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Landowner Opinions Regarding Wild Pigs in Georgia, USA

Michael T. Mengak

Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia

ABSTRACT: Wild pigs, present in over 140 (of 159) counties in Georgia, cause significant problems. They are hunted and trapped for recreation, yet they are responsible for over \$150 million in damage to property and crops. Research suggests that the public has divergent approaches to wild pig control, lacks knowledge about effective control strategies, undertakes a range of legal and non-legal control activities, and suffers significant financial losses from wild pigs. Not all landowners experience similar amounts of damage and therefore attitudes regarding the significance of the wild pig problem in Georgia differ widely among citizens. Respondents from a previous wild pig survey in Georgia (farmers in ¹/₄ of the state) felt most control measures were ineffective and that state and federal agencies should provide more assistance. Previous respondents perceived a decline in some native game species and blamed wild pigs. I conducted a statewide survey of 3,000 landowners in February 2015 to assess broader perceptions towards wild pigs, estimate economic losses from wild pig damage, and determine attitudes toward wild pigs. Overall response rate was 38% (n = 1,109). Analysis suggests that farmers have more direct contact than other landowners with wild pigs and therefore shoulder more of the costs related to damage (e.g., crop loss, food plot, and timber damage). Statewide, respondents favor measures to reduce wild pig populations. Respondents believe wild pig populations are increasing due to lack of hunting, natural reproductive potential, and illegal trap and transfer. Generally, respondents felt that self-implemented lethal control measures were not effective at reducing wild pig populations or damage.

KEY WORDS: damage assessment, economic impact, feral swine, Georgia, landowners, opinion survey, questionnaire, *Sus scrofa*, wild pig

INTRODUCTION

Swine (*Sus scrofa*) are not native to United States. Most authorities believe the Spanish in the mid-1500s (Tisdell 1982) first introduced them. Many feral swine present in our forests and fields today are descendants of farm animals turned loose from family farms during the Depression and early part of the 20th century. Other feral swine originated from animals intentionally released for stocking and hunting opportunities, a practice that is generally illegal throughout most of the South.

Anecdotal reports as well as published sources (Mayer and Brisbin 1991) suggest that some stock was imported from Europe: so called "Russian boars" or "Russian wild hogs." The first introduction was in 1886 (Mayer and Brisbin 1991) followed by other introductions including the well-known 1912 introduction at Hooper Bald near the Great Smoky Mountains National Park (Brill 2011). All pigs (or feral swine) are the same species and there is no biological difference between farm pigs, wild boars, wild pigs, feral swine, or feral hogs. Farm pigs will revert to the ancestral color, size, and attitude of "wild boars" within a few generations. No matter what we call them, free-ranging wild pigs can be very destructive to forests, farms, orchards, crops, and timber plantations (Campbell and Long 2009). They can also be a challenging animal to hunt and are pursued by many big game hunters throughout the southeastern U.S. Wild pigs occur in 38-42 states. In most cases, they cause significant financial Wild pigs may transmit and ecological damage. important diseases to humans, domestic livestock, wildlife, and pets. Swine brucellosis, a significant disease in domestic livestock and wild ungulates, occurred in 53% of samples from Florida and 18% in South Carolina (Hartin et al. 2007).

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Physical descriptions of wild pigs and valuable information about their management, control, spread, ecology, and biology are available in recent publications (West et al. 2009, Hamrick et al. 2011, Foster and Mengak 2015). While information is easily available on the biology and ecology of wild pigs, less is known about their management, control, and impacts to farms, agricultural producers, and landowners (Miller 1993, Rollins 1993, Harper et al. 2016). Few studies are available on public attitudes towards wild pigs and their presence in the environment (Harper et al. 2016). The objectives of this project were to use a statistically valid and reliable survey methodology to: 1) assess the extent of wild pig distribution in Georgia, 2) assess the damage (physical and economic) attributable to wild pigs in the state, and 3) gather information on the opinions of landowners regarding the presence of wild pigs in the state.

