out management techniques or may enlist the help of residents in management efforts. Additionally, because feral swine move freely on the landscape it is important to have consensus of landowners to accomplish management goals.

### ***Conceptual Approach***

This study employs a social psychological theory that has been adapted for use in wildlife management (Manfredo, 2008). The cognitive hierarchy model links values, value orientations, beliefs and attitudes, and behaviors (Homer & Kahle, 1988). This framework lays the foundation for predicting human behavior. However, it is important to acknowledge that other factors can influence behavior and that people with similar values or value orientations may not always choose the same behavior. This is in part because attitudes vary depending on the context or situation in question (Ajzen & Fishbein, 1980). For example, wildlife value orientations (WVOs) should predict a person's attitude toward hunting on a broad scale. However, that person's attitude toward hunting a specific species may be different from the predicted attitude because of personal experiences with the species (Whittaker, Vaske, & Manfredo, 2006). The cognitive hierarchy along with demographics is often used in studies to inform wildlife management decisions (Fulton, Manfredo, & Lipscomb, 1996; Manfredo, 2008; Bruskotter, Vaske, & Schmidt, 2009). Figure 1 is an illustration of the cognitive hierarchy.

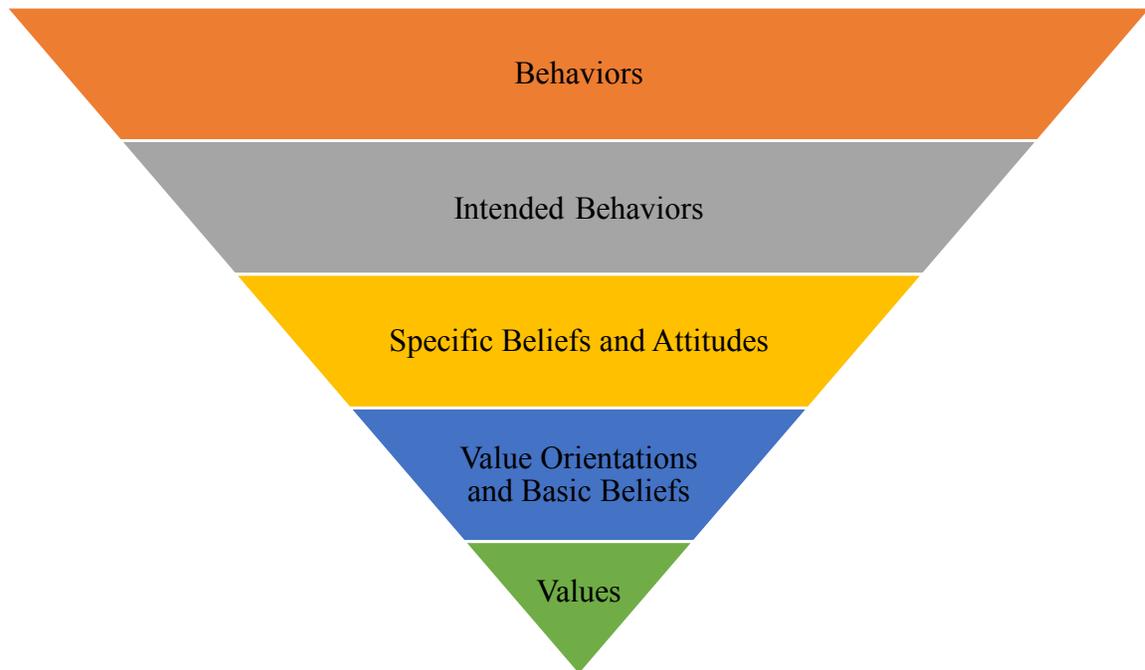


Figure 1. The cognitive hierarchy (adapted from Manfredi, 2008).

Values are the foundation for an individual's thoughts and actions (Rokeach, 1973). A person's values are few in number, slow to change, and cover a broad scope. However, a person's fundamental values are not specific enough to inform management decisions (Fulton et al., 1996). According to the cognitive hierarchy, in order to utilize the public's values to inform management decisions their value orientations must be measured (Bright, Manfredi, & Fulton, 2000). Value orientations are a measure of how a person's values inform their basic beliefs as they relate to a more specific, yet still broad, subject (e. g., wildlife). These basic beliefs, combined with personal experiences or information gathering inform specific beliefs and attitudes (Fishbein & Ajzen, 1975). Specific beliefs and attitudes lead to intended behaviors and actual behaviors (Ajzen & Fishbein, 1980).

Wildlife value orientations are measured using a series of belief statements that were developed based on eight basic belief dimensions related to wildlife (Fulton et al., 1996). These eight basic beliefs then come together further to form the WVOs. The WVO scale consists of

four basic belief categories. These groups are appropriate use beliefs and hunting beliefs, which come together to form the domination orientation, and social affiliation beliefs and caring beliefs which form the Mutualism orientation (Teel & Manfredi, 2010). Those who have a domination orientation hold a value suggesting humans have dominion over nature; the mutualism orientation suggests values of equality between humans, fish, and, wildlife. WVOs of rural landowners, farmers, and livestock producers are generally more domination-oriented than those of the general public (Vaske, Jacobs, & Sijtsma, 2011; Gamborg & Jensen, 2016). People expressing more domination-oriented values also tend to be older and male (Teel et al., 2005; Vaske et al., 2011; Gamborg & Jensen, 2016).

The behavior in question for this study is the respondents' willingness to pay (WTP) for the eradication of feral swine from their property. Socio-economic variables are often used as explanatory variables for willingness to pay studies (Arrow et al., 1993). However, willingness to pay can be viewed as an intended behavior and can therefore be explained by value orientations, beliefs, and attitudes (Ojea & Loureiro, 2007). Previous studies linking attitudes to willingness to pay have focused on environmental attitudes and willingness to pay for environmental protection or species recovery (Stern, Dietz, & Kalof, 1993; Ojea & Loureiro, 2007). Studies linking wildlife values and attitudes toward a specific species and willingness to pay for removal of that species are not as common.

### ***Study Purpose and Objectives***

This study focused on landowners' willingness to pay for feral swine control on their land contingent on their desire to not have feral swine on their land. The target population for this study was limited-resource farmers (farmers who make less than the national poverty level; see

full definition in Methods section) in the southeastern United States. The research objectives were as follows.

*Research Objective 1. To determine the relative impacts of wildlife value orientations, attitudes toward feral swine, and demographics on the amount that farmers who currently have feral swine on their land are willing to pay to eradicate the species from their land.*

*Research Objective 2. To determine the relative impacts of wildlife value orientations, attitudes toward feral swine, and demographics on the amount that farmers who do not currently have feral swine on their land are willing to pay to prevent the species from coming onto their land.*

These research objectives effectively allow comparison on the impact of social psychological and demographic factors on the two groups of farmers' willingness to pay for feral swine control to insure the species is not found on their land.

