THESIS

FACTORS PREDICTING ACCEPTABILITY OF TOXICANT USAGE TO CONTROL FERAL SWINE

Submitted by

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ABSTRACT

FACTORS PREDICTING ACCEPTABILITY OF TOXICANT USAGE TO CONTROL FERAL SWINE

The population increase and spread of feral swine across the United States is of increasing concern to producers, land managers, the common public, and government. Feral swine carry harmful diseases, cause extensive damage to property, and are opportunistic omnivores that will eat anything. This study explores how mass media coverage and aspects of the cognitive hierarchy influence the specific lethal management action of a toxicant usage to control feral swine. A content media analysis was conducted to observe how the media portrays the toxicant Kaput across different time periods and news platforms. Statistical analysis revealed that a little over half of the articles were published following four major events which included, a) approval of 'Kaput' as a state-limited-use pesticide in Texas, b) restraining order against the use of 'Kaput', c) the passing of a bill requiring strict scientific study of any further toxicant before release in Texas, and d) the withdrawal of 'Kaput' in the state of Texas. An additional analysis revealed the most discussed themes within the articles including, a) the use of a toxicant as a management tool to control feral swine, b) the mention of the toxicant containing a Warfarin base, and c) challenges regarding the toxicant as being species-specific. The majority of these articles were either negative or neutral, mostly describing the toxicant and then explaining the faults in its use. This resulted in the toxicant being pulled off of the market. In addition to the content media analysis, a wildlife survey was mailed out to 200 urban residents and 200 rural residents from each of the 50 United States to measure individuals' wildlife value orientations, general beliefs toward feral swine, and their support or opposition of the use of poison to kill feral swine. The overall response rate was 11%. Statistical analysis revealed that negative attitudes toward feral swine and a domination wildlife value orientation were key identifiers of support for a toxicant lethal management action of feral

swine ($p < .05$). The opposite was determined with a non-significant value for a mutualism value orientation, opposing the use of a toxicant. As wildlife managers and government agencies continue efforts to mitigate damages and manage feral swine, the value orientations and attitudes of the public should be taken into consideration. The lethal management action chosen should reflect the public's value orientations and attitudes to have an accepted management technique suitable to control feral swine as well as support the public.

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CHAPTER 1

Content media analysis of feral swine and the toxicant Kaput

Introduction

Feral Swine

Feral Swine (*Sus scrofa*) are known by many names, some including wild boar, wild hogs, and wild pigs, are considered an invasive nuisance species (Keiter et al., 2016 ; Ditchkoff & West, 2007). Free ranging domestic pigs were originally introduced to the United States by Spanish explorers in the early 1500s (Bates, 2017; Castañeda, 1907). Feral swine were once largely confined to the southern United States, but the populations have spread up to more than 42 states in recent years (Mouton, 2009). However, after significant management efforts to reduce populations, feral swine are now present in less than 35 states (Corn & Jordan, 2017).

The spread of feral swine is attributed to their ability to adapt to many environments, lack of predators, and high fecundity (Bates, 2017; Mayer & Brisbin, 2009; Taylor & Hellgren, 1997). When feral swine are introduced into a new environment, they compete with native wildlife for food sources as well as consume native wildlife (Li et al., 2010; Timmons et al., 2011; Yarrow & Kroll, 1989). Feral swine are highly dependent on plant based crops (Schley & Roper, 2003), however, as opportunistic omnivores, feral swine will forage for any available food source, including ground nesting birds, reptiles, amphibians, small mammals, and offspring of large mammals (Frederick, 1998; Mayer 2009; Mayer, 2017; Schley & Roper, 2003; Taylor & Hellgren, 1997; Timmons et al., 2011). In addition to feral swine impacts on wildlife, they also cause damage that degrades water quality, creates soil erosion, and damages agriculture (Bengsen et al., 2014; Taylor & Hellgren, 1997; Wood & Lynn, 1977). Feral swine

also carry diseases that are harmful to humans, pets, wildlife, and livestock (Bengsen et al., 2014; Henderson, 2009). Feral swine are most detrimental to farmers due to the high sources of protein and extensive food availability that the farms contain (Schley et al., 2008). The destruction caused by feral swine has the potential to effect public's livelihood and health which creates a need for feral swine management control.

Management Tactics

There are numerous management techniques available to reduce damage caused by feral swine including: aerial shooting, baiting and shooting, hunting with dogs, sport-hunting, trapping, snaring, physical exclusion, habitat manipulation, fertility control, and toxicant (Bengsen et al., 2014; Campbell et al., 2010; Choquenot et al., 1993; Coblentz & Baber, 1987; Mayer & Brisbin, 2009). Studies have indicated that, to prevent existing populations of feral swine from increasing, 70% of the feral swine population has to be eliminated every year (Bevins et al., 2014; Dzieciolowski et al., 1992; Mayer, 2009). To achieve this population reduction, a combination of management techniques must be implemented; which includes a feral swine toxicant (Bengsen et al., 2014; Campbell & Donlan, 2005; Campbell & Long, 2009; Jay & Wiscomb, 2008).

For wildlife managers, the use of an oral toxicant is often the most effective means to reduce large populations of feral swine on the landscape in a short amount of time (Cowled et al., 2008; McIlroy & Saillard, 1989; Mitchell, 2008). Kaput, the only oral toxicant approved by EPA for feral swine control, contains the anticoagulant warfarin. Although warfarin has been used as the active ingredient in rodent baits for decades, significant testing of the efficacy and specificity of the compound for feral swine was required for registration (US EPA, 2017). Feral swine are more susceptible to warfarin than other rodents and wildlife (Hone & Kleba, 1984; O'Brien et al., 1987), allowing the concentration in Kaput baits to be one-fifth that found in rodent baits.

Regardless of the high susceptibility, there is controversy over whether the toxicant could potentially harm other wildlife or humans if they come into contact with it or if hunters were to consume a contaminated feral swine. Concern is high because studies have shown that consumption in mass quantities continuously over several days may have a lethal effect on other species of wildlife as well as the species the toxicant is intended for (McIlroy et al., 1989; US EPA, 2017; WS USDA APHIS, 2018). The news media covers studies and informs the public of a variety of projects, including the toxicant, further influencing the concern of the toxicant.

News Media Coverage

Media impacts how individuals think and talk about particular subjects by framing. Framing is the process used by the media to emphasize a particular aspect of a story (Entman, 1993).There are two types of frames that influence public perception of events: episodic and thematic events. Episodic events tend to be more case-study oriented, focusing on specific events in an issue, while thematic events tend to be more big-picture syntheses that focuses on long-term trends of issues (Iyengar, 1991). An example of an episodic event would be that a man was attacked by feral swine in the woods, while a thematic event would be the issue of feral swine attacks in general, not a specific attack. How the news is framed can affect public understanding of a specific issue (Jacobson et al., 2012). News coverage tends to be more episodic rather than thematic (Iyengar, 1991) so individuals tend to be more interested in the topic at hand.

The media utilizes more current and negative news stories to influence public opinion on what is believed to be important (Stocking & Leonard, 1990; Wimmer & Dominick, 2003). Since the media is primarily framed with negative stories, the public opinion on issues are more negative. Media coverage affects individuals' perceptions and attitudes toward an issue by providing persuasive information, therefore informing researchers of public attitudes toward wildlife issues based on how stories are

portrayed or framed (Ader, 1955; Gans, 2004; Katz & Lazarsfel, 1955; Kepplinger & Roth, 1979; Parlour & Schatzow, 1978; Weaver et al., 2004; Wilson, 1995). When asked about an issue that has been reported, the majority of individuals will recite the coverage of the news story, and imply that the findings are their own beliefs about the issue (Tambor et al., 2002). In this case, when news articles are framed negatively toward the use of 'Kaput', this generates a negative public attitude toward the use of the toxin (Yalden, 1986).

How the news is framed along with the types of sources that are quoted in news stories may influence public perceptions of issues that lead to a specific interpretation (Jacobson et al., 2012). Public attitude toward a subject may be persuaded by sources including politicians, conservation groups, state and federal wildlife agencies, government, special-interest groups, professionals, scientists, farmers, etc. (Corbett, 1995; Muter et al., 2013). Scientists are considered reliable and trustworthy sources for information, especially about topics regarding conservation or invasive species (Fazio et al., 2001). In addition to reporting sources, the closer in proximity an individual is to the location described in a news story, the more enticing the story will be to the individual (Corbett, 1995; Gore et al., 2009; Kleiven et al., 2004).

Few studies have been conducted on media coverage focused on feral swine and the use of different management techniques, however, such studies may increase wildlife management's understanding of public opinions, attitudes, and tolerance of management interventions, as well as provide guidance for future management techniques (Decker et al., 2001; Gore et al., 2009; Wolch et al., 1997). Understanding the current media coverage and ensuring positive media coverage on a specific subject is pertinent for wildlife managers to create a successful and accepted management plan, as well as gain public support on the issue (Jacobson et al., 2012). If the public is against an issue, the management plan may not work. Researchers understand the importance of studying public approval of

management techniques before they are initiated to ensure long-term success (Donnelly & Vaske, 1995; Li et al., 2010).