STUDY AREA

Georgia has the largest land area of any state east of the Mississippi River (57, 513 mi²) and has a 2015 human population of 10.2 million, ranking it 8th among all states in total U.S. population. Georgia is divided into 159 counties and 14 U.S. Census Bureau, Metropolitan Statistical Areas (MSAs) (U.S. Census Bureau 2015). Large metropolitan areas include Atlanta, Augusta, Savannah, Columbus, Macon, and Athens. Total 2014 population estimate in MSAs was 8.4 million (82.4% of state total population). Large metropolitan areas include all or parts of 52 counties. Georgia consists of over 25 million acres of forestland (Georgia Forestry Commission 2016) and over 9.6 million acres of farmland (Georgia Farm Bureau 2016).

METHODS

For this study, I did not sample counties in the MSAs with a human population exceeding 50,000. I purchased landowner names and addresses from Survey Sampling International (SSI, Shelton, CT). Names were sorted into two groups: farmers (registered with USDA NRCS or other government farm assistance programs), and rural landowners (hereafter "non-farmers"). I defined non-farmers as rural landowners who owned \geq 5 acres of land in non-MSA areas or MSA counties with a population less than 50,000. There were 4,759 names on the farmer list and 19,312 names on the non-farmer list. I obtained a proportional random sample of 3,000 farmers and non-farmers from SSI (594 farmers and 2,406 non-farmers). The total sample of 3,000 names was arbitrarily determined by the funding available for this survey.

I developed an eight-page questionnaire during fall 2014 that was a modification of a recently conducted wild pig survey in Georgia (Mengak 2012). I took questions from similar wild pig surveys recently completed in Texas, Mississippi, Alabama, and Louisiana. In addition, I modified questions from a recent survey of Georgia residents regarding attitudes towards black bears in Georgia (Agee and Miller 2009). All questions were modified (re-written or re-phrased) to apply to Georgia and to wild pigs. Experts in survey research also provided input in the survey design. The University of Georgia Office of The Vice President for Research Institutional Review Board approved the final questionnaire (IRB Study #00001660; approved 5 January 2015). The final questionnaire can be obtained from the author. An information letter and list of frequently asked questions was developed and included in material sent to all randomly-chosen survey participants.

The first mail package consisted of: 1) the questionnaire, 2) the information letter, 3) the FAQ sheet, and 4) a postage-paid pre-addressed return envelope. The first mailing of 3,000 survey packets was sent on 4 February 2015, and a reminder postcard was mailed on 18 February 2015. I deleted returned and undeliverable addresses from the dataset. Another complete survey packet was mailed to each non-respondent on 4 March 2015. Accounting for undeliverable surveys (due to bad address, deceased individuals, miscellaneous undeliverable reasons), 2,939 surveys were delivered.

A technician entered all data into an EXCEL spreadsheet and every entry was checked for accuracy by a second technician. Data analysis was conducted in both EXCEL and SPSS (IBM, Version 23, August 2015). Data analysis consisted of frequency histograms and percentage responses for qualitative and binomial (Yes-No) questions, and means (and standard deviation) for numerical data.

For the economic analysis and summary, I summed the dollars of damage reported by all respondents and summed the acreage reported by the respondents, then calculated a per-acre mean estimate of damage. If a dollar amount or an acreage amount was not reported, that survey was not used in this calculation. Responses were summarized for each UGA Cooperative Extension District. For crop damage estimates, there were only two data points from the Northwest District, so I combined the Northwest and Northeast District results. For non-crop estimates, there were only four data points from the Northwest District, so I combined the Northwest and Northeast District results. I applied the calculated average dollar amount lost per acre to the total farm acres in non-MSA counties in each District (Table 1) to arrive at the total dollar loss for the district. I completed similar calculations for the reported average dollar amount lost per acre for non-crop items.

District	Acres in Farmland	Acres Included in this Survey	Percent Included
Northeast	1,468,833	1,380,950	94.02
Northwest	1,253,893	1,019,980	81.35
Southeast	2,803,890	2,749,799	98.07
Southwest	4,080,422	3,902,617	95.64

Table 1. Distribution of farmland acreage among the fourCooperative Extension Service districts in Georgia in2015.