## **Methods**

Tuskegee University facilitated administration of the survey through extension services at the 1890 Land-Grant Universities (historically Black colleges and universities). The survey utilized a questionnaire designed by researchers at the USDA/APHIS/WS National Wildlife Research Center. The National Feral Swine Damage Management Program funded this study.

### ***Data Collection***

Extension offices from 13 of the 19 1890 Land-Grant Universities participated in the survey<sup>2</sup>. Surveys were administered in two "rounds", which took place during the spring and

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<sup>2</sup> These included: Alcorn State University in Mississippi, Florida A&M University, Fort Valley State University in Georgia, Kentucky State University, Langston University in Oklahoma, Lincoln University in Missouri, North Carolina A&T State University, Prairie View A&M University (Texas), South Carolina State University, Southern University (Louisiana), Tuskegee University (Alabama), University of Maryland Eastern Shore, and Virginia State University.

summer of 2015. Not all of the extension offices maintained records of the number surveys distributed or the number of people asked to participate (sample size), making it impossible to calculate a precise response rate for the entire sample. Table 2.1 provides the sample size, number of completed questionnaires, and subsequent response rate of those extension offices that were able to provide both types of data (Group A) and the extension offices that were not able to provide sample size (Group B). The response rate for Group A was 46%.

Table 2.1. Survey responses: Survey of limited resource farmers in the southeastern US during 2015

	Surveys Distributed	Surveys Completed	Response Rate
Group A	694	316	46%
Group B	unknown	280	N/A

All survey participants were presented with the same questionnaire (see Appendix A.) Most often, the questionnaire was delivered in person and filled out immediately, some surveys were delivered in person and mailed back to the extension office, others were contacted by phone and asked to participate and then a questionnaire was hand delivered, mailed out, or emailed. The processes of selecting survey participants varied by school. These processes were decided upon independently by each Extension service due to varying characteristics among states and specific relationships between the Extension service members and the producers they work with. While sample selection is likely to have varied across the schools, a common intention was to sample limited resource farmers, which make up the population of producers working with extension officers associated with this project. Limited resource farmers are defined as:

1. A person with direct or indirect gross farm sales not more than \$176,800 in each of the previous two years, and

2. A person with a total household income at or below the national poverty level for a family of four or less than 50 percent of county median household income in each of the previous two years.

### ***Measurement***

#### *Wildlife Value Orientations*

WVOs were measured by asking respondents the extent to which they agreed or disagreed with 19 statements: 10 domination statements (humans have control over nature) and nine mutualism statements (humans and wildlife should live in harmony) (Table 1.2). Examples of the domination statements included (a) humans should manage fish and wildlife populations so that humans benefit and (b) fish and wildlife are on earth primarily for people to use. The mutualism statements included (a) I care about animals as much as I do other people and (b) animals should have rights similar to the rights of humans. The wildlife value orientation statements were measured on a scale of “strongly disagree” (1) to “strongly agree” (7). These statements have been used and validated by previous studies (Manfredo, Teel, & Henry, 2009; Teel & Manfredo, 2010).

The internal consistency of the belief statements for the Wildlife Value Orientation scales (Domination and Mutualism) was examined using reliability analysis. Reliability analysis allows for the determination that hypothesized groupings of items into value orientations provided a good fit for the data collected. Further, it assess the extent to which consistent results were obtained across multiple items measuring a given value orientation.

#### *Attitudes*

Attitudes toward feral swine were measured using 11 belief statements on a five-point scale from “strongly disagree” (1) to “strongly agree” (5). These statements were borrowed from

previous studies that examined stakeholder attitudes toward controversial wildlife, including feral swine (Agee & Miller, 2009; Mengak, 2012; Harper, Miller, Vaske, Mengak, & Bruno, 2016). The items included nine statements that suggested a negative connotation (e.g., wild pigs are a nuisance) and two that suggested a positive connotation (e.g., it is important to me that wild pigs exist) (Table 1.3). After reverse coding the positive statements, the internal consistency of the belief statements for the Attitude scale was examined using reliability analysis.

### *Demographics*

Survey respondents were asked to self-identify as male (1) or female (0). They were also asked to write in their age; age was a continuous variable. Household income was self-reported. This variable was categorical with the options (a) less than \$10,000, (b) \$10,000 to \$24,999, (c) \$25,000 to \$49,999, (d) \$50,000 to \$74,999, (e) \$75,000 to \$99,999, (f) \$100,000 to \$124,999, (g) \$125,000 to \$149,999, (h) \$150,000 to \$174,999, (i) \$175,000 to \$199,999, (j) \$200,000 to \$224,999, (k) \$225,000 to \$249,999, and (l) \$250,000 and higher.

### *Willingness to Pay*

To measure Willingness to Pay (WTP) respondents were first asked to choose between six statements that describe if they have or do not have feral swine on their land and their desire for change or no change of the number of feral swine on their land. A follow-up question asked the amount they would be willing to pay for their desired state. For example, if the respondent chose “I have some wild pigs on my land, but would prefer to have none,” they would then be asked “if eradication costs were spread across all farmers in your region, what is the most you would pay to guarantee permanent eradication of wild pigs from your land?” All respondents were then asked to choose from 12 payment amounts per acre: (a) \$0, (b) \$5, (c) \$10, (d) \$15, (e) \$20, (f) \$25, (g) \$50, (h) \$75, (i) \$100, (j) \$200, (k) \$500, (l) \$1,000. The responses for the

amount survey participants were willing to pay were reduced to three categories: No WTP (\$0), Moderate WTP (\$5, \$10, and \$15), and High WTP (greater than or equal to \$20) (Table 2.5).

### ***Analysis***

Discriminant analysis was conducted with the WTP amount categories as the dependent variable and Domination, Mutualism, Attitudes, Age, Gender, and Income as the independent variables.

## **Results**

### ***Developing Study Indices***

The reliability tests revealed high internal consistency for the latent variables (Cronbach's alpha  $\geq .60$ ). A Cronbach's alpha can range from 0.00 to 1.00. An alpha of .770 indicates that the scale is 77% reliable. In human dimensions research, an alpha of  $\geq .65$  is considered adequate; some researchers are more strict (Cronbach's alpha  $> .80$ ) and some more lenient (Cronbach's alpha  $> .60$ ) (Vaske, 2008). The overall latent scales were created from the measured variables. The basic belief statements about wildlife were averaged into four subcategory scales (appropriate use beliefs, hunting beliefs, social affiliation beliefs, and caring beliefs) then further reduced to the two main WVOs: Domination and Mutualism (Table 2.2).