Study Purpose and Objectives

The purpose of this paper is to summarize how the media portrays the toxicant Kaput across different time periods and news platforms. The target population for this study was mass media coverage or stories about the toxicant 'Kaput'. The research objectives were to a) determine the presence of the toxin in the media prior to the release of Kaput and compare it to media coverage after the release of Kaput to see the timing differences in attitudes or news coverage of toxicants, b) analyze the whole United States to determine a wide distribution of media content on Feral Swine and the toxicant Kaput, and c) determine how the media portrays the toxicant and what that may look like in future news releases.

Methods

This study constitutes descriptive content analysis that focused on feral swine and the toxicant 'Kaput' in US media outlets. The entire United States distribution of media content on Feral Swine and the toxicant 'Kaput' were examined to determine how the media portrayed the toxicant and how future news releases may portray a toxicant.

Data Collection

The content analysis was completed primarily using the search engine Meltwater and secondarily NewsBank to examine articles that were released between July 2016 and July 2017. In order to gauge public attitude toward toxicant, articles were analyzed six months prior to the release and six months after the release of the toxicant. "Meltwater uses web crawlers to search and archive these web outlets to create a searchable database…much like Google News" (Herman, 2015, p. 206-207). The

search string used was '((feral OR wild) NEAR (hog* OR pig* OR swine OR boar) NOT pigeon) NEAR (toxicant OR poison OR kaput OR hoggone OR warfarin)'. Articles that contained one term for feral swine and one term for toxicant in the headline or within the lede (i.e., the opening sentence or paragraph (Merriam-Webster, 2017)) of the article were retained for analysis, and those that did not were excluded. In order for the articles to be retained, they must have a clear focus on feral swine, on the toxicant, and state a clear link to the release of the toxicant within the title and/or lede.

Data Analysis

Within the content analysis, both newspaper and magazine articles were examined, on and off-line, because research has shown that people get most of their news from these mass-media sources (NSF, 2004; Project for Excellence in Journalism, 2006). The search command was designed to include as many target stories as possible, while excluding articles that did not concern feral swine or a toxicant (e.g., stories about wrestling or that use the word Kaput, etc.). The original search yielded 267 articles. While analyzing the content, 78 additional articles were excluded due to lack of primary information, access to the article, or non-relevant information, leaving a remainder of 189 articles. In preparation of analysis, two researchers completed a one-hour training session to review and agree upon source materials that were broken down into three categories (i.e. feral swine destruction, toxicant destruction/concern, and management concerns) and further broken down into 45 variables of classified areas of interest/themes (Table 1.1). After themes were determined, Google's random number generator was used to obtain 15% (29) of randomly sampled articles and pulled them to analyze and obtain inter-coder reliability (Krippendorff, 2004; Lombard et al., 2002). Table 1.1 presents an example of a select few variables of interest used to analyze articles.

Table 1.1 A select few variables of interest/themes used to analyze articles

Theme Name	Code	Definition/Description	Keywords
attToxicant	1 'positive' 0 'negative' 2 'neutral'	Positive (accepting of toxicant, useful, etc.); Negative (backlash, lawsuit, etc.); Neutral (informative)	Accepting, backlash, lawsuit, useful, destructive, tool, etc.
toxThreatWildCarc	1 'yes' 0 'no'	Threat to pets and wildlife from ingesting dead carcass who consumed toxicant	Secondary poison, food chain, death, extinction, harm, etc.
manToolControl	1 'yes' 0 'no'	Control methods for feral swine other than toxins	Aerial gunning, trapping, corralling, etc.
toxSpecies	1 'yes' 0 'no'	Challenges regarding the toxin as being species specific (supposed to be or company is claiming it is)	Species specific toxin, bears, coyotes, wildlife, death, contamination, pets, etc.
destFS	1 'yes' 0 'no'	General destruction from feral swine, not specific	Property damage, destruction, etc.

Each researcher independently read the same 15% (29) of randomly sampled articles and compared coding results of interpretation (Riffe et al., 2005). After a three hour discussion of comparison, researchers determined further keywords for themes. This discussion led to a test for inter-coder reliability by comparing the number of differences in the themes we had chosen and analyzed. Out of 1,305 different choices for 45 themes with 29 articles, there was 32 differences, resulting in an inter-coder reliability of .976. After obtaining an acceptable reliability of .80 or greater (Krippendorff, 2004; Lombard et al., 2002; Neuendorf, 2002), Google's random number generator was used to equally divide the remaining articles to code and analyze, providing a remainder of 80 articles each. Two additional articles were deemed unfit for analysis based on inability to access full articles. Results of analysis were recorded into a Microsoft Excel spreadsheet to store all of the meta-data derived from the relevant studies. After reading the remainder of the articles, analyses were combined and results were calculated using SPSS.

Results

Number of articles released after major events

From July 2016 to July 2017, 187 articles were analyzed and determined to be relevant. Of the 187 articles, 46% (86) portrayed a negative attitude toward the toxicant, 15.5% (29) exhibited a positive attitude toward the toxicant, and 38.5% (72) were neutral (Table 1.2). These results are shown in Table 1.2. For the sake of clarity the articles will be referred to as negative, positive, and neutral, based on their determined attitude toward the toxicant. Even though the media analysis was conducted for a full year, the first article found and analyzed was published February 10th, 2017. In completing the media analysis, the majority of the media coverage that was published occurred within five days following a major event (Figure 1.1). The four major events pertaining to this study were the approval of 'Kaput' as a state-limited-use pesticide in Texas (February 21st, 2017), the restraining order against the use of 'Kaput' (March 2nd, 2017), the passing of a bill requiring strict scientific study of any further toxicant before release in Texas (April 18th, 2017), and the withdrawal of 'Kaput' in the state of Texas (April 24th, 2017).

Table 1.2. Attitude on Toxicant versus each theme analyzed in the articles

Theme Name	Description	Negative % (n)	Positive % (n)	Neutral % (n)	Total % (n)
fsthreatDisHum	Threat to human safety from FS by spreading disease	2.3 (2)	34.5 (10)	5.6 (4)	8.6 (16)
fsthreatAttackHum	Threat to human safety from FS by attacks	5.8 (5)	20.7 (6)	8.3 (6)	9.1 (17)
fsthreatLivDis	Threat to livestock from FS by spreading disease	3.5 (3)	27.6 (8)	4.2 (3)	7.5 (14)
fsthreatLivAttack	Threat to livestock from FS attacks	9.3 (8)	31 (9)	8.3 (6)	12.3 (23)
fsthreatWildDis	Threat to wildlife from FS by spreading disease	1.2 (1)	24.1 (7)	1.4 (1)	4.8 (9)
fsthreatWildAttack	Threat to wildlife from FS attacks	5.8 (5)	34.5 (10)	6.9 (5)	10.7 (20)
toxThreatCons	Threat to human safety from toxicant by consumption or ingesting it	8.1 (7)	0 (0)	0 (0)	3.7 (7)

toxThreatKids	Threat to children from ingesting toxicant	2.3 (2)	0 (0)	0 (0)	1.1 (2)
toxThreatLiv	Threat to livestock from ingesting toxicant	34.9 (30)	13.8 (4)	13.9 (10)	23.5 (44)
toxThreatWildCons	Threat to pets and wildlife from ingesting toxicant	64 (55)	41.4 (12)	30.6 (22)	47.6 (89)
toxThreatWildCarc	Threat to pets and wildlife from ingesting carcass who consumed toxicant	57 (49)	48.3 (14)	31.9 (23)	46 (86)
toxThreatBears	Threat to black bears from toxicant	14 (12)	13.8 (4)	13.9 (10)	13.9 (26)
toxThreatFish	Threat to fish from toxicant	3.5 (3)	6.9 (2)	8.3 (6)	5.9 (11)
destPPNonAg	Destruction of personal non-agricultural property from FS	23.3 (20)	58.6 (17)	36.1 (26)	33.7 (63)
destAg	Destruction of agricultural property from FS	41.9 (36)	82.8 (24)	50 (36)	51.3 (96)
destEnvNonAg	Destruction of non-agricultural environment from FS	27.9 (24)	55.2 (16)	26.4 (19)	31.6 (59)
fsEconDam	Economic damages caused by FS	39.5 (34)	79.3 (23)	44.4 (32)	47.6 (89)
manToolTox	Toxin used as a management tool to control FS	95.3 (82)	100 (29)	94.4 (68)	95.7 (179)
manToolNotox	First time use of toxin as a tool to control FS	8.1 (7)	31 (9)	15.3 (11)	14.4 (27)
manToolControl	Control methods for FS other than toxins	46.5 (40)	48.3 (14)	45.8 (33)	46.5 (87)
addTool	Recognition for an additional tool to control FS (excluding hunting, trapping, and poison)	31.4 (27)	31 (9)	23.6 (17)	28.3 (53)
Epa	Toxin was approved by the EPA	26.7 (23)	58.6 (17)	36.1 (26)	35.3 (66)
toxTest	Talk about whether the toxin went through required testing or not	19.8 (17)	48.3 (14)	18.1 (13)	23.2 (44)
toxTestCorrect	Article reporting correct information about required testing	10.5 (9)	44.8 (13)	16.7 (12)	18.2 (34)
toxUse	Use of the toxin	15.1 (13)	27.6 (8)	16.7 (12)	17.6 (33)
toxWater	Worry of toxin contaminating the water source	17.4 (15)	10.3 (3)	11.1 (8)	13.9 (26)
toxWarfarin	Talk about the toxin being Warfarin based	84.9 (73)	82.8 (24)	84.7 (61)	84.5 (158)
toxCompare	Comparison to another toxin	8.1 (7)	6.9 (2)	5.6 (4)	7 (13)
toxHowto	How to use the toxin, label requirements	43 (37)	69 (20)	33.3 (24)	43.3 (81)