The survey also consisted of 19 Likert scale questions intended to measure general attitudes and beliefs about feral swine. The results of the attitude/belief statements are not presented here but are available in the 2015 Georgia Feral Swine Survey Final Report from the author or on the Georgia Wild Pigs website (www. georgiawildpigs.com).

RESULTS

Background

Using statistics on Georgia agriculture from the Georgia Statistics Database - County Guide at the UGA College of Agriculture & Life Sciences (UGA 2015), a background profile on the state of agriculture in the approximately 100 counties receiving surveys was The most recent figures in the Georgia assembled. Statistics Database are from 2012. Georgia is divided into four districts by the UGA Cooperative Extension Service (UGA Extension 2015), and each district consists of approximately 40 counties. Farms cover 9,620,836 acres of land in Georgia with 42,257 individual farms (2012 data; Georgia Farm Bureau 2016). Agriculture contributes over \$72.5 billion to the state economy, and the 2013 total Farm Gate value of all farm products was \$13.6 billion. Most acreage is located in the southern half of the state (Table 1). Deleting counties in the MSAs with over 50,000 people resulted in total farmland acreage of 9,053,346 (94.24% of total farmland acreage). Most deleted acres were in the Northwest district, which included the Atlanta MSA and surrounding counties.

Demographic questions were included in Section III of the survey. There were 1,109 useable returned surveys. Males made up 65.6% of respondents while females made up 29.2% and 5.2% of respondents did not answer the gender question. The average age of all respondents (n = 1,040) was 64 years. Average age by gender was 63.8 years (SD = 12.46 years) for males and 64.3 years (SD = 12.08 years) for females (F = 0.207, P = 0.813). Respondents (n = 1,045) reported living on their land for an average of 28.2 years (SD = 16.72 years). Respondents (n = 1,051) have lived in Georgia for an average of 53.34 years (SD = 19.67 years).

On two general knowledge questions, 81.1% (n = 899) of respondents reported that they knew feral swine could be a problem for landowners, while 14.2% (n = 158) reported not knowing feral swine could be a problem and 4.7% (n = 52) did not respond to this question. On the question "Are feral swine considered native wildlife in Georgia or a non-native species," 17.1% (n = 190) responded "native," 36.3% (n = 403) responded "non-native," 40.7% (n = 451) are "unsure," and 5.9% (n = 65) did not answer this question.

When asked, "In the past 2 years, have you attended any type of feral swine education event or program in Georgia?" 92.6% (n = 1,027) responded "no," 2.5% (n =28) responded "yes," and 4.9% (n = 54) did not respond. When asked, "Are you a non-agricultural landowner such as forester, consulting forester, wildlife biologist, real estate agent, etc.," 72.0% (n = 799) responded "no," 21.8% (n = 242) responded "yes," and 6.2% (n = 68) did not respond.

Instructions directed respondents to continue with the survey if they had feral swine on their land, otherwise, they were instructed to skip ahead to opinion statements and demographic questions. Only 318 people reported that feral swine were present on their land, so there should be a maximum of 318 responses to most of the remaining questions. However, this was not the case, as many survey respondents ignored or did not fully understand the instructions to skip ahead to the demographic and opinion questions. Therefore, many answers had a sample size greater than 318. I combined all responses without regard to the category "farmer" or "non-farmer" of the respondent. For the remainder of this summary, I report only results related to occurrence of wild pigs, type of damage, and economic impact.

Responses to Questions

Q. Are feral swine present on your land? (Please circle one)

Feral swine occurred on property owned by 318 (28.7%) respondents, while 2.5% of respondents left this question blank (Figure 1). Respondents were asked if they hunted or shot feral swine on their land, and if they allowed others to hunt or shoot feral swine on their land. I received 388 responses to the first sub-question and 217 (55.9%) respondents hunt or shoot feral swine on their land. I received 382 responses to the second sub-question and 234 (61.4%) respondents allow others to hunt or shoot feral swine on their land.