The reliability test resulted in a Cronbach's alpha of .870 indicating these beliefs have a high internal consistency for the attitude toward feral swine (Table 2.3). The attitude scale was computed as the mean of the belief statements.

### ***Descriptive Statistics***

The mean score for the Mutualism scale was 3.93 on a 7-point scale and the Domination scale was further from the neutral point with a mean score of 5.23 (Table 2.4). The Attitude scale, measured on a 5 point scale, had a mean of 3.84. Seventy-two percent of respondents were

Table 2.2. Basic beliefs toward wildlife: Survey of limited resource farmers in the southeastern US during 2015

Wildlife value orientations, basic belief dimension, and basic belief item	Cronbach's alpha
<b>Domination</b>	<b>.770</b>
Appropriate use beliefs	.726
Humans should manage fish and wildlife population so that humans benefit.	
The needs of humans should take priority over fish and wildlife protection.	
Fish and wildlife are on earth primarily for people to use.	
It is acceptable for people to kill wildlife if they think it poses a threat to their life.	
It is acceptable for people to kill wildlife if they think it poses a threat to their property.	
It is acceptable to use fish and wildlife in research even if it may harm or kill some animals.	
<b>Hunting beliefs</b>	<b>.617</b>
We should strive for a world where there's an abundance of fish and wildlife for hunting and fishing.	
Hunting is cruel and inhumane to animals.*	
Hunting does not respect the lives of animals.*	
People who want to hunt should be provided the opportunity to do so.	
<b>Mutualism</b>	<b>.849</b>
Social affiliation beliefs	.723
We should strive for a world where humans and wildlife and fish can live side by side without fear.	
I view all living things as part of one big family.	
Animals should have rights similar to the rights of humans.	
Wildlife are like my family and I want to protect them.	
<b>Caring beliefs</b>	<b>.766</b>
I care about animals as much as I do other people.	
I feel a strong emotional bond with animals.	
I value the sense of companionship I receive from animals.	
It would be more rewarding to me to help animals rather than people.	
I take great comfort in the relationships I have with animals.	

male and the mean age was 56 years old (minimum = 20, maximum = 91). The two highest categories for income were US\$25,000 – US\$49,999 and US\$50,000 – US\$74,999 with 26 percent and 27 percent, respectively.

Table 2.3. Beliefs about feral swine: Survey of limited resource farmers in the southeastern US during 2015

Beliefs Statements about Feral Swine	Cronbach's alpha
Negative Statements	<b>.870</b>
Wild pigs are a nuisance.	
Wild pigs should be eliminated wherever possible.	
Wild pigs might cause damage to my property.	
Wild pigs are a threat to the safety of people.	
Wild pigs destroy native wildlife.	
I am concerned that wild pigs are a source of disease to livestock a threat to their life.	
I am concerned that wild pigs will be a source of disease to people.	
Wild pigs harm wildlife habitat.	
Wild pigs impact songbird populations.	
Positive Statements	
Problems related to wild pigs are exaggerated.	
It is important to me that wild pigs exist.	

Table 2.4. Descriptive statistics of independent latent variables: Survey of limited resource farmers in the southeastern US during 2015.

	Mean	Standard deviation	Variance
Mutualism <sup>1</sup>	3.93	1.189	1.414
Domination <sup>1</sup>	5.23	.905	.312
Attitude <sup>2</sup>	3.84	.668	.446

<sup>1</sup> Measured on a 7-point scale with 1 representing “strongly disagree” through 7 representing “strongly disagree.”

<sup>2</sup> Measured on a 5-point scale with 1 representing “strongly disagree” through 5 representing “strongly disagree.”

Table 2.5 presents the results of the WTP question. The majority ( $n=230$ , 39%) of respondents indicated they did not have feral swine on their land and did not want feral swine on their land. Upon being prompted with the question, “What would be the most you would pay to guarantee that feral swine never spread to your land,” 131 (57%) respondents chose \$0 per acre, and as a result make up one group for analysis, hereafter referred to as the “No WTP” group. The other producers who chose this option were split between the group consisting of \$5, \$10, and \$15 ( $n=57$ , 25%), hereafter referred to “Moderate WTP”, and the group including all other

responses  $\geq$  \$20 ( $n=42$ , 18%), hereafter referred to as “High WTP”. The other response option included in this paper is, “I have some feral swine on my land, but would prefer to have none” ( $n=138$ , 23%). The majority of the respondents for this option indicated they would pay \$5, \$10, or \$15 ( $n=62$ , 45%). Forty-seven respondents indicated they would pay \$0 and 29 respondents would pay  $\geq$  \$20 (Table 2.5).

The mean scores for the independent variables across the three dependent variable groups for the respondents who identified as having feral swine on their land but would prefer to not have any are found in Table 2.6. The means for the independent variables across the three dependent variable groups did not vary greatly. The High WTP group has a slightly higher Domination score and is slightly younger.

The mean scores for the independent variables across the three dependent variable groups for the respondents who identified as not having feral swine on their land and would prefer to continue to not have any are found in Table 2.7. The means for most of the independent variables across the three dependent variable groups did not vary. However, Mutualism is slightly higher for No WTP and slightly lower for High WTP relative to Moderate WTP.

### ***Analysis of Research Objectives***

Research Objective 1 was *to determine the relative impacts of wildlife value orientations, attitudes toward feral swine, and demographics on the amount that farmers who currently have feral swine on their land are willing to pay to eradicate the species from their land*. Coefficients for the independent variables based on the discriminate analysis for those who currently have feral swine on their land but would prefer to not have any are presented in table 2.8.

Table 2.5. Willingness to pay for various feral swine statuses on producers' property: Survey of limited resource farmers in the southeastern US during 2015.

Land status, preference	<i>n</i>		No WTP %	Moderate WTP %	High WTP %
I don't have feral swine on my land, and I would prefer to keep it that way.	230	What would be the most you would pay to guarantee that feral swine never spread to your land?	57.0	24.8	18.3
I have some feral swine on my land, but would prefer to have none.	138	If eradication costs were spread across all farmers in your region, what is the most you would pay to guarantee permanent eradication of feral swine from your land?	34.1	44.9	21.0
I have some feral swine on my land, but would prefer to have fewer.	41		56.1	26.8	17.1
I have some feral swine on my land, and I wouldn't change how many.	14	What is the minimum you would have to be paid per acre to allow permanent eradication of feral swine from ALL of your land?	42.9	14.3	42.9
I have some feral swine on my land, but would prefer to have more	1		100.0	0.0	0.0
I don't have feral swine on my land, but would prefer to have them.	17	What is the minimum you would have to be paid per acre to never have feral swine on your land?	47.1	29.4	23.5

\*No WTP = \$0, Moderate WTP = \$5, \$10, and \$15, High WTP ≥ \$20

\*The rows above the dotted line are included in this paper. The other four statements were excluded do to low responses.