toxSigns	Signs of consumption/effects of toxin on FS	37.2 (32)	48.3 (14)	25 (18)	34.2 (64)
toxCase	What to do in case of toxin consumption; human or animal	1.2 (1)	3.4 (1)	2.8 (2)	2.1 (4)
meatCons	Concerns with pig meat consumption after pig consumed toxin	61.6 (53)	44.8 (13)	37.5 (27)	49.7 (93)
Revenue	Could hurt the revenue of hunters or food processors, etc.	22.1 (19)	10.3 (3)	13.9 (10)	17.1 (32)
toxSpecies	Challenges regarding the toxin as species specific	74.4 (64)	51.7 (15)	48.6 (35)	61 (114)
toxDelivery	Challenges regarding the toxins specific delivery system	37.2 (32)	20.7 (6)	26.4 (19)	30.5 (57)
toxTime	How long does it take the pig to die after toxin consumption	20.9 (18)	13.8 (4)	16.7 (12)	18.2 (34)
toxThinner	How the toxin works with blood thinning	51.2 (44)	75.9 (22)	55.6 (40)	56.7 (106)
toxDosagePigs	Certain dosage needed to kill pigs	9.3 (8)	34.5 (10)	12.5 (9)	14.4 (27)
toxDosageOthers	Certain dosage needed to kill pigs compared to other animals or humans	7 (6)	41.4 (12)	16.7 (12)	16 (30)
Other	Anything else important that is not mentioned in the previous themes	11.6 (10)	3.4 (1)	5.6 (4)	8 (15)
Gendisease	General disease of FS	10.5 (9)	27.6 (8)	9.7 (7)	12.8 (24)
destFS	General destruction caused by FS	40.7 (35)	79.3 (23)	50 (36)	50.3 (94)
fsReproRate	Feral swine reproduction rate, number of litters, etc.	25.6 (22)	44.8 (13)	20.8 (15)	26.7 (50)

Figure 1.1. Media coverage of number of articles published following major events

Table 1.3 presents the percentages of attitudes toward the toxicant of media coverage following the four major events described. After the first event, the approval of the use of the toxicant, there were 42 articles published within the following five days. Of those articles, 35.7% (15) were negative, 23.8% (10) were positive, and 40.5% (17) were neutral. After the second event, the issuance of the restraining order, 18 articles were published within the following five days, and of those articles, 44.4% (8) were negative, 11.2% (2) were positive, and 44.4% (8) were neutral. After the third event, the passage of the bill, 16 articles were published within five days following this event. Of those articles, 68.8% (11) were negative, 0% (0) were positive, and 31.2% (5) were neutral. Finally, within five days following the fourth event, the withdrawal of 'Kaput' in Texas, 19 articles were published, and of those articles, 36.8% (7) were negative, 21.1% (4) were positive, and 42.1% (8) were neutral. Within five days following the four major events, 50.8% (95) of the articles were published indicating high publication rates following major events.

Table 1.3. Percentages of attitudes toward the toxicant of media coverage following four major events.

Event	Date Range	Negative % (n)	Positive % (n)	Neutral % (n)
Approval of Kaput	Feb. 21st – Feb. 25th	35.7 (15)	23.8 (10)	40.5 (17)
Restraining Order	March 2nd – March 6th	44.4 (8)	11.2 (2)	44.4 (8)
Bill Passed	April 18th – April 22nd	68.8 (11)	0 (0)	31.2 (5)
Withdrawal of Kaput use in TX	April 24th – April 28th	36.8 (7)	21.1 (4)	42.1 (8)

Most discussed themes

Out of all of the articles, there were three themes discussed most frequently (Table 1.4). The first of which, discussed in 95.7% (179) of the articles, was the use of a toxicant as a management tool to control feral swine. The second theme discussed in 84.5% (158) of the articles was the mention of the toxicant being Warfarin based, and the third theme discussed in 61% (114) of the articles was the challenges regarding the toxicant as being species-specific.

Listing from the first to third most frequently discussed theme, the following percentages of negative articles discussed each variable: 95.3% (82), 84.9% (73), and 74.4% (64), respectively. Within the positive articles, the following percentages discussed each theme: 100% (29), 82.8% (24), and 51.7% (15), respectively. Within the neutral articles the following percentages discussed each theme: 94.4% (68), 84.7% (61), and 48.6% (35), respectively. The three highly discussed themes, acknowledgment of the toxicant as a management tool, understanding the toxicant as warfarin-based, and acknowledgement that there may be challenges regarding the toxicant as being species-specific, are among high negativity and controversy, determining high publicity for news media.

Table 1.4. Percentages of the three themes most frequently discussed in the articles.

Themes	Negative % (n)	Positive % (n)	Neutral % (n)	Total % (n)
Toxicant management tool	95.3 (82)	100 (29)	94.4 (68)	95.7 (179)
Warfarin based	84.9 (73)	82.8 (24)	84.7 (61)	84.5 (158)
Species-specificity	74.4 (64)	51.7 (15)	48.6 (35)	61 (114)

Differences in Positive vs. Negative Views

Additionally, there were several themes that that were not clearly skewed in any particular direction between the negative, positive, and neutral articles. Four of these themes include 1) threats of livestock, pets, and wildlife ingesting the toxin, 2) threat to pets, wildlife, and humans consuming pig meat containing the toxin, 3) general destruction caused by feral swine, and 4) recognition for an additional tool to control feral swine.

About 71.1% (133) of the total articles discussed the threat of livestock, pets, and wildlife (animals) ingesting the toxin (Figure 1.2). Of these articles, 49.4% (85) of the negative articles, 27.6% (16) of the positive articles, and 22.2% (32) of the neutral articles, mentioned the threat. These numbers suggest that negative articles were more likely to publish the concerns about other species' threat of consumption of the toxicant. About 95.7% (172) of the total articles discussed the threat to pets, wildlife, and humans from consuming a carcass or pig meat after the pig has ingested the toxicant. Of these articles, 59% (102) of the negative, 46.6% (40) of the positive, and 34.7% (50) of the neutral articles, mentioned the threat.

About 50.3% (94) of the total articles discussed the general destruction caused by feral swine. Of these articles, 40.7% (35) of negative, 79.3% (23) of positive, and 50% (36) of neutral articles mentioned destruction. Positive articles reported destruction twice as much as the negative articles and about one-third more than neutral articles. About 28.3% (44) of the articles discussed recognition for an additional

tool to control feral swine, excluding hunting, trapping, and the use of a toxicant. Of these articles, 31.4% (27) of negative, 31% (9) of positive, and 23.6% (17) of neutral articles discussed this need for an additional management tool. This suggests that about a third of people, despite their views on the toxicant, agree that there needs to be an additional control method for feral swine. These results are presented in Figure 1.2 below.