Q. Have feral swine ever caused any type of damage to your land?

There were 459 responses to this question and 288 (62.7%) respondents reported feral swine had inflicted damage to their land.

Q. What is the <u>Primary</u> use for this land?

Respondents were instructed to select a single, primary use for the largest parcel they reported to own/lease/rent. There were a total of 464 answers to this question from 382 individual respondents, meaning that respondents often selected more than one primary land use. The most frequently selected land use was row crop production, followed by "other" (Figure 2). A total of 117 respondents reported that row crops production was the primary use, and 82 listed a crop. Peanuts was the most often named crop (28 respondents), followed by corn (22 respondents) and cotton (19 respondents). Other crop uses include blueberries (n = 1), soybeans (n = 3), vegetables (n = 1), wheat (n = 2). In the category "livestock production," cattle were listed by 55 of 61 respondents. Other livestock included chickens, hogs, horses, and sheep (listed once each).



Figure 1. Prevalence of feral swine on private property as reported by rural landowners responding to the Georgia 2015 Feral Swine survey. Survey administered between 4 February 2015 and 4 March 2015 to rural landowners in Georgia. Responses based on 1,109 useable surveys returned.



Figure 2. Primary land use (%) reported by respondents (n = 382) to the 2015 feral swine survey conducted between 4 February 2015 and 4 March 2015 in Georgia.

Q. When did you first notice feral swine or damage related to feral swine on this property?

There were 324 responses to this question, with 156 (48.1%) respondents reporting that feral swine or feral swine damage has been present for more than five years, and only 19 (5.9%) stated that 2014 was the first year they notice feral swine or feral swine damage (Figure 3). Similar to the 2012 Georgia Wild Pig Survey, the current year was the least frequently chosen response, while "more than 5 years ago" was the most frequently chosen. In 2012, 56.3% of respondents indicated that feral swine have been a problem since prior to 2007. The current survey confirms that feral swine remain a serious pest, and with 6% of respondents reporting 2014 as the first year for swine or damage, this suggests the problem may be expanding across the state but has been a significant issue for landowners for many years.



Figure 3. Reported time when feral swine or evidence of their presence was first noticed by respondents to the 2015 feral swine assessment survey administered between 4 February 2015 and 4 March 2015 to rural residents in Georgia.

Q. During 2014, which of the following were damaged by feral swine? (Please select ALL that apply)

Respondents indicated the type or types of damage they suffered from a list of damage events. The two most frequently selected types of damage were damage to nontimber cash crops, and damage to food plots (Table 2). Responses to the choice "other" included damage to roads (n = 8), rooting in forest (n = 5), personal injury to human or domestic stock (n = 4), damage to deer feeders (n = 2), and answers unable to be classified or "none" (n = 13).

Q. Please tell us the crops you grow or produce that were damaged by feral swine. (Please select all that apply)

There were 272 responses to this question. Hay fields/pastures were the primary crop reported damaged by feral swine, followed by peanuts, corn, and timber (Figure 4). Minor crops also reported as damaged by feral swine include watermelon (n = 13; 4.8%), blueberry/blackberry (n = 9; 3.3%), fruit trees (n = 7; 2.6%), landscape/yards (n = 7; 2.6%), pecans (n = 7; 2.6%), sunflowers (n = 2; 0.7%), mushrooms (n = 1; 0.4%), and "reefer" (n = 1; 0.4%).

Q. During 2014, what type of damage did you have? (Please select all that apply)

Not all survey respondents were farmers, so this question was intended to examine damage from feral swine in a more general sense. It asked the type of damage rather than the specific crop receiving the damage. There were 297 responses to this question. Rooting (or grubbing) and wallowing were the most frequently reported type of damage (Figure 5). Minor damage (reported by less than 5% of respondents) included damage to irrigation equipment or pipes (n = 8; 2.7%), injury to livestock (n = 5; 1.7%), disease transfer to domestic pigs (n = 5; 1.7%), and injury to pets (n = 4; 1.3%). In the category "other," damage reported included decreased hunting opportunities or wildlife habitat destruction (n = 4), damage to food plots (n = 2), damage to crops (n = 2), damage to deer feeders (n = 1), damage to pine straw production (n = 1), and odor (n = 1).