Table 2.6. A comparison of group mean scores on independent variables: Farmers who currently have feral swine on their land but would prefer to not have any; from a survey of limited resource farmers in the southeastern US during 2015.

Variables	Group Mean/(SD)			Univariate F <sup>a</sup>
	No WTP	Moderate WTP	High WTP	
Mutualism	4.0 (1.12)	3.8 (.88)	3.8 (1.29)	.410
Domination	5.5 (.82)	5.4 (.73)	5.8 (.59)	1.905
Beliefs	4.1 (.47)	4.2 (.54)	4.0 (.67)	.569
Gender	1.2 (.40)	1.3 (.45)	1.2 (.44)	.416
Age	55.8 (14.45)	56.4 (12.84)	50.7 (13.77)	1.430
Income	3.9 (1.91)	4.9 (2.48)	4.5 (2.75)	1.764
<i>n</i>	37	55	21	

<sup>a</sup>df<sub>1</sub> = 2, df<sub>2</sub> = 110

\*No WTP = \$0, Moderate WTP = \$5, \$10, and \$15, High WTP ≥ \$20

Table 2.7. A comparison of group mean scores on independent variables: Farmers who currently have feral swine on their land but would prefer to not have any and the predictor variables; from a survey of limited resource farmers in the southeastern US during 2015.

Variables	Group Mean/(SD)			Univariate F <sup>a</sup>
	No WTP	Moderate WTP	High WTP	
Mutualism	3.9 (1.32)	3.5 (1.33)	3.2 (1.26)	3.305
Domination	5.4 (1.01)	5.2 (.99)	5.1 (.71)	.579
Beliefs	3.8 (.76)	3.9 (.65)	4.1 (.54)	2.727
Gender	1.4 (.49)	1.3 (.48)	1.3 (.44)	.774
Age	54.1 (12.82)	55.4 (13.44)	52.6 (12.66)	.431
Income	3.9 (1.73)	4.1 (2.32)	4.0 (1.73)	.126
<i>n</i>	87	46	28	

<sup>a</sup>df<sub>1</sub> = 2, df<sub>2</sub> = 158

\*No WTP = \$0, Moderate WTP = \$5, \$10, and \$15, High WTP ≥ \$20

Table 2.8. Classification Coefficients for those who currently have feral swine on their land but would prefer to have none: Survey of limited resource farmers in the southeastern US during 2015.

Independent variable	No WTP	Moderate WTP	High WTP
Mutualism	6.247	6.072	6.200
Domination	13.018	12.652	13.616
Attitudes	9.884	10.116	9.506
Gender	15.831	16.309	16.375
Age	.215	.216	.189
Income	.016	.208	.108
Constant	-85.268	-85.021	-86.617

The classification coefficients are applied to functions as follows with FG1 representing the “No WTP” group, FG2 representing the “Moderate WTP” group, and FG3 representing the “High WTP” group.

$$FG1 = -85.268 + 6.247(\text{Mutualism}) + 13.018(\text{Domination}) + 9.884(\text{Attitudes}) + 15.831(\text{Gender}) + 0.215(\text{Age}) + 0.016(\text{Income}).$$

$$FG2 = -85.021 + 6.072(\text{Mutualism}) + 12.652(\text{Domination}) + 10.116(\text{Attitudes}) + 16.309(\text{Gender}) + 0.216(\text{Age}) + 0.208(\text{Income}).$$

$$FG3 = -86.617 + 6.200(\text{Mutualism}) + 13.616(\text{Domination}) + 9.506(\text{Attitudes}) + 16.375(\text{Gender}) + 0.189(\text{Age}) + 0.108(\text{Income}).$$

The FG with the largest number is the group to which the individual respondent will be predicted to belong. This model correctly classified 49.3% of group membership (Table 2.9). Because the model is predicting for three groups this is better than guessing (33.3%).

Table 2.9. Classification results for those who currently have feral swine on their land but would prefer to not have any: Survey of limited resource farmers in the southeastern US during 2015.

Actual group	No. of cases	Predicted group membership			<i>n</i> (%)
		No WTP	Moderate WTP	High WTP	
No WTP	47	20 (42.6)	10	17	47
Moderate WTP	62	14	30 (48.4)	18	62
High WTP	29	6	5	18 (62.1)	29
Total					138 (49.3)

For all willingness to pay categories, a respondent's Gender had the strongest influence on WTP grouping (15.831 for "No WTP", 16.309 for "Moderate WTP", and 16.375 for "High WTP" respectively). One's score on the Domination wildlife value orientation had the second strongest influence on preferred willingness to pay (13.018, 12.652, and 13.616 respectively). Attitude toward feral swine had the third strongest influence on WTP grouping (9.884, 10.116, and 9.506 respectively). The fourth strongest influence was the mutualism wildlife value

orientation (6.247, 6.072, and 6.200 respectively). The influence of age (fifth strongest effect) and income (sixth strongest effect) were the weakest predictors of one’s willingness to pay for feral swine control with coefficients less than .250.

Research Objective 2 was to *determine the relative impacts of wildlife value orientations, attitudes toward feral swine, and demographics on the amount that farmers who do not currently have feral swine on their land are willing to pay to prevent the species from coming onto their land.*

Coefficients for the independent variables based on the discriminate analysis for those who do not have feral swine on their land and would prefer to continue not to have any are presented in Table 2.10.

Table 2.10. Classification Coefficients for those who do not have feral swine on their land and would prefer to continue not to have any: Survey of limited resource farmers in the southeastern US during 2015.

Independent variable	No WTP	Moderate WTP	High WTP
Mutualism	5.163	4.857	4.748
Domination	7.574	7.220	7.029
Attitudes	8.615	8.848	9.203
Gender	9.259	9.164	8.730
Age	.202	.211	.191
Income	.414	.468	.461
Constant	-60.237	-58.695	-57.115

The classification coefficients are applied to functions as follows with FG1 representing the “No WTP” group, FG2 representing the “Moderate WTP” group, and FG3 representing the “High WTP” group.

$$FG1 = -60.237 + 5.163(Mutualism) + 7.574(Domination) + 8.615(Attitudes) + 9.259(Gender) + .202(Age) + .414(Income).$$

$$FG2 = -58.695 + 4.857(Mutualism) + 7.220(Domination) + 8.848(Attitudes) + 9.164(Gender) + .211(Age) + .468(Income).$$

$$FG3 = -57.115 + 4.748(\text{Mutualism}) + 7.029(\text{Domination}) + 9.203(\text{Attitudes}) + 8.730(\text{Gender}) + .191(\text{Age}) + .461(\text{Income}).$$

The FG with the largest number is the group to which the individual respondent will be predicted to belong. This model correctly classified 40.9% of the respondents (Table 2.11). However, classification for No WTP and High WTP were much better than that of Moderate WTP (46.6%, 42.9%, and 26.3%, respectively).