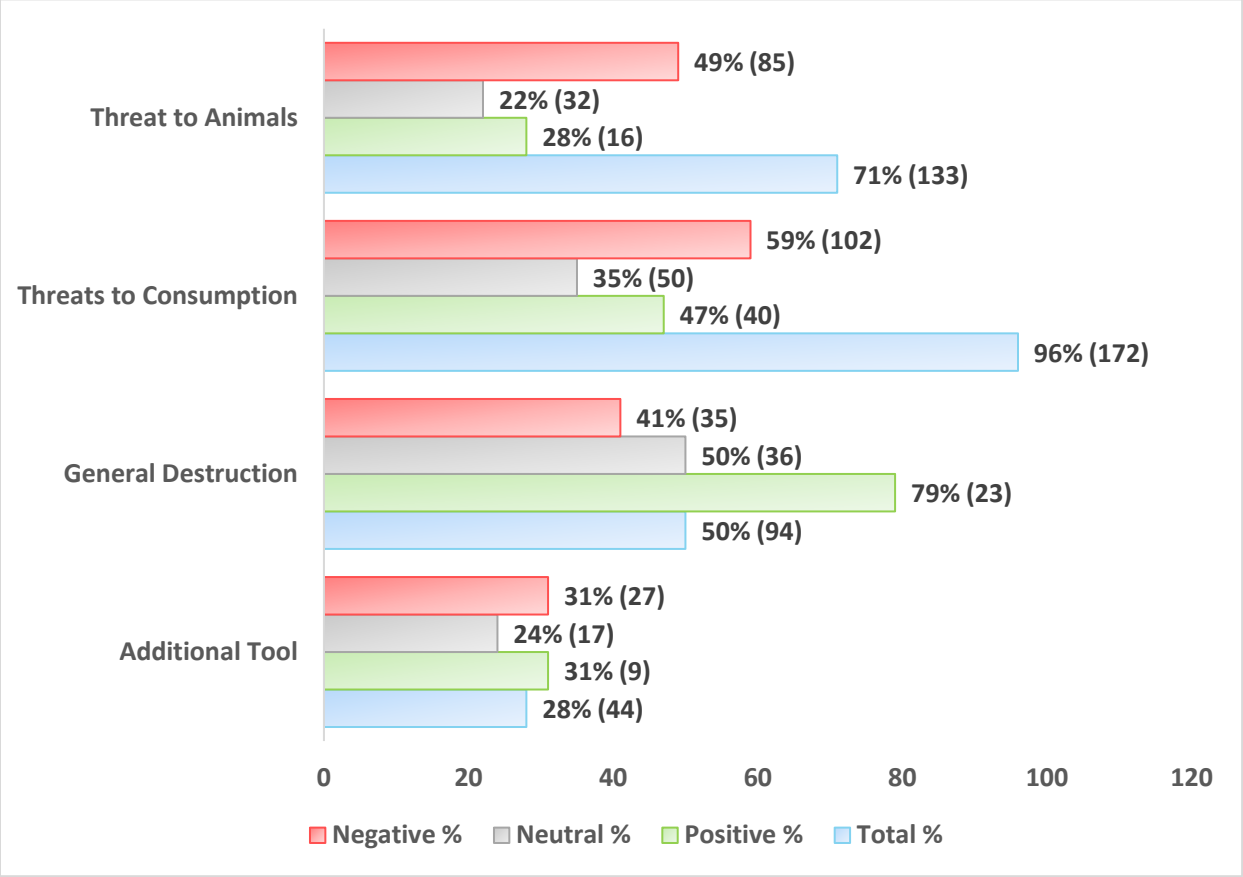

Figure 1.2. Differences in positive vs. negative vs. neutral articles with the four most contradicting themes.

Discussion

The majority of the articles were either negative or neutral, mostly describing the toxicant and then explaining the faults in its use. Half of the articles were published within five days following a major event, suggesting that the major event initiated a negative media reaction.

In the beginning of the analysis, right before 'Kaput' was released, the majority of the articles informing the public of the toxicant were neutral, with the remaining articles split evenly between positive and negative. As time continued, more negative articles were published, with the original amount of negative articles doubling in size. Eventually, there were more articles published as framing the toxicant as negative, than there were neutral and positive articles. This is probably due to more negative articles reporting the unknowns and the harmful side effects of the toxicant. This increased the public's awareness of the toxicant in the environment and ultimately altered their opinions and attitudes, so much so that the toxicant was pulled off the market.

As a result of the articles, the three most discussed themes were: toxicant as a management tool, toxicant as being warfarin based, and concern for the species-specificity of the toxin. The high percentage of mention within the articles, these three themes all play a role in the overall attitude portrayal of the toxicant. The public understands feral swine's destructive and invasive tendencies, therefore people want to rid them of their property with any means necessary, including a toxicant. As the understanding of these tendencies increases, the acceptability of the use of a toxicant as a management tool to control feral swine increases. However, the majority of the public are familiar with warfarin, and they understand that the toxicant contains warfarin, therefore the public are concerned with warfarin's broad spectrum toxicity and about non-target hazard, related to Kaput. Regardless of how people felt about the toxin in means of its broad spectrum and hazardous tendencies, the majority of individuals view the toxicant as a management tool to control feral swine.

The four most varying themes within the articles between negative, positive, and neutral were 1) threats to livestock, pets, and wildlife by ingesting the toxin, 2) threats to pets, wildlife, and humans by consuming pig meat after ingesting the toxin, 3) general destruction caused by feral swine, and 4) recognition for an additional tool to control feral swine. The first theme within the articles were split with half of the negative articles and a quarter of the positive articles discussing this theme. Within the

negative articles, more discrimination and negative comments against the toxicant were discussed than in the positive and neutral articles. The negativity displayed within these articles may be due to the desire for the toxicant to be banned from use.

The second theme, is highly discussed within all attitude articles (95.7% or 172), primarily within the negative articles. The negative articles are more likely to mention the potential threats of secondary toxin exposure due to the desire for the toxicant to be banned. However, even though the positive articles mentioned the threat, these articles typically argued for the null concern of secondary poisoning due to the fact that 'dose makes the poison' with low toxicity toward other wildlife.

The third theme, is mentioned in half of the total articles. The positive articles reported destruction twice as much as the negative articles and about one-third more than the neutral articles. This split may be due to positive articles wanting the public to understand the severity of the destruction caused by feral swine in hopes of gaining acceptance of the toxicant as a management tool. The more often destruction is mentioned, the more the public will know the extent of damage caused by feral swine. With more knowledge of potential and actual destruction and loss that the individual may ensue, this may then lead to more accepting measures to control feral swine.

The fourth theme, recognition for an additional tool to control feral swine, excluding hunting, trapping, and the use of a toxicant, is mentioned in a little over a quarter of the articles. Within these articles, about one-third of articles, despite their attitudes toward the toxicant, agree that there needs to be an additional control method for feral swine. In hopes to control or maintain feral swine at a sustainable level, there have been a variety of control methods, all of which have not quite been successful. The public are aware of the level of destruction caused by these animals and are in need of a control method that works.

Overtime, more negative articles were published regarding the feral swine toxicant. This is due to the highly discussed themes all playing a role in the attitude and portrayal of the feral swine toxicant. The public is aware of the general destruction caused by feral swine, therefore they push for a tool to control this destructive species. A toxicant has been known to help eliminate other nuisance species in the past and is currently considered a management tool. As time progressed, more negative attitudes were discussed about the toxicant and its inclusion of a warfarin base. The concern about warfarin was increased in regards to species-specificity, threats to livestock, pets, wildlife, and humans by either primarily or secondarily consuming the toxicant. As a result of these concerns, the toxicant was pulled off of the market. The public recognizes that there is a need for an additional tool to control feral swine excluding hunting, trapping, and the use of a toxicant. The current destruction and potential harm caused by feral swine will ultimately impact future efforts of restoration projects, crop production, health issues, etc. A goal would be to reverse this environmental destruction by implementing a management plan to rid feral swine, or to at least maintain them at a more sustainable level.

Future Research

As a result of this media content analysis several lessons were learned for future release of a toxicant including: public involvement, audience research, and research pertaining to possible outcomes of the release. The results of this release could have been avoided or changed completely if the public were to be informed of the process of making and testing the toxicant. This toxicant came as a surprise to the public when it was released, let alone not knowing the side-effects or harms that it could potentially cause. If the public were to be involved or informed of the testing processes and the test results, it may have been less of a shock, and the public may have been less likely to reject the toxicant so harshly. The researchers and agencies should have also researched their audience before releasing the toxicant. Researchers could angle the release in favor of the public as a management tool instead of forcing it into acceptance. Along with audience analysis, possible outcomes should have been

researched in ways to anticipate possible reactions or comments from the public. If outcomes were anticipated, the research agencies could have a ready response as to why this toxicant is best suited for the public to control feral swine. As a result of the lack of these three components, the media took over in outrage of this new possibly harmful toxicant and portrayed it as negative. The public's perception of the toxicant became more negative due to the increase in negative articles, so much so that the company that created the toxicant pulled it off of the market before it was actually even used.

For future releases, researchers should involve the public to the extent deemed necessary, research their audience for what their needs are, and come up with possible outcomes or rejections of the product in order to have a counterargument as to why their product should be accepted. It is important to do a media content analysis because it informs researchers of the media and public's views toward specific topics. After learning how the public perceives information, future research can utilize the information gained as a way to better release a new product in hopes to have the news and public's support.

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CHAPTER 2

Impacts of values and attitudes toward toxicant usage for feral swine control

Introduction

Feral Swine

Feral Swine (*Sus scrofa*) are known by many names, some including wild boar, wild hogs, and wild pigs, are considered an invasive nuisance species (Keiter et al., 2016 ; Ditchkoff & West, 2007). Free ranging domestic pigs were originally introduced to the United States by Spanish explorers in the early 1500s (Bates, 2017; Castañeda, 1907). Feral swine were once largely confined to the southern United States, but the populations have spread to more than 42 states in recent years (Mouton, 2009). However, after significant management efforts to reduce populations, feral swine are now present in less than 35 states (Corn & Jordan, 2017).

The spread of feral swine is attributed to their ability to adapt to many environments, lack of predators, and high fecundity (Bates, 2017; Mayer & Brisbin, 2009; Taylor & Hellgren, 1997). When feral swine are introduced into a new environment, they compete with native wildlife for food sources as well as consume native wildlife (Li et al., 2010; Timmons et al., 2011; Yarrow & Kroll, 1989). Feral swine are highly dependent on plant based crops (Schley & Roper, 2003), however, as opportunistic omnivores, feral swine will forage for any available food source, including ground nesting birds, reptiles, amphibians, small mammals, and offspring of large mammals (Frederick, 1998; Mayer 2009; Mayer, 2017; Schley & Roper, 2003; Taylor & Hellgren, 1997; Timmons et al., 2011). In addition to feral swine impacts on wildlife, they also cause damage that degrades water quality, creates soil erosion, and damages agriculture (Bengsen et al., 2014; Taylor & Hellgren, 1997; Wood & Lynn, 1977;). They also carry diseases that are harmful to humans, pets, wildlife, and livestock (Bengsen et al., 2014; Henderson,

2009). Feral swine are most detrimental to farmers due to the high sources of protein and extensive food availability that the farms contain (Schley et al., 2008). The destruction caused by feral swine has the potential to effect public's livelihood and health which creates a need for feral swine management control.