Table 2. Damage reported by 307 respondents to the Georgia Feral Swine impact assessment survey conducted between 4 February and 4 March 2015 by mail questionnaire sent to 3,000 residents across Georgia. Responses exceed 100% because multiple answers were possible.

Type of Damage	Response Count	Response Percent	
Damage to non timber each cron	136	14.3	
Damage to non-timber cash crop	130	44.5	
Damage to food plots	130	42.3	
Damage to pastures	119	38.8	
Damage to streams or ponds	84	27.4	
Damage to landscapes or yards	70	22.8	
Damage to timber	70	22.8	
Damage to fences	40	13.0	
Damage to equipment	8	2.6	
Damage to stored commodities	3	1.0	
Other types of damage not listed above	32	10.4	
Total number who answered this question	307		



Figure 4. Crops reported most often damaged by feral swine based on 272 responses to the 2015 Georgia Feral Swine survey. Only crops reported by at least 5% of respondents are listed here, see text for additional crops reported damaged by feral swine.



Figure 5. Types of damage most frequently reported due to feral swine based on 297 responses to the 2015 Georgia Feral Swine survey. Only damage categories reported by at least 5% of respondents are listed here, see text for additional damage reported by survey respondents.

Q. Estimates of financial damage due to feral swine. (a) Please estimate your losses to crops and/or crop related damage (i.e., equipment damage, etc.) by feral swine during the past year.

(b) Please estimate your losses to items other than crops (i.e., timber, food plots, lease values, etc.) caused by feral swine during the past year.

I received 132 surveys with useable data for this analysis. The Southwest District, which has the largest amount of farmland acreage, reported the highest dollar estimate of crop damage (Table 3). Based on dollar losses reported in this survey, the estimated loss in 2014 statewide due to feral swine was \$98.87 million to crops and \$ 51.74 million to non-crop property. The combined estimated economic impact by feral swine to crops and other property exceeded \$150.61 million in Georgia in 2014.

Q. Because of damage you expected to receive from feral swine, did you avoid planting one crop (which would receive high damage and plat a crop of lower value?

(a) If you answered "YES" to this question, what crop (or crops) did you avoid planting because you expected feral swine damage?

(b) If you answered "YES" to this question, which crop did you plant instead?

(c) How much money do you estimate that you LOST because feral swine caused you to plant a lower value crop? This is the difference between the dollars you would have earned if you planted the higher value crop compared to the dollars you earned from planting the lower value crop.

Of the 281 responses to this question, 198 (70.5%) respondents stated that they did not plant a crop of lower

Table 3. Total economic cost in	crop and non-crop damage base	d on self-reported estimates t	from respondents to the 2015
feral swine assessment survey	y administered between 4 Februar	y 2015 and 4 March 2015 to r	ural residents in Georgia.

Extension District	Damage reported in this District (\$)	Number of Responses	Average loss per acre of farmland (\$)	Total estimated losses (\$)
		Crop	000000	
Northeast	\$ 44.100	24	L05565	
Northwest	\$ 600	2		
Combined NE & NW	\$ 44,700	26	\$ 11.53	\$ 27,682,722
Southeast	\$ 371,450	55	\$ 11.98	\$ 32,942,592
Southwest	\$ 478,800	51	\$ 9.80	\$ 38,245,646
Total				\$ 98,870,961
		Non-(crop Losses	
Northeast	\$ 28,000	22		
Northwest	\$ 6,350	4		
Combined NE & NW	\$ 34,350	26	\$ 8.24	\$ 19,783,663
Southeast	\$ 149,460	42	\$ 6.47	\$ 17,791,200
Southwest	\$ 99,000	34	\$ 3.63	\$ 14,166,500
Total				\$ 51,741,363

Table 4. Perceived reasons for increasing feral swine populations in Georgia based on the 2015 Georgia feral swine survey conducted between 4 February 2015 and 4 March 2015 in Georgia.