Table 2.11. Classification results for those who do not have feral swine on their land and would prefer to continue not to have any: Survey of limited resource farmers in the southeastern US during 2015.

Actual group	Predicted group membership			n (%)
	No WTP	Moderate WTP	High WTP	
No WTP	61 (46.6)	42	28	131
Moderate WTP	22	15 (26.3)	20	57
High WTP	11	13	18 (42.9)	42
Total				230 (40.9)

Gender has the strongest influence on “No WTP” (9.259) and “Moderate WTP” (9.164) and Attitude has the strongest influence on “High WTP” (9.203). Attitude has the second strongest influence on “No WTP” and “Moderate WTP” and Gender has the second strongest influence on “High WTP” (8.615, 8.848, and 8.730). The third strongest influence on all categories is Domination (7.574 for “No WTP”, 7.220 for “Moderate WTP”, and 7.029 for “High WTP”) and the fourth is Mutualism (5.163 for “No WTP”, 4.857 for “Moderate WTP”, and 4.748 for “High WTP”). The impacts of age (fifth strongest influence) and income (sixth strongest influence) were the weakest predictors of one’s willingness to pay for feral swine control with coefficients less than .500.

## **Discussion**

The management of feral swine in the United States has become increasingly important over the past few decades, as the feral swine population has rapidly increased. To slow the spread of feral swine and reduce their economic impact managers must work with landowners, farmers, ranchers, and municipalities to create management plans. It is important for managers to have an understanding of various characteristics that may influence a person's willingness to pay for a specific management action. The cognitive hierarchy suggests that a combination of WVOs and attitudes are strong predictors of intended behaviors. Other research has shown gender, age, and income to be predictors of intended behaviors and willingness to pay (Arrow et al., 1993; Stern, Dietz, & Kalof, 1993; Ojea & Loureiro, 2007).

Gender and Domination followed by Attitudes and Mutualism had the most influence on willingness to pay amounts for farmers who had feral swine on their land and wanted none. Gender and Attitudes followed by Domination and Mutualism had the most influence on willingness to pay amounts for farmers who do not have feral swine on their land and want to continue to have none. Age and Income had very little influence on the WTP amounts. The models in this study identify different aspects of past theory and research as having predictive power on different willingness to pay amounts. The models presented in this paper do have a predictability that is better than guessing (49% for farmers who have feral swine on their land and 40% for farmers who do not have feral swine on their land).

Overall, these models are not good predictors for respondents' willingness to pay for removal of feral swine or for protection from feral swine invasion. The models are better than guessing, but not by much. Therefore, other variables must be influencing people's willingness to pay. These could include crop loss, property damage, fear of the species, or how people view feral swine. We can infer from the mire totals in the response categories that those who have

feral swine and do not want feral swine are willing to pay more to remove swine from their land than those who do not have feral swine and want to continue to not have feral swine are willing to pay to prevent swine from entering their land. This would suggest that personal experience with feral swine leads to an increase in willingness to pay amounts.

As mentioned before, feral swine must be managed across a full landscape. Managing on one property will just push the swine to a neighboring property. It will be important for managers and farmers who are managing to remove swine to elicit the support (physically and monetarily) of all landowners in a management area. Additionally, the costs of managing feral swine can be quite high depending on the management action used, the landscape, feral swine density, and time of year. Currently, there is a large federal program focused on managing feral swine. This program provides funding and trained personnel to carry out feral swine management actions. If, or more likely when, this funding is no longer available it will be up to local managers to partner with landowners to conduct management and it will be up to the states and the landowners to provide the funding for this management. Managers can utilize information from this study by informing those without feral swine about the destructive power of feral swine. First-hand accounts from farmers with feral swine damage may help influence neighboring farmers to participate in feral swine control efforts. Management of feral swine across an entire landscape is the only feasible way to mitigate damages for all farmers.

Because feral swine have populated the part of the country involved in this study for 500 years, the assumption was made that survey participants would consider feral swine to be wildlife. Therefore, the WVOs were employed to predict willing to pay for feral swine management. However, if those involved in this survey do not view feral swine as wildlife then many of the theories this study is based on may not hold true. Also, Previous WTP research

focused on willingness to pay for forest regeneration, endangered species protection, wetland restoration, or other environmental positive activities (Stevens, Echevarria, Glass, Hager, & More, 1991; Spash & Hanley, 1995; Spash, 2000; Kotchen & Reiling, 2000; Ojea & Loureiro, 2007). These studies used value orientations focused on the environment in general. No previous WTP studies have utilized WVO in conjunction with specific attitudes toward the species in question. Further, studies focused on the removal or exclusion of a species are not common.

The distribution of domination oriented respondents and mutualism respondents was not equal as might be expected for the general populations (Teel et al., 2005). This could have occurred for several reasons. First the base line for wildlife value orientations is based on a study that was conducted in the Western United States. This study includes states that are in the southeastern United States. It is possible that these states in general are more domination oriented. Second, farmers tend to be more domination oriented than the general public. This study focused on crop producers, and therefore was expected to be more domination oriented. The third possible influence was the questionnaire design. The WVOs came at the end of the survey (before only the demographics). It is possible that even though the questions were about wildlife people may have associated them with feral swine because the rest of the questionnaire was about feral swine, and answered differently than they normally would have.

Future studies should focus on willingness to pay for protection from feral swine of the general population, wildlife value orientations for those living in southeastern United States, and additional variables that may be influencing respondents' willingness to pay.