Management Tactics

There are numerous management techniques available to reduce damage caused by feral swine including: aerial shooting, baiting and shooting, hunting with dogs, sport-hunting, trapping, snaring, physical exclusion, habitat manipulation, fertility control, and toxicant usage (Bengsen et al., 2014; Campbell et al., 2010; Choquenot et al., 1993; Coblentz & Baber, 1987; Mayer & Brisbin, 2009). Studies have indicated that to prevent existing populations of feral swine from increasing, 70% of the feral swine population has to be eliminated every year (Bevins et al., 2014; Dzieciolowski et al., 1992; Mayer, 2009). To achieve this population reduction, a combination of management techniques must be implemented; which includes a feral swine toxicant (Bengsen et al., 2014; Campbell & Donlan, 2005; Campbell & Long, 2009; Jay & Wiscomb, 2008).

The use of a toxicant is the most effective and efficient control method used by wildlife managers to reduce high numbers of feral swine in a large area in a short amount of time (Cowled et al., 2008; McIlroy & Saillard, 1989; Mitchell, 2008; O'Brien, 1986). There are several toxicants that have been tested and implemented to control feral swine within the United States and Australia including Kaput, sodium flouracetate, yellow phosphorous, and sodium nitrite. The toxicant 'Kaput' eliminates feral swine after consumption by its anticoagulant component Warfarin (US EPA, 2017), which has also been used in rodent baits. The time it takes feral swine to die after consumption of this bait is 6-10 days on average (Hone & Kleba, 1984; O'Brien, 1988; O'Brien & Lukins, 1990). Two other toxicants, sodium fluoroacetate (1080) and yellow phosphorous, are approved for use in Australia, however the time it

takes for the toxicant to be lethal after consumption is 2 hours – 5 days for sodium fluoroacetate (Hone & Kleba, 1984; O'Brien 1988) and 2-4 days for yellow phosphorous (O'Brien & Lukins, 1990). The toxicant sodium nitrite is currently being developed and tested for further use as a control method. This toxicant eliminates feral swine within 3-4 hours after consumption of the bait by reducing the ability of blood to transfer oxygen to tissues which renders the pig unconscious and it quickly dies (Cowled et al., 2008; Snow et al., 2017; WS USDA APHIS, 2018). Sodium nitrite seems to be the most humane toxicant for feral swine due to the quickness and lethal doses, rendering the feral swine unconscious without prolonged preliminary period of distress (Cowled et al., 2008; Lapidge et al., 2009; Porter & Kuchel, 2009). Even though the use of a toxicant may be the most effective and efficient management technique, there is still controversy over whether toxicants could potentially harm other wildlife or humans if they come into contact with the toxicant. Numerous studies have shown that consumption in mass quantities continuously over several days may have a lethal effect on other species of wildlife (McIlroy et al., 1989; US EPA, 2017; WS USDA APHIS, 2018).

Cognitive Hierarchy (WVO)

This study utilized psychological theory that has been adapted for use in wildlife management (Manfredo, 2008). The cognitive hierarchy model links behaviors, beliefs and attitudes, value orientations, and values (Homer & Kahle, 1988). This model helps predict human behavior based on values that are mediated by attitudes, beliefs, and value orientations. The cognitive hierarchy model is frequently utilized in studies to help generate wildlife management decisions (Whittaker et al., 2006). These elements build upon one another in an inverted pyramid called the cognitive hierarchy (Figure 2.1).

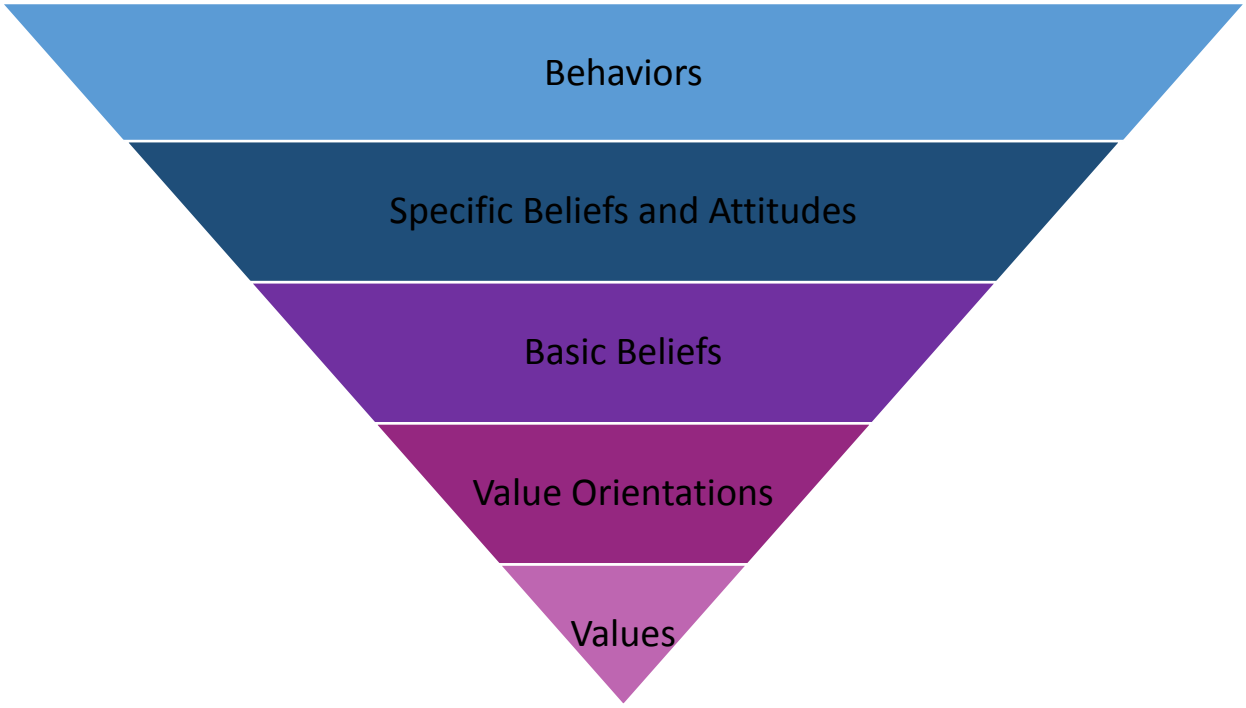

Figure 2.1. The cognitive hierarchy (adapted from Manfredo, 2008).

Values are the cornerstone for an individual's thoughts and actions (Rohan, 2000; Rokeach, 1973). A person's values are slow to change, few in number, enduring in nature, and cover a large scope. However, due to an individual's values being broad, they do not inform management decisions (Fulton et al., 1996), therefore we need to measure value orientations, which are much more specific. Value orientations measure how a person's values inform their basic beliefs as they relate to a specific subject. While combining personal experiences and basic beliefs, it informs attitudes and specific beliefs (Fishbein & Ajzen, 1975) which lead to intended and actual behaviors (Ajzen & Fishbein, 1980).

Wildlife Value Orientations (WVOs) are measured using a series of belief statements that were developed based on eight basic wildlife belief dimensions (Fulton et al., 1996). These eight basic beliefs further come together to form four basic belief categories, which ultimately comes down to form the two WVOs, Domination and Mutualism (Fulton et al., 1996; Teel et al., 2005). Domination value orientation is the primary value orientation of most Americans in the western United States (Kluckholn

& Strodtbeck, 1961; Manfredo et al., 2009; Schwartz, 2006) and is considered as humans having control over wildlife as the protector, guardian, and executioner (Manfredo et al., 2009). Humans assume power over animals in ways to increase human benefits, distinguish clear separated groups of humans and animals, and acceptance of animals as being subordinate to humans (Manfredo et al., 2009). Mutualism value orientation is more of an egalitarian ideology rather than power over animals. Mutualism emphasizes equality between humans and animals, viewing wildlife as capable of living in harmonious and trustworthy relationships with humans (Manfredo et al., 2009). Mutualism value orientation is on the rise for Americans. WVO affect behaviors through the hierarchical chain mediated by attitudes (Fulton et al., 1996). These are important because they are determinants of attitudes which then help explain behaviors related to wildlife (Fulton et al., 1996). "WVO provide consistency and organization among the broad spectrum of beliefs, attitudes, and behaviors regarding wildlife" (Fulton et al., 1996, pg. 28).

Study Purpose and Objectives

The purpose of this paper is to identify support or opposition in the use of a toxicant lethal management option to control feral swine populations. The target population for this study was rural and urban residents in the 50 United States. The research objectives were to examine and determine a) the relationship between Wildlife Value Orientations and support or opposition of the use of toxicants as a lethal management action to control feral swine populations, b) if there are significant relationships between Wildlife Value Orientations of Mutualism and Domination, and Attitudes toward feral swine populations, and c) if the significant relationships between Wildlife Value Orientation dimensions and support or opposition of the use of toxicants as a lethal management action to control feral swine populations are completely or partially mediated by attitude toward feral swine and the use of the toxicant.

Methods

Data Collection

The sample for this study included 400 people from each of the 50 United States (20,000 total). The sample was obtained from infoUSA® and was stratified to include 200 urban residents and 200 rural residents from each of the 50 states. The response rate for this study was a total of 2,225 surveys returned (11% response rate). Data for this study was collected using a mail survey with an online response option. A pre-notification post card was mailed followed one week later by a questionnaire packet (cover letter, questionnaire, and stamped return envelope). A thank you/reminder postcard was mailed, then another questionnaire packet, and a final thank you/reminder postcard with an online response option. The online questionnaire was provided through SurveyMonkey®.