Perceived reasons for feral swine increase	Number	Percent	
Lack of hunting pressure	148	54.4	
Natural causes	125	52.9	
Illegal release or transfer	116	42.6	
Hunt clubs are releasing them	78	29.0	
Neighbor's management practices	39	15.4	
Wildlife department policy	19	7.0	
Domestic producers	18	6.6	
Timber management is changing	10	4.8	
Other	9	3.3	
Stock laws	3	1.5	
Local government	3	1.5	

value, while 65 (23.1%) respondents said "Yes," and 18 (6.4%) respondents were unsure. Respondents had the opportunity (sub-question 'a') to list one or more crops they avoided planting. Of the crops listed, peanut or peanuts in combination with other crops was listed by 31 (47.7%) respondents; corn or corn in combination with other crops was listed by 19 (29.2%) respondents. Other crops listed include alfalfa, chufa, clover, soybeans, sunflowers, vegetables, and wheat. The most common responses to sub-question 'b' included cotton or cotton in combination with other crops (n = 32; 49.2%), nothing planted (n = 10; 15.4%), followed by numerous other crops or combinations. There were 34 responses to subquestion 'c'. While the sample size was very small, respondents reported a mean dollar value lost (because they planted a lower value crop) of \$14,416.91 per respondent (SE = 3,443.16; range = 25-100,000).

Q. Did you take any action to correct the problem?

Of 281 answers to this question, 85(30.2%) respondents said "No" while 196 (69.8%) respondents answered affirmatively.

Q. When you have had damage, did you seek outside help?

(a) If you sought outside help, please tell who you contacted.

Of 295 responses, 113 (38.3%) respondents said they sought outside help, and 182 (61.7%) respondents said they did not seek outside help. Of those seeking outside help, the most frequent response was "other" (n = 83) and the second-most-frequent response was to use a private hog control company (n = 61 respondents). Additional responses included: Cooperative Extension Service (n =24), Georgia Wildlife Resources Division (n = 10), USDA/APHIS Wildlife Services (WS) (n = 5), and Georgia Forestry Commission (n = 3). With the exception of USDA APHIS WS, these state agencies do not provide operational assistance with feral swine. Of the respondents selecting "other," 68 respondents listed some form of "hunting" as the method used, followed by family or neighbors trapping feral swine. Hunting generally included the landowner, family, neighbors, and/or friends. Of 151 respondents, 117 (77.5%) reported that they would seek help from the same source, while 23

(15%) said they would not seek help from the same source, and 11 (7%) were unsure.

Q. Considering the current population of feral swine on land you own, lease or rent – how has the population changed in the following time spans? (Please circle one answer in each row).

Respondents were asked to select one choice from "Lower," "Same," "Higher," or "Unsure" for each of three time steps: last year (2014), three years ago (2012), or five years ago (2010). Of respondents, 292 (38%) felt the feral swine population was "higher" than last year (2014), while 51.8% and 53.4% felt the population was "higher" than three and five years ago, respectively.

Q. If feral swine are increasing, what do you think is/are the reasons? (Please select all that apply)

There were 272 total responses to this question. Most respondents felt that lack of hunting pressure and natural causes were the primary reasons for any perceived increase in feral swine population (Table 4). When asked to fill in responses for the choice "Other," respondents wrote in responses such as "prolific breeding," "rapid reproduction," and "reproduction rate." Answers such as these were re-coded as "natural causes" and included in the count for that answer choice. Other re-coded responses included "safe havens like government land and unhuntable private land" (neighbor), "WMAs in Burke and Jenkins County create safe haven" (neighbor), "stock laws need to be improved - no transport" (stock laws), and "many hunt clubs refuse to let them be hunted" (neighbor). Generally, respondents suggested that lack of hunting pressure and the naturally high reproductive rate of feral swine combined to create many of the current population problems. In other words, respondents seem to understand that high reproductive output and little or limited hunting are the underlying causes of the feral swine problem (Table 4). This may suggest a basic understanding among the general rural public that hunting alone will not reduce feral swine populations or problems.