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APPENDIX A  
QUESTIONNAIRE

**Section 1. Farm Information.** Please answer the following questions regarding the property you own, farm, or ranch

1. About how many acres do you own or lease? \_\_\_\_\_ acres  
 1A. In which county is most of this property located? \_\_\_\_\_ district  
 1B. About how many of your total acres are in this county? \_\_\_\_\_ acres
2. Over the last 3 years, have feral swine been present (to your knowledge) in this county?  
 \_\_\_\_ Yes \_\_\_\_ No \_\_\_\_ Unsure
3. Over the last 3 years have you seen feral swine on the property you own, farm, or ranch?  
 \_\_\_\_ Yes \_\_\_\_ No \_\_\_\_ Unsure

**Section 2. Crop Production.** Please answer the following questions regarding crops that you grow on this property.

1. Over the last 3 years, have you planted at least one crop?  
 \_\_\_\_ Yes (Please continue with Question 1A)  
 \_\_\_\_ No (Please skip to Section 3, Page 2)
- 1A. List (up to two) crops you have planted over the last 3 years in order of importance or check does not apply (N/A):  
 (1) \_\_\_\_\_ (2) \_\_\_\_\_ \_\_\_\_ N/A

Please answer the following based on *the last 3 years for the crops listed above.*

	Crop 1	Crop 2
2. About how many acres did you plant annually? (over the last 3 years ON AVERAGE)	_____ acres	_____ acres
3. What was the approximate yield per acre? (over the last 3 years ON AVERAGE)	_____ per acre	_____ per acre
4. Please indicate UNITS of measurement you use for this crop. (e.g., bushels, etc.)	_____	_____
5. When you sold the crop, what was the price per unit? (over the last 3 years ON AVERAGE)	\$ _____	\$ _____
6. About what percent of this crop was grown certified organically? (over the last 3 years ON AVERAGE)	_____ %	_____ %
7. Have feral swine been present during the last 3 years (to your knowledge) on your fields of this crop?	____ Yes ____ No	____ Yes ____ No

8. During the last 3 years was this crop damaged (to your knowledge) by feral swine? If No or Don't Know, skip to question 14.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
9. About how many acres were damaged annually? (over the last 3 years ON AVERAGE)	_____ acres	_____ acres
10. What was your approximate yield per acre on the acres damaged by feral swine? (over the last 3 years ON AVERAGE)	_____ per acre	_____ per acre
11. What do you estimate the yield per acre would have been without the damage? (over the last 3 years ON AVERAGE)	_____ per acre	_____ per acre
12. <i>If you made NO ATTEMPT to control feral swine damage BUT other local producers MAINTAINED current feral swine control practices, what do you believe your yield per acre would have been across all acres you planted? (over the last 3 years ON AVERAGE)</i>	_____ per acre	_____ per acre
13. <i>If you AND all other local producers made NO ATTEMPT to control feral swine damage, what do you believe your yield per acre would have been across all acres you planted? (over the last 3 years ON AVERAGE)</i>	_____ per acre	_____ per acre
14. In the last 3 years have you had crop insurance on this crop?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
14A. Did this policy cover wildlife damage?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
14B. Did you file at least one crop insurance claim on this crop for feral swine damage?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
14C. About how much money did you receive from the insurance company for these claims over the last 3 years?	\$ _____	\$ _____
15. Do you have access to a wildlife damage refund program for crop damage?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Don't Know
15A. If yes, did you receive money from this program over the last 3 years?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
15B. If yes, how much money did you receive over the last 3 years?	\$ _____	\$ _____

**Section 3. Livestock Production.** Please answer the following questions regarding livestock raised on this property.

1. Over the last 3 years have you raised at least one type of livestock?

Yes (Please continue with Question 2)  
 No (Please skip to Section 4, Page 3)

2. Please indicate the type(s) of livestock that you have raised over the last 3 years. (*Check all that apply*)

Cattle  Domestic Pigs  Sheep/Goats  Poultry  
 Other (Please specify): \_\_\_\_\_

3. Please indicate the number of livestock that you have raised each year over the last 3 years ON AVERAGE.

\_\_\_\_\_ Cattle \_\_\_\_\_ Domestic Pigs \_\_\_\_\_ Sheep/Goats  
 \_\_\_\_\_ Poultry \_\_\_\_\_ Honey Bees \_\_\_\_\_ Aquaculture  
 \_\_\_\_\_ Other (Please specify): \_\_\_\_\_

4. Over the last 3 years ON AVERAGE, how much revenue did you earn from the sale or production of all livestock each year? \$ \_\_\_\_\_

5. How many times in the last 12 months have feral swine been seen in areas where livestock are kept? \_\_\_\_\_ times

5.A. About how many feral swine (on average) did you see on these occasions? \_\_\_\_\_ pigs

6. In the last 12 months, is there any evidence that feral swine have entered or gained access to...  
 housing for livestock (e.g., barns, pens)  Yes  No  
 stored animal feed (e.g., hay, grain)  Yes  No

7. Over the last 3 years have you ever lost any livestock because of feral swine?

Yes (Please continue with Question 7A)  
 No (Please skip to Section 4, Page 3)

7A. Fill out the following table based on an annual average over the last 3 years:

Livestock type	Number lost to feral swine	Feral swine-related cause (circle all that apply)	Market value of animals lost to feral swine (approximate)
Cattle	_____	Disease <input type="checkbox"/> Attack <input type="checkbox"/> Other <input type="checkbox"/>	\$ _____
Domestic Pigs	_____	Disease <input type="checkbox"/> Attack <input type="checkbox"/> Other <input type="checkbox"/>	\$ _____
Sheep/Goats	_____	Disease <input type="checkbox"/> Attack <input type="checkbox"/> Other <input type="checkbox"/>	\$ _____

Poultry	_____	Disease	Attack	\$ _____
		Other		
Other (Please indicate):	_____	Disease	Attack	\$ _____
		Other		

8. If any of your livestock was lost due to feral swine-related disease(s), who typically made the diagnosis?

\_\_\_\_\_ Myself    \_\_\_\_\_ Farm Manager    \_\_\_\_\_ Biologist    \_\_\_\_\_ Veterinarian    \_\_\_\_\_  
 Other (specify): \_\_\_\_\_

9. How knowledgeable are you regarding the potential spread of diseases from feral swine to livestock?

\_\_\_\_\_ Very knowledgeable    \_\_\_\_\_ Somewhat knowledgeable    \_\_\_\_\_ Not knowledgeable

**Section 4. Property.** Please answer the following questions regarding this property.

1. Did you experience property damage from feral swine in the last 3 years?

\_\_\_\_\_ Yes    (please continue with Question 1A)  
 \_\_\_\_\_ No    (please skip to Section 5, Page 4)

1A. Fill out the following table based on the last 3 years.

Check the type(s) of damage that have occurred during the last 3 years		Rate the severity of the damage(s) (Circle one number for each)				What is your estimate of repair cost (even if unrepaired)
		Not a problem	Moderate problem	Severe Problem	Unsure	
_____	Damage to non-residential buildings	0	2	3	4	\$ _____
_____	Damage to fencing	0	2	3	4	\$ _____
_____	Damage to livestock waterers, water pumps, irrigation equipment	0	2	3	4	\$ _____
_____	Damage to residential property	0	2	3	4	\$ _____
_____	Damage to terraces, stream banks, or ponds	0	2	3	4	\$ _____
_____	Other (Please indicate): _____	0	2	3	4	\$ _____
_____	Loss of wildlife habitat	0	2	3	4	
_____	Soil erosion	0	2	3	4	

_____	Loss of trees	0	2	3	4	
_____	Reduced water quality	0	2	3	4	

**Section 5. Control Efforts.** Please answer the following questions regarding pig-control efforts on this property.

1. Have you or others working on your farm ever taken actions to **reduce** or **prevent** damage from feral swine on this property?