Measurement

Wildlife Value Orientations

WVOs were measured by asking respondents the extent to which they agreed or disagreed with 10 domination statements (humans have power and control over nature) and nine mutualism statements (there should be equality between humans and wildlife). Examples of domination statements included (a) the needs of humans should take priority over fish and wildlife protection, and (b) we should strive for a world where there's an abundance of fish and wildlife for hunting and fishing. The mutualism statements included (a) we should strive for a world where humans and wildlife and fish can live side by side without fear, and (b) I take great comfort in the relationship I have with animals. 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 et al., 2009; Teel & Manfredo, 2010).

The internal consistency of the belief statements for the Wildlife Value Orientation scales (Domination and Mutualism) were examined using reliability analysis. Reliability analysis determines whether or not the hypothesized groupings of questions into the two wildlife value orientations are ultimately a good fit for the data collected. The analysis further evaluates the extent to which consistent results were measured and obtained from numerous items given a specific value orientation.

Feral Swine Beliefs/Attitudes

An additional 13 belief statements were included to measure general beliefs toward feral swine. These statements were measured on a five-point scale ranging from strongly disagree (1) to strongly agree (5). The items included 11 statements that suggested a negative connotation (e.g., wild pigs degrade wildlife habitat) and two that suggested a positive connotation (e.g., wild pigs have the right to exist wherever they may occur). The two positive statements were reverse coded and internal consistency of the 13 belief statements for the Attitude scale was examined using reliability analysis (Cronbach's alpha ≥ .70).

Support or Opposition to Feral Swine Management Actions

Survey participants were asked to agree or disagree, using the seven-point scale from "strongly disagree" (1) to "strongly agree" (7), with the statement "if legal poison became available for wild pigs that caused minimal suffering and little harm to other wildlife, it would be ethical to use". This statement was utilized within the analyses as the dependent variable to determine support or opposition of the use of the toxicant as a lethal management option.

Data Analysis

Three regressions were computed to determine a mediation analysis (Baron & Kenney, 1986). The first regression used support or opposition of a feral swine toxicant management action as the

dependent variable and two Wildlife Value Orientations, mutualism and domination, as the independent variables. A second regression utilized Attitudes as the dependent variable and Wildlife Value Orientations, mutualism and domination, as the independent variables.

The third regression utilized support or opposition of a feral swine toxicant management action as the dependent variable and remaining Wildlife Value Orientations and Attitudes as the independent variables. These three regressions were performed separately to obtain a mediation analysis. The existence of mediation is explained as occurring under the following conditions, described in the context of this study. The predictor variables (the Wildlife Value Orientations) must be statistically related to the criterion variable (support or opposition for the use of a feral swine toxicant); the predictor variables (the Wildlife Value Orientations) must be significantly related to the mediator (Attitude toward feral swine). Full mediation occurs when, in the third regression, the path between the mediator variable (Attitude) and the criterion variable (support or opposition for the use of a feral swine toxicant) is statistically significant and the path or paths between the predictor variables (the Wildlife Value Orientations) is statistically nonsignificant. Partial mediation occurs when, in the final regression, the path or paths between the predictors and the criterion variable decreases, but remains statistically significant (Vaske & Donnelly, 1999).

Results

Descriptive Statistics of Returned Surveys

The survey was sent out to 20,000 individuals, 200 rural and 200 urban residents within the 50 United States. Out of the total surveys, 2,225 were returned with approximately an 11% response rate. For the returned surveys, the mean, minimum, and maximum of age and income were determined as appropriate, as well as other descriptive statistics for gender and rural vs. urban residency were determined (Table 2.1). Within the survey, individuals were asked to write in their age; age was analyzed

as a continuous variable. The mean age determined was 58 years old (18 years = minimum, 100 years = maximum). Individuals were asked to identify as male (1), genderqueer (2), female (3), prefer not to answer (4), trans male (5), or trans female (6). Due to the lack of response for the options other than male and female, statistics for male and female are solely reported; 1,255 respondents (60%) were male, 831 respondents (40%) were female. The categorical variable of household income was self-reported including options (a) less than $10,000, (b) $10,000 to $14,999, (c) $15,000 to $24,999, (d) $25,000 to $34,999, (e) $35,000 to $49,999, (f) $50,000 to $74,999, (g) $75,000 to $99,999, (h) $100,000 to $149,999, (i) $150,000 to $199,999, and (j) $200,000 or more. The majority of respondents (21%) answered with household incomes averaging between $50,000 and $74,999. The mean fell within the $50,000 to $74,999 category, with a normal distribution. The number of rural vs. urban residents' responses were 1,250 responses (56%) rural and 968 responses (44%) urban. The state responses varied from Nevada and New Jersey with a frequency of 26 respondents in each state (1.2%) to Vermont with a frequency of 64 respondents (2.9%), see Appendix B for complete breakdown of the 50 United States. Overall, the majority of survey respondents were Males, averaging 58 years old, with an income between $50,000 and $74,999 who live in a rural area. Research has shown that age, gender, and income are predictors of beliefs and behaviors, shown within the cognitive hierarchy (Thompson, 2015).

Table 2.1. Descriptive statistics of individuals who returned surveys

	Mean	Minimum	Maximum	Standard Deviation
Age	58 years	18 years	100 years	15.802 years
Income	$50,000 – $74,999	Less than $10,000	$200,000 or more	2.142

Developing Study Indices

The study indices, created from the measured variables, were determined to include high internal consistency, revealed from the reliability tests (Cronbach's alpha ≥ .70). 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).

Table 2.2. Basic beliefs toward wildlife: Survey of urban and rural residents in the 50 United States during 2017 and their Cronbach's alpha of reliability analysis.

Wildlife value orientations, basic belief dimension, and basic belief item	Cronbach's alpha
Domination	**.834**
Appropriate use beliefs	.764
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.	
Hunting beliefs	.804
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.	
Mutualism	**.867**
Social affiliation beliefs	.758
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.	
Caring beliefs	.822
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.	

* Statement was reverse coded

The reliability test for the measure of Attitude toward feral swine resulted in a Cronbach's alpha of .935, which suggests that these beliefs have a high internal consistency for measure of attitude (Table 2.3).

Table 2.3. Beliefs about feral swine: Survey of urban and rural residents in the 50 United States during 2017 and their Cronbach's alpha of reliability analysis.

Beliefs Statements about Feral Swine	Cronbach's alpha
Negative Statements	**.935**
Wild pigs are a nuisance.	
Wild pigs harm native wildlife.	
Wild pigs can transmit diseases to domestic livestock.	
Wild pigs can transmit diseases to people.	
Wild pigs degrade wildlife habitat.	
Wild pigs pose a threat to ground-nesting birds (ex. Turkey, quail).	
Wild pigs compete with other wildlife species for food.	
Wild pigs reduce water quality of streams, ponds, etc.	
Wild pigs can injure adult livestock.	
Wild pigs can cause damage to agricultural fields.	
Wild pigs pose a threat to human safety.	
Positive Statements	
Wild pigs have the right to exist wherever they may occur.*	
Wild pigs increase my overall quality of life.*	

* Statement was reverse coded

Descriptive Statistics of Included Themes

The mean score, standard deviation, and variance descriptive statistics were determined for the Mutualism scale, Domination scale, Attitude scale, and Toxicant management tool. Listing from the first to the fourth statistics, the mean scores were 4.50 on a 7-point scale, 4.88 on a 7-point scale, 3.73 on a 5-point scale, and 3.28 on a 7-point scale, respectively. The following are the standard deviations of these items, 1.20, 1.06, 0.66, and 1.81, respectively. Further, the variance of these items, 1.45, 1.12, 0.44, and 3.27, respectively (Table 2.4). Overall, approximately 52% of the population opposed the use of the toxicant as a lethal management tool (strongly disagree, disagree, and somewhat disagree) and 48% supported the use of the toxicant (neutral, strongly agree, agree, and somewhat agree) (Table 2.5).

Table 2.4. Descriptive statistics of Wildlife Value Orientations, Attitude toward feral swine, and support or opposition of the use of a toxicant as a lethal management tool.

	Mean	Standard Deviation	Variance
Mutualism	4.50	1.20	1.45
Domination	4.88	1.06	1.12
Attitude	3.73	0.66	0.44
Toxicant Management Tool	3.28	1.81	3.27

Table 2.5. Frequency and percent of support and opposition of toxicant used as a lethal management action for feral swine.

	Frequency (%)
Strongly Disagree	439 (22%)
Disagree	385 (19%)
Somewhat Disagree	216 (11%)
Neutral	514 (25%)
Somewhat Agree	181 (9%)
Agree	154 (8%)
Strongly Agree	124 (6%)
Total	2,013 (100%)

Analysis of Research Objectives

Mediation analysis was tested using the three linear regressions described earlier, and within the context of the three research objectives of this study.

Research Objective 1. To examine the relationship between Wildlife Value Orientations and Support or Opposition of the use of toxicants as a lethal management action to control feral swine populations.