DISCUSSION

Over 25% of respondents to the 2015 Georgia feral swine survey have pigs on their land, and 62.7% of respondents suffered damage from feral swine. In a recent survey of limited-resource farmers, only 29% of those surveyed reported property damage due to feral swine in the last three years (Slootmaker et al. 2016). Fifty-six percent and 61%, respectively, of respondents in my survey hunt/shoot feral swine or allow others to hunt/shoot feral swine on their land. Yet respondents widely report damage, indicating that hunting/shooting alone is not controlling feral swine population growth. Nearly 50% of survey respondents reported that feral swine have been a persistent problem for more than five years. Feral swine damage, or are perceived to damage, all types of crops, equipment, habitat, and wildlife populations with no relief on the horizon. Respondents seem to have noticed increasing feral swine populations from 2010 to 2012, but fewer respondents felt the population had increased from 2013 to 2014. This may indicate the feral swine populations are "leveling" off in most areas. Alternatively, people may be more accustomed to the population size and are not noticing a change in population size, and thus are resigned to the current level of swine.

Crops reported damaged in this survey did not differ substantially from the 2012 survey (Mengak 2012). In 2012, peanuts were the most frequently damaged crop, followed by corn (54.6%), cotton (36.9%), and timber (30.5%). Differences between the two surveys may be due to the geographic area covered by each survey. The 2012 survey covered only southwest Georgia, while the 2015 survey was statewide. Also, in the 2015 survey, hay fields/pastures were damaged in all four Cooperative Extension Districts across the state, while peanut, corn, and cotton damage was largely confined to the SE and SW Cooperative Extension Districts (i.e. the primary area where these commodities are produced).

Survey respondents overwhelmingly (81%) know that feral swine can be a problem for landowners, but more that 57% thought feral swine are a native species or do not know their origin. This lack of knowledge on some basic aspects of the feral swine problem presents both opportunities for educational outreach and difficulties for managers when they attempt to consolidate support for more stringent control measures.

Economic impacts of feral swine are difficult to estimate. These figures reported here may be conservative or excessive. Accuracy depends on the skill, ability, and honesty of the survey respondent to self-report losses. Damage from wild pigs takes many forms. One survey respondent reported that a sounder of pigs might damage 2-5 acres in a 100-acre peanut field; the damage may be scattered across the entire field. Losses thus take the form of lost harvest and also wasted fertilizer, irrigation water, tractor time, and operator time. Such losses are subtle and not easy to quantify across the entire state. However, such losses are very real and perhaps significant to an individual. As is often the case with wildlife damage, a small percentage of producers may bear the majority of the damage; everyone does not equally share damage.

Perhaps the most widely quoted estimate of feral swine damage is \$1.5 billion annually, nationwide (Pimentel 2007). However, recent attempts to estimate feral swine damage have suggested this estimate should be revised upward. Pimentel (2007) attributed crop damage and control costs of \$300 per pig annually to arrive at his damage estimate. Keeping the same dollar amount per pig, but using a recent estimate of 6.293 million pigs in the U.S. (Mayer 2016), raises the national estimate of damage to \$1.88 billion annually. Taking into account inflation, and accounting for improved damage reporting practices including elevated awareness of feral swine impacts, it is logical to assume a higher per-pig damage estimate. At \$350 per pig, the national impact of feral swine would be \$2.2 billion.

To the extent that damage is scattered among producers and diffused across the landscape, the figures reported here might be conservative. The caveat is that this is a crude estimate of damage, as reported by survey respondents. Further refinement of these survey methodology with on-site field verification and damage cost estimates will require additional research that may need to be site specific rather than region-wide. However, the figures give an approximate starting point for future discussion around the overall negative financial impacts of feral swine.