- Yes (Please continue with Question 1A)  
 No (Please skip to Question 2)

1A. If yes, please check which actions you took and circle how effective that action was.

Action s taken	Actions to reduce pigs damage	Not at all effective			Extremel y effective	
		1	2	3	4	5
_____	Shoot on sight	1	2	3	4	5
_____	Hunting without dogs	1	2	3	4	5
_____	Hunting with dogs	1	2	3	4	5
_____	Aerial hunting	1	2	3	4	5
_____	Trapping	1	2	3	4	5
_____	Electric fencing	1	2	3	4	5
_____	Non-electric fencing	1	2	3	4	5
_____	Repellants	1	2	3	4	5
_____	Other (Please indicate): _____	1	2	3	4	5

1B. If you have ever installed **non-electric** fencing specifically for feral swine:

What was the approximate installation cost of this fencing? \$ \_\_\_\_\_

From the time of installation, how long do you expect this fencing to last? \_\_\_\_\_  
years

1C. If you have ever installed **electric** fencing specifically for feral swine:

What was the approximate installation cost of this fencing? \$ \_\_\_\_\_

From the time of installation, how long do you expect this fencing to last? \_\_\_\_\_  
years

1D. Over the last 3 years ON AVERAGE, about how much (including labor) did it cost to control feral swine with each of the following annually?

Hunting without dogs	\$ _____ ____ N/A	Trapping	\$ _____ ____ N/A
Hunting with dogs	\$ _____ ____ N/A	Shoot on sight	\$ _____ ____ N/A
Aerial hunting	\$ _____ ____ N/A	Repellants	\$ _____ ____ N/A
Other (Please indicate): _____ \$ _____			

2. If you have experienced damage in the last 3 years, did you seek help from a county, state, or federal agency because of this damage?

- \_\_\_\_ Yes (Please continue with Question 2a)  
 \_\_\_\_ No (Please skip to Question 3)

2A. If yes, please check which agency(ies) you sought help from (*Check all that apply*) and your satisfaction with their response (*Circle one number for each*).

Agencies Contacted	Agencies	Unsatisfie d	Somewhat Unsatisfie d	Neutra l	Somewha t Satisfied	Satisfie d
_____	University extension	1	2	3	4	5
_____	County extension	1	2	3	4	5
_____	State wildlife agency	1	2	3	4	5
_____	State agriculture agency	1	2	3	4	5
_____	USDA Wildlife Services	1	2	3	4	5
_____	Other federal wildlife agency	1	2	3	4	5
_____	Other: _____ _____	1	2	3	4	5

3. During the last 3 years,

3A. About how many feral swine have been **killed** on your property? (If none please write 0).  
 \_\_\_\_\_pigs

3B. About how many **live** feral swine have been removed from your property? (If none please write 0). \_\_\_\_\_pigs

3C. Have you sold any live feral swine removed from your land? \_\_\_\_\_ Yes \_\_\_\_\_  
 No

3D. If yes, about what price did you receive per head? \$ \_\_\_\_\_

4. How has each of the following affected feral swine **populations** on your property? (*Circle one number for each*)

Events	Substantiall y Decreased	Decrease d	No Change	Increased	Substantiall y Increased	Don't Know
Hunting of feral swine	1	2	3	4	5	88
Neighbor's agriculture practices	1	2	3	4	5	88
Trapping of feral swine	1	2	3	4	5	88
Predators	1	2	3	4	5	88
Pigs wandering from adjacent lands	1	2	3	4	5	88
Pigs wandering to adjacent lands	1	2	3	4	5	88
State regulations prohibiting...						
...Feral swine hunting	1	2	3	4	5	88
...Transport of wild pigs	1	2	3	4	5	88
USDA Wildlife Services actions	1	2	3	4	5	88
Other Federal Government actions	1	2	3	4	5	88

5. Over the last 3 years, has the feral swine population increased or decreased in the county where most of your farming or ranching occurred? (Check one) \_\_\_\_\_ Increased \_\_\_\_\_ Decreased \_\_\_\_\_ Stayed the same \_\_\_\_\_ Don't Know

**Section 6. Hunting.** Please answer the following questions related to hunting on this property

1. Do you or anyone else hunt on the property you farm or ranch?

\_\_\_\_\_ Yes (Please continue with 1A)

\_\_\_\_\_ No (Please skip to Section 7, Page 6)

1A. Please answer the following questions based on the last 3 years. (Check as many boxes as necessary)

	Feral swine	Deer	Upland Birds	Feral Sheep/Goat	Turkey	Other
Which (if any) do you or your immediate family hunt?	<input type="checkbox"/>					
Which (if any) has anyone else been allowed to hunt these without paying?	<input type="checkbox"/>					
For which (if any) do you lease or rent your land and/or hunting rights?	<input type="checkbox"/>					
For which (if any) have you provided a guide or outfitting service to paying hunters?	<input type="checkbox"/>					
Which, if any, have experienced a decline in population that you would attribute to feral swine?		<input type="checkbox"/>				

2. What was your approximate annual net income related to feral swine hunting (over the last 3 years ON AVERAGE)? If none, please write 0. \$ \_\_\_\_\_

3. What was your approximate annual net income from all hunting activities (over the last 3 years ON AVERAGE)? If none, please write 0. \$ \_\_\_\_\_

**Section 7. Opinion.** Please answer the following questions about feral swine

1. Please choose one of the statements below that best describes your opinion:

I have some feral swine on my land, and I wouldn't change how many. \_\_\_\_\_ (go to **1A** below)

I have some feral swine on my land, but would prefer to have more \_\_\_\_\_ (go to **1A** below)

I have some feral swine on my land, but would prefer to have fewer. \_\_\_\_\_ (go to **1B** below)

I have some feral swine on my land, but would prefer to have none. \_\_\_\_\_ (go to **1B** below)

I don't have feral swine on my land, and I would prefer to keep it that way. \_\_\_\_\_ (go to **1C** below)

I don't have feral swine on my land, but would prefer to have them. \_\_\_\_\_ (go to **1D** below)

Please answer **only one** of the following questions based on your response above.