Research objective 1 describes the first regression required for mediation analysis. Both Domination and Mutualism are significant ($p < .001$) predictors of the support of or opposition to the usage of toxicant as a lethal management action (Table 2.6). The support of the management action increases as the Domination score increases. This is the strongest predictor for using poison to lethally remove feral swine ($\beta = .198$, $p < .001$), and Mutualism is the lowest predictor for using poison to

lethally remove feral swine (β = -.129, $p < .001$). Therefore as one's Domination score increases, so does the support for using poison to lethally remove feral swine. As one's Mutualism score increases, the support for using poison to lethally remove feral swine decreases. These variables explain 8.3% of variance ($R^2 = .083$).

Table 2.6. Regression model examining the relationship between Wildlife Value Orientations of Domination and Mutualism, and Support or Opposition of the use of toxicants as a lethal management action to control feral swine populations.

Independent Variable	β	*p*	R^2
Domination	**.198**	**<.001**	**.083**
Mutualism	**-.129**	**<.001**	

Research Objective 2. To determine if there are significant relationships between Wildlife Value Orientations of Mutualism and Domination, and Attitudes toward feral swine populations.

Research objective 2 describes the second regression required for mediation analysis. Domination has a significant ($p < .001$) relationship with Attitudes toward feral swine populations (β = .333) (Table 2.7). As the Domination score increases, so does negative Attitudes toward feral swine. Mutualism however did not have a significant relationship with Attitudes. Since Mutualism is not significantly related to Attitudes in this regression, it was eliminated from further analysis.

Table 2.7. Regression model examining if there are significant relationships between Domination and Mutualism value orientations and Attitudes toward feral swine. Domination is significant, Mutualism is not significant.

Independent Variable	β	*p*
Domination	**.333**	**<.001**
Mutualism	-.013	.611

Research Objective 3. To determine if the significant relationships between Wildlife Value Orientation dimensions and support or opposition of the use of toxicants as a lethal management action to control feral swine populations are completely or partially mediated by Attitude toward feral swine and the use of the toxicant.

Research objective 3 describes the third regression required for mediation analysis. With the WVO Mutualism removed from the analysis, only the WVO Domination and the potential mediator, Attitude were regressed on support or opposition for usage of the feral swine toxicant. Both Domination and Attitudes were significant ($p < .001$) predictors for the support or opposition of feral swine toxicant used as a lethal management action. As the Domination and Attitudes scores increase, so does the support for using toxicant as a lethal management action to control feral swine populations (Table 2.8). These variables explain 12% of variance ($R^2 = .12$). Attitudes were a relatively strong predictor of support or opposition of a feral swine toxicant used as a lethal management action, the effect did not mediate the relationship between Domination and the support or opposition. This was due to Domination having a continued strong effect, just as before Attitudes were included in the model.

Table 2.8. Regression model evaluating the influence of WVOs on Attitude toward the ethical beliefs of a toxicant as a lethal management option for feral swine in the United States.

Independent Variable	β	*p*	R^2
Domination	**.196**	**<.001**	**.12**
Attitudes	**.201**	**<.001**	

Discussion

Due to rapidly increasing populations of feral swine, the management of this species in the United States has become increasingly important over the past few decades. To reduce the spread of feral swine and their economic impacts to agriculture and communities, wildlife managers need to work with the surrounding public to create acceptable, efficient, and effective management plans. To do so,

managers must understand the public's values that may influence their acceptance or opposition of a toxicant usage management action. The cognitive hierarchy suggests that a combination of wildlife value orientations and attitudes are strong predictors of support or opposition toward management actions, therefore managers should look within the hierarchy.

Individuals hold different cultures, personalities, and values throughout different regions (Rentfrow et al., 2008) which alters management plans that may affect these differences in individuals. These individuals may have pre-determined values or beliefs on certain subjects that are difficult to change. They may hold the same values, but how they support and act upon those values may differ.

Previous research has determined that people who hold a domination value orientation tend to be older men living in rural areas as opposed to mutualists who tend to be in urban areas with higher average income (Vaske et al., 2011; Manfredo et al., 2009; and Teel & Manfredo, 2010). This study identified a domination wildlife value orientation and a negative attitude toward feral swine to be key identifiers of support for a toxicant lethal management action of feral swine. When individuals hold a domination wildlife value orientation, they believe that humans have control or power over wildlife in all aspects of wildlife's life to increase human benefits. The more an individual has a negative attitude toward feral swine, the more likely that individual will be in support of a toxicant management action to lethally manage feral swine.

The opposite holds true for a mutualism wildlife value orientation. When an individual holds a mutualism value orientation, that individual is less likely to hold a negative attitude toward feral swine and less likely to support a toxicant lethal management action of feral swine. This may be due to mutualists holding an egalitarian ideology rather than power over animals. These individuals emphasize equality between humans and animals and are less likely to support the toxicant management action.

However, when just looking at wildlife value orientations and attitudes toward feral swine, the domination value orientation was a significant predictor of attitude while mutualism value orientation was not significant. When an individual holds a domination value orientation, they are more likely to have more negative attitudes toward feral swine. This may be due to the underlying values that domination and mutualism hold. Mutualists value animals as equals and dominants value animals as subordinates. Therefore mutualism value orientation will not be significant in predicting negative attitudes toward feral swine.

Overall, the regression models helps predict the influence of domination wildlife value orientation and attitudes on the ethical beliefs of the use of a toxicant as a lethal management option. Attitudes were a relatively strong predictor of support or opposition of a toxicant used as a lethal management action to control feral swine, however, the effect did not mediate the relationship between domination and support or opposition of a toxicant. Domination continued to have just as strong as an effect before as it did after Attitudes were included in the model, meaning that Attitudes did not mediate the relationship. The regression models allowed the determination that general attitudes toward feral swine are a significant predictor in the relationship between wildlife value orientations and the ethical belief of the use of a toxicant as a lethal management option for feral swine control in the United States. This informs us that not only are the public's wildlife value orientations a significant factor in determining a feral swine management action, so are their general attitudes toward feral swine. The analysis is supported by the cognitive hierarchy, attitudes may have an influence on wildlife value orientations to determine certain behaviors toward the use of a toxicant, however, attitudes and wildlife value orientations are also directly effecting the certain behaviors toward the use of a toxicant.

Future Research

As a result of this wildlife survey and regression models, several questions arose from interpretation of the results including: word usage of poison, word usage of minimal suffering and little harm, and possible direct experience/effect of damages influencing the acceptance from the public. The understanding of the word "poison" to the public could be interpreted as a bad or dangerous product that will harm any animal or human if they come into contact with it. The term "toxicant" is less harsh when it comes to describing a product due to less exposure of the word. For example, there are warning labels on chemicals to call "poison" control if the chemical is consumed. The public may have a negative connotation or interpretation already associated with the word "poison" rather than with the word "toxicant".

In addition to "poison", the public may also interpret the word usage of "minimal suffering and little harm" differently. Some individuals may interpret minimal suffering and little harm as an inconvenience to wildlife while others may interpret it as internal hemorrhaging and pain to wildlife. The public may also not like the potential harm that the toxicant could cause to non-target species, like other wildlife, livestock, pets, or to feral swine in general. This would explain the low predictability of value orientations to the support of the toxicant management tool. In future surveys, the word usage should be reevaluated in order to incorporate new public opinions.

Direct damages/effects to the public may also influence their willingness to support a toxicant as a lethal management action of feral swine. The more damages feral swine cause to an individual's property, the more likely that individual will be accepting of a lethal management option. However, if an individual is making an income from others hunting feral swine on their property, they may be less likely to poison the feral swine as not to reduce their income by having less hunters, or having more concerns about contaminated meat. The uncertainty of the toxicant may explain why people who hold mutualism

value orientations are not accepting of the management action. If managers can understand the public's values and attitudes toward feral swine, they will be able to better focus efforts and achieve specific management goals.

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APPENDIX A

Mailed Wildlife Survey

ALL RESPONSES ARE CONFIDENTIAL.
YOUR HELP ON THIS STUDY IS GREATLY APPRECIATED!

Please take 15 minutes of your time to complete this questionnaire and return it in the postage-paid return envelope provided.

MISSISSIPPI STATE UNIVERSITY™
CENTER FOR RESOLVING HUMAN-WILDLIFE CONFLICTS
EXTENSION SERVICE
FOREST AND WILDLIFE RESEARCH CENTER

"Wild pig" in this questionnaire refers to any pig that is roaming free and does not have an owner. Other names for "wild pig" include feral swine, feral hog, feral pig, wild boar, or wild hog. This does not include the peccary found in parts of Arizona, New Mexico, and Texas.

Section 1: Wildlife

1. Please indicate which of the following you would consider *wildlife. (Check ALL that apply.)*

____ Deer	____ Turtles	____ Blue Jays	____ Snakes	____ Alligators
____ Frogs	____ Snails	____ Bees	____ Fish	____ Panthers
____ Coyotes	____ Mussels	____ Mosquitoes	____ Bears	____ Wild Pigs
____ Raccoons	____ Wild Horses	____ Squirrels	____ Pigeons	____ Pheasants

2. In the past 12 months have you had problems with wildlife near your home (including your place of residence and the area within a few miles of it)?

____ Yes ____ No (Skip to Question 3) ____ Prefer not to answer (Skip to Question 3)

2a. If yes, please briefly explain the problem(s) and the wildlife that caused it. For example, 'birds eating from fruit tree," deer damaging landscaping," or "bear threatening human safety." *(List as many as apply)*

_____

_____

_____

3. In the past 12 months have you fed wildlife (birds, deer, squirrels, etc.) near your home (including your place of residence and the area within a few miles of it)?