LITERATURE CITED

- Agee, J. D., and C. A. Miller. 2009. Factors contributing toward acceptance of lethal control of black bears in central Georgia, USA. Human Dimens. Wildl. 14:198-205.
- Brill, D. 2011. Wild hogs and wild times on Hooper Bald. Smokies Life Magazine 5(1):47-54.
- Campbell, T. A., and D. B. Long. 2009. Feral swine damage and damage management in forested ecosystems. Forest Ecol. Manage. 257:2319-2326.
- Foster, M., and M. T. Mengak. 2015. Georgia landowner's guide to wild pig management. River Valley Regional Commission, Columbus, GA. 102 pp.
- Georgia Farm Bureau. 2016. Agriculture: Georgia's \$74 billion industry. Website. Georgia Farm Bureau, Macon, GA. http://www.gfb.org/aboutus/georgia_agriculture.html. Accessed on 8 June 2016.
- Georgia Forestry Commission. 2016. Forest Management. Georgia Forestry Commission, Covington, GA. http://www .gfc.state.ga.us/forest-management/. Accessed 8 June 2016.
- Hamrick, B., M. Smith, C. Jaworowski, and B. Strickland. 2011. A landowner's guide for wild pig management: practical methods for wild pig control. ANR-1397, Alabama Cooperative Extension Service, Auburn, AL. 42 pp.
- Harper, E. E., J. J. Vaske, C. A. Miller, M. T. Mengak, and S. Bruno. 2016. Stakeholder attitudes and beliefs toward wild pigs in Georgia and Illinois. Wildl. Soc. Bull. 40(2):269-273. doi: 10.1002 /wsb.653
- Hartin, R. E., M. R. Ryan, and T. A. Campbell. 2007. Distribution and disease prevalence of feral hogs in Missouri. Human-Wildl. Confl. 1(2):186-191.
- Mayer, J. J. 2016. Estimation of the number of wild pigs found in the United States. Poster Presentation, 2016 International Wild Pig Conference: Science, Management, and Solutions. April 17-20, 2016, Myrtle Beach, SC.
- Mayer, J. J., and I. L. Brisbin, Jr. 1991. Wild Pigs of the United States: Their History, Morphology, and Current Status. University of Georgia Press, Athens, GA. 313 pp.
- Mengak, M. T. 2012. 2012 Georgia wild pig survey: final report. Outreach Publication WMS-12-16, Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA. 42 pp. Revised 8 June 2015.
- Miller, J. E. 1993. A national perspective on feral swine. Pp. 9-16 in: C. W. Hanselka and J. F. Cadenhead (Eds.), Feral swine: A Compendium for Resource Managers. Texas Agricultural Extension Service, College Station, TX.
- Pimentel, D. 2007. Environmental and economic costs of vertebrate species invasions into the United States. Pp. 2-8 *in*: G. W. Witmer, W. C. Pitt, and K. A. Fagerstone (Eds.), Managing Vertebrate Invasive Species: Proceedings of an International Symposium. USDA APHIS WS National Wildlife Research Center, Fort Collins, CO.

- Rollins, D. 1993. Statewide attitude survey on feral hogs in Texas. Pp. 1-8 *in*: C.W. Hanselka and J. F. Cadenhead (Eds.), Feral swine: A Compendium for Resource Managers. Texas Agricultural Extension Service, College Station, TX.
- Slootmaker, C., E. Harper, A. Anderson, J. Holderieath, and S. Shwiff. 2016. Economic impacts of feral swine on limited resource farmers in the United States. Final Report. USDA APHIS WS National Wildlife Research Center, Fort Collins, CO. 75 pp.
- Tisdell, C. A. 1982. Wild Pigs: Environmental Pest or Economic Resource? Pergamon Press, Sydney, Australia. 454 pp.
- UGA. 2015. The Georgia County Guide. Carl Vinson Institute for Government, and University of Georgia Extension, Athens, GA.
- UGA Extension. 2015. About Extension: County Offices. Website. University of Georgia Cooperative Extension, Athens, GA. http://extension.uga.edu/about/county/index .cfm. Accessed 8 June 2016.
- U.S. Census Bureau. 2015. Current lists of metropolitan and micropolitan statistical areas and delineations. Website. Census Bureau, U.S. Dept. of Commerce. http://www .census.gov/population/metro/data/metrodef.html
- West, B. C., A. L. Cooper, and J. B. Armstrong. 2009. Managing wild pigs: A technical guide. Human-Wildl. Interact. Monogr. 1:1-55.