**1A.** What is the minimum you would have to be paid per acre to allow permanent eradication of feral swine from ALL of your land? (Check **ONE** dollar amount below)

**1B.** If eradication costs were spread across all farmers in your region, what is the most you would pay to guarantee permanent eradication of feral swine from your land? (Check **ONE** dollar amount below)

**1C.** What would be the most you would pay to guarantee that feral swine never spread to your land? (Check **ONE** dollar amount below)

**1D.** What is the minimum you would have to be paid per acre to never have feral swine on your land? (Check **ONE** dollar amount below)

- |                         |                         |                         |                           |
|-------------------------|-------------------------|-------------------------|---------------------------|
| ___ \$0                 | ___ \$5/acre per year   | ___ \$10/acre per year  | ___ \$15/acre per year    |
| ___ \$20/acre per year  | ___ \$25/acre per year  | ___ \$50/acre per year  | ___ \$75/acre per year    |
| ___ \$100/acre per year | ___ \$200/acre per year | ___ \$500/acre per year | ___ \$1,000/acre per year |

2. State how much you disagree or agree with the following statements about feral swine by circling the number that matches your response.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Feral swine are a nuisance.	1	2	3	4	5
Feral swine should be eliminated wherever possible.	1	2	3	4	5
Feral swine might cause damage to my property.	1	2	3	4	5
Feral swine are a threat to the safety of people.	1	2	3	4	5
Feral swine destroy native wildlife.	1	2	3	4	5
Problems related to feral swine are exaggerated.	1	2	3	4	5
I am concerned that feral swine are a source of disease to livestock.	1	2	3	4	5

I am concerned that feral swine will be a source of disease to people.	1	2	3	4	5
It is important to me that feral swine exist.	1	2	3	4	5
Feral swine harm wildlife habitat.	1	2	3	4	5
Feral swine impact song bird populations.	1	2	3	4	5

3. Please state how much you disagree or agree with each of the following statements by circling the number that matches your response...

I feel that...	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Hunting feral swine without dogs is ethical	1	2	3	4	5	6	7
Hunting feral swine with dogs is ethical	1	2	3	4	5	6	7
Sharpshooting feral swine from a helicopter is ethical	1	2	3	4	5	6	7
Trapping and removing feral swine is ethical	1	2	3	4	5	6	7
If a legal poison became available for feral swine that caused minimal suffering and little harm to other wildlife, it would be ethical to use	1	2	3	4	5	6	7

4. In general do you think of feral swine as...

(For each set of words please circle the number that best represents your response).

	Extremely	Moderately	Slightly	Neutral	Slightly	Moderately	Extremely	
Bad	1	2	3	4	5	6	7	Good

Harmful	1	2	3	4	5	6	7	Beneficial
Negative	1	2	3	4	5	6	7	Positive
Vicious	1	2	3	4	5	6	7	Gentle
Dirty	1	2	3	4	5	6	7	Clean

5. Please state how much you disagree or agree with each of the following statements by circling the number that matches your response..

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
Humans should manage fish and wildlife populations so that humans benefit.	1	2	3	4	5	6	7
We should strive for a world where humans and fish and wildlife can live side by side without fear.	1	2	3	4	5	6	7
We should strive for a world where there is an abundance of fish and wildlife for hunting and fishing.	1	2	3	4	5	6	7
I care about animals as much as I do other people.	1	2	3	4	5	6	7
The needs of humans should take priority over fish and	1	2	3	4	5	6	7

wildlife protection.							
I view all living things as part of one big family.	1	2	3	4	5	6	7
Hunting is cruel and inhumane to the animals.	1	2	3	4	5	6	7
It would be more rewarding to me to help animals rather than people.	1	2	3	4	5	6	7
It is acceptable for people to kill wildlife if they think it poses a threat to their life.	1	2	3	4	5	6	7
Animals should have rights similar to the rights of humans.	1	2	3	4	5	6	7
Hunting does not respect the lives of animals.	1	2	3	4	5	6	7
I take great comfort in the relationships I have with animals.	1	2	3	4	5	6	7
It is acceptable for people to kill wildlife if they think it poses a threat to their property.	1	2	3	4	5	6	7
Wildlife are like my family and I	1	2	3	4	5	6	7

want to protect them.							
People who want to hunt should be provided the opportunity to do so.	1	2	3	4	5	6	7
I feel a strong emotional bond with animals.	1	2	3	4	5	6	7
It is acceptable to use fish and wildlife in research even if it may harm or kill some animals.	1	2	3	4	5	6	7
I value the sense of companionship I receive from animals.	1	2	3	4	5	6	7
Fish and wildlife are on earth primarily for people to use.	1	2	3	4	5	6	7

**Section 8. Demographic Information.** The following questions are important to help us understand more about the people involved in farming and ranching across the United States. All responses are kept confidential.

1. What is your age? \_\_\_\_\_ years old
2. What is your gender? \_\_\_\_\_ Male \_\_\_\_\_ Female
3. Which of the following best describes you? *(Check one)*
  - \_\_\_\_ Full-time farmer/rancher, landowner
  - \_\_\_\_ Full-time farmer/rancher, NON-landowner
  - \_\_\_\_ Part-time farmer/rancher, landowner
  - \_\_\_\_ Part-time farmer/rancher, NON-landowner

- Farm/ranch manager
- Landowner living ON farm and NO agricultural production occurs on land
- Landowner living ON the farm but LEASING to someone else who farms/ranches
- Landowner living OFF farm and NO agricultural production occurs on land
- Landowner living OFF the farm but LEASING to someone else who farms/ranches
- I do not farm/ranch

3A. About how long do you plan to continue this role? \_\_\_\_\_years

4. About how long have you been involved in agricultural production? \_\_\_\_\_years

5. If you own the land you farm, do you plan to pass the farm on to a family member?  
 Yes     No

6. Which of the following best describes who in your household makes decisions about farming/ranching:

- You make most or all of the decisions
- Someone else makes most or all of the decisions (specify): \_\_\_\_\_
- You and someone else share decision making roughly equally

7. What is your approximate annual household income before taxes? (*Check one*)

- |   |   |   |
|---|---|---|
| <input type="checkbox"/> Less than \$10,000   | <input type="checkbox"/> \$75,000 to \$99,999   | <input type="checkbox"/> \$175,000 to \$199,999 |
| <input type="checkbox"/> \$10,000 to \$24,999 | <input type="checkbox"/> \$100,000 to \$124,999 | <input type="checkbox"/> \$200,000 to \$224,999 |
| <input type="checkbox"/> \$25,000 to \$49,999 | <input type="checkbox"/> \$125,000 to \$149,999 | <input type="checkbox"/> \$225,000 to \$249,999 |
| <input type="checkbox"/> \$50,000 to \$74,999 | <input type="checkbox"/> \$150,000 to \$174,999 | <input type="checkbox"/> \$250,000 and higher   |

8. Approximately what percent of your household income is derived from farming and ranching?  
 0%       1-25%       26-50%       51-75%       100%

COMMENTS