____ Yes ____ No

4. Are you a member of or have you donated to any organization that promotes wildlife conservation or habitat enhancement (ex. Ducks Unlimited, The Nature Conservancy, Audubon Society, etc.)?

____ Yes ____ No

4a. If yes, please list the organizations you are a member of or have donated to.

_____

_____

5. Are you a pet owner?

____ Yes ____ No

5a. If no, would you like to have a pet?

____ Yes ____ No

6. Have you ever hunted?

____ Yes ____ No

6a. If you could only hunt one day a year and only one species on that day, which species would you hunt? *(Check ONE.)*

____ Deer ____ Waterfowl ____ Wild pigs ____ Turkey

____ Elk ____ Upland birds ____ Small game

____ Other (please describe): _____

6b. Have you ever hunted specifically for wild pigs?

____ Yes ____ No

7. 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 wildlife protection.	1	2	3	4	5	6	7
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

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
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 want to protect them.	1	2	3	4	5	6	7
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 2: Wild pigs in the United States

1. Before receiving this questionnaire, had you ever heard of wild pigs in the United States?

____ Yes ____ No (If No, skip to Question 2)

1a. If yes, how did you hear about them? *(Check ALL that apply.)*

____ Television ____ Newspapers ____ Internet (not Social Media)
____ Radio ____ Magazines ____ Social Media
____ Word of Mouth ____ First-hand Experience ____ Scientific Journals
____ Wildlife Organization ____ Other (please explain):_____

1b. For the sources you selected above, please state the name...(ex. Hogs Gone Wild, Hunters Digest, have seen pigs in your yard, etc.). (Please use the comments section at the end if you need more space).

2. For each statement, please select true or false. If you don't know or aren't sure, select Don't Know and go to the next question.

	True	False	Don't Know
Wild pigs only have one litter of young every year.	□	□	□
Wild pigs are most active at night.	□	□	□
Wild pigs are native to the United States.	□	□	□
Wild pigs only eat plants.	□	□	□
Wild pigs carry diseases that can spread to humans.	□	□	□

3. State how much you disagree or agree with the following statements about wild pig legal considerations by circling the number that matches your response.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Does Not Apply
Wild pigs should be allowed to be transported anywhere in the U.S. without restrictions.	1	2	3	4	5	6
Restrictions on the transportation of wild pigs from my state to other states are strictly enforced.	1	2	3	4	5	6
Wild pigs should be allowed to be transported anywhere in the U.S. after a veterinarian verifies they are clean of any transmittable disease.	1	2	3	4	5	6
There should be penalties for illegally transporting wild pigs from my state to other states.	1	2	3	4	5	6
There should be penalties for illegally transporting wild pigs within my state.	1	2	3	4	5	6

4. State how much you disagree or agree with the following statements about wild pigs in general by circling the number that matches your response.

I believe wild pigs...	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
... are a nuisance.	1	2	3	4	5
... harm native wildlife.	1	2	3	4	5
... can transmit diseases to domestic livestock.	1	2	3	4	5
... can transmit diseases to people.	1	2	3	4	5
... have the right to exist wherever they may occur.	1	2	3	4	5
... degrade wildlife habitat.	1	2	3	4	5

I believe wild pigs...	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
... pose a threat to ground-nesting birds (ex. turkey, quail).	1	2	3	4	5
... compete with other wildlife species for food.	1	2	3	4	5
... reduce water quality of streams, ponds, etc.	1	2	3	4	5
... can injure adult livestock.	1	2	3	4	5
... can cause damage to agricultural fields.	1	2	3	4	5
... pose a threat to human safety.	1	2	3	4	5
... increase my overall quality of life.	1	2	3	4	5

5. 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 wild pigs without dogs is ethical.	1	2	3	4	5	6	7
... hunting wild pigs with dogs is ethical.	1	2	3	4	5	6	7
... sharpshooting wild pigs from a helicopter is ethical.	1	2	3	4	5	6	7
... trapping and removing wild pigs is ethical .	1	2	3	4	5	6	7
... using poison that causes minimal suffering and little harm to other wildlife is ethical.	1	2	3	4	5	6	7

6. Please tell us more about your support or opposition for the use of poison to kill pigs.

7. State how much you disagree or agree with the following statements about wild pigs by circling the number that matches your response.

I believe wild pigs...	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
... should be hunted to reduce the amount of wild pig damage.	1	2	3	4	5
... should be promoted as an animal that is good to eat.	1	2	3	4	5
... should be treated as pest animals.	1	2	3	4	5
... should be treated as a game species.	1	2	3	4	5
... may add value to hunting leases on private property.	1	2	3	4	5
... may encourage hunters trespassing on a person's land.	1	2	3	4	5

8. The wild pig population in your county has _____ in the last 3 years. *(Check ONE.)*

____ Increased ____ Decreased ____ Stayed the Same ____ I don't know

9. How has each of the following affected the number of wild pigs in the county where you live?

Events	Substantially Decreased	Decreased	No Change	Increased	Substantially Increased	Unsure
Hunting of wild pigs	1	2	3	4	5	6
Neighbor's agriculture practices	1	2	3	4	5	6
Trapping of wild pigs	1	2	3	4	5	6
Predators	1	2	3	4	5	6
State regulations prohibiting wild pig hunting	1	2	3	4	5	6
State regulations prohibiting transport of wild pigs	1	2	3	4	5	6
Other State government actions	1	2	3	4	5	6
USDA Wildlife Services actions	1	2	3	4	5	6
Other Federal Government actions	1	2	3	4	5	6
Release or escape of domestic pigs	1	2	3	4	5	6
Release or transfer of pigs for hunting by private individuals	1	2	3	4	5	6
Release of pigs by hunters	1	2	3	4	5	6
Natural movement of pigs	1	2	3	4	5	6
Availability of food sources for pigs	1	2	3	4	5	6

Section 3: Demographics

1. What is your current gender identity?

____ Male ____ Female ____ Trans male ____ Trans female
____ Genderqueer ____ Prefer not to answer

2. What is your age? _____ years old

3. What is your race?

____ Black, non-Hispanic ____ Native American or Alaskan Native ____ Asian
____ White, non-Hispanic ____ Spanish, Hispanic, or Latino ____ Native Hawaiian
____ Other Pacific Islander ____ Other (please describe): _____

4. What is your highest completed level of education? *(Check ONE.)*

____ Some high school ____ High School/GED ____ Some college
____ Associates degree ____ Bachelor's degree ____ Master's degree (include MBA/JD)
____ Doctorate ____ Vocational/Professional Certification

5. What best describes the area where you were raised as a youth? *(Check ONE.)*

____ Farm or rural area ____ Small city with 25,000 to 49,999
____ Small town/village with less than 5,000 people ____ City with 50,000 to 99,999
____ Town with 5,000 to 9,999 people ____ City with 100,000 to 249,999
____ Town with 10,000 to 24,999 people ____ Large city with 250,000 people or more

6. What best describes the area where you live now?

____ Farm or rural area ____ Small city with 25,000 to 49,999
____ Small town/village with less than 5,000 people ____ City with 50,000 to 99,999
____ Town with 5,000 to 9,999 people ____ City with 100,000 to 249,999
____ Town with 10,000 to 24,999 people ____ Large city with 250,000 people or more

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

____ Less than $10,000 ____ $35,000 to $49,999 ____ $150,000 to $199,999
____ $10,000 to $14,999 ____ $50,000 to $74,999 ____ $200,000 or more
____ $15,000 to $24,999 ____ $75,000 to $99,999
____ $25,000 to $34,999 ____ $100,000 to $149,999

8. What County do you live in? _____

9. What State do you live in? _____

Comments

Thank you for your participation.

APPENDIX B

State Breakdown Table

State	N	%
Alabama	45	2.0
Alaska	52	2.3
Arizona	42	1.9
Arkansas	46	2.1
California	40	1.8
Colorado	52	2.3
Connecticut	32	1.4
Delaware	42	1.9
Florida	37	1.7
Georgia	37	1.7
Hawaii	38	1.7
Idaho	55	2.5
Illinois	49	2.2
Indiana	43	1.9
Iowa	55	2.5
Kansas	62	2.8
Kentucky	30	1.4
Louisiana	36	1.6
Maine	47	2.1
Maryland	46	2.1
Massachusetts	36	1.6
Michigan	42	1.9
Minnesota	55	2.5
Mississippi	56	2.5
Missouri	45	2.0
Montana	59	2.7
Nebraska	52	2.3
Nevada	26	1.2
New Hampshire	43	1.9
New Jersey	26	1.2
New Mexico	33	1.5
New York	38	1.7
North Carolina	43	1.9
North Dakota	38	1.7
Ohio	46	2.1
Oklahoma	53	2.4
Oregon	41	1.8
Pennsylvania	62	2.8
Rhode Island	28	1.3
South Carolina	34	1.5
South Dakota	51	2.3
Tennessee	40	1.8
Texas	47	2.1

Utah	41	1.8
Vermont	64	2.9
Virginia	38	1.7
Washington	49	2.2
West Virginia	47	2.1
Wisconsin	48	2.2
Wyoming	57	2.6