THE INFLUENCE OF KNOWLEDGE GAINED AND THE LIKELIHOOD OF RECOMMENDING TEXAS A&M AGRILIFE EXTENSION SERVICE ON THE PLANNED ADOPTION OF WILD PIG CONTROL TECHNIQUES

A Thesis

by

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ABSTRACT

Wild pigs are an exotic invasive species in Texas that cause severe economical and ecological damage. Educational programs have been conducted to disseminate best practice management plans in order to mitigate the growth and damage of this species. The purpose of this study was to determine knowledge gained and plans to adopt practices for wild pig control in the framework of Rogers' theory of diffusion of innovations, Ajzen's Theory of Planned Behavior, and Knowles' Theory of Andragogy. Data collected from the Statewide Wild Pig Damage Abatement Pilot Project, conducted from 2006-2014, were analyzed.

Pastures and owner or employee time are the areas of most concern to landowners who attended a program. The technique most used prior to the program was trapping and destroying. Data suggested that all regions experienced overall reductions in loss as a result of participating in an Extension program. Landowners felt Extension programs were successful at transmitting knowledge in four areas. Landowners indicated they were most likely to adopt methods related to trapping. Extension programs reported a high Net Promoter Score, with more individuals willing to recommend Extension than not. The data suggested the Statewide Wild Pig Damage Abatement Project is successful in transferring knowledge to landowners, and this knowledge appears to have a positive effect on the likelihood of landowners to adopt wild pig management practices. The constructs that were the best predictors of likelihood to adopt control practices were efficient trap/bait techniques and total number of control methods used.

DEDICATION

This seminal work is dedicated to my family. You have always encouraged me to be all that I can be, but you have never pressured me. You will never know how much that kind of support meant to me. I knew I could trust you, come to you for help, and that if I failed you would help me get back up and try again. I am truly so blessed to have each of you. This paper is for you. It is a testament of the love and support you have never ceased giving. I thank God every day that he granted me blessings beyond what I deserve. Psalm 46:5.

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NOMENCLATURE

NPS	Net Promoter Score

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CHAPTER I

INTRODUCTION

Invasive species can be defined as those species that are spread from their native habitat to a new niche, usually due to human influence (Praseeda & Newport, 2010). Invasive species are second only to habitat loss as the greatest threat to biodiversity (Park, 2004). Loss of biodiversity negatively affects an ecosystem's ability to withstand and adapt to change (Chapin III, Zavaleta, Eviner, Naylor, Vitousek, Reynolds, & Diaz, 2000). The rapid rate at which ecosystems are currently deteriorating is cause for concern because the fossil record suggests the recovery rate of ecosystems requires millions of years (Novacek & Cleland, 2001). The first step in restoring ecosystems is to remove the invasive species triggering the problem (Blackwood, Hastings, & Costello, 2010). Removal of alien species encourages a rebound in native biodiversity (Genovesi, 2005). However, when an ecosystem's composition is altered, it is nonnative species of flora that recover the most quickly. Invasive species create an environment conducive for other nonnative species to flourish (Tierney & Cushman, 2006). The negative effects of invasive species are now widely acknowledged; as a result, research has begun focusing on identifying ecological and economic problems that result from invasions, and programs are being developed to reduce the impact of invasive species (Pyšek & Richardson, 2010). At times an invasive species population will collapse naturally due to disease or the introduction of a predator; however, this is a rare case and does not permit a rationale for a hands-off management approach (Simberloff & Gibbons, 2004).

Ecology and economics are elements that should be included when analyzing the impacts invasive species have on an ecosystem and consequently on the decision making process (Pejchar & Mooney, 2009). However, there can be many obstacles to this goal, including conflicts between stakeholders. A primary argument between interested parties is a lack of evidence supporting the respective sides (Shine & Doody, 2010). For instance, a survey conducted in Texas revealed farmers and ranchers believed wild pigs often crossed over from neighboring properties (Adams, Higginbotham, Rollins, Taylor, Skiles, Mapston, & Turman, 2005). Whether eradication or mitigation of wild pig populations is the goal depends on the stance of the stakeholder (Massei, Roy, & Bunting, 2011).

Management programs can be helped or hindered by outside pressure groups, so it is important to understand the attitudes of the public. Educational outreach programs can better inform those concerned of the benefits of the eradication program as well as the precautions taken to ensure minimal residual effects (Bremner & Park, 2007). The legality of methods to prevent the introduction and spread of invasive species is not synchronized between the international and national levels (Outhwaite, 2010). There has been a call for federal leadership, in conjunction with all other levels of government, to coordinate and disseminate cost-effective control methods and education programs (Lodge, Williams, MacIsaac, Hayes, Leung, Reichard, Mack, Moyle, Smith, Andow, Carlton, & McMichael, 2006). Much of the research up to this point has been focused primarily on assessing the scope of the problem rather than determining effective solutions (Hulme, 2006).

Managing and decreasing invasive animal populations can be expensive to both individuals and government entities (Olson, 2006). Environmental losses and damages caused by invasive animal species in the United States amount to nearly $120 billion annually (Pimentel, Zuniga, & Morrison, 2005). Additionally, invasive species are the primary factor for listing approximately 42% of species on the Threatened or Endangered Species at Risk list (Pimentel et al., 2005). Species specific control programs may be best suited to reduce invasive species populations, thus reducing the economic and environmental impacts of those species (McMahon, Brook, Collier, & Bradshaw, 2010).

Climate Change

Global warming has been a topic of interest for years, but there is a growing trend to study how complex factors interact to cause this phenomenon. The relationship between climate change and the proliferation of invasive species is of particular interest (Hellman, Byers, Bierwagen, & Dukes, 2008; Rahel & Olden, 2008). Climate change can have an effect on the distribution and spread of invasive species, as well as how suitable an environment is for the survival of a nonnative species (Jarnevich, Bradley, Holcombe, Stohlgren, & Morisette, 2010). Changing climactic conditions can also impact the success or failure of invasive species control programs (Runyon, Butler, Friggens, Meyer, & Sing, 2012). Conversely, nonnative species can also influence climate change; for instance, invasive plants can affect water and soil composition, quality, or amount (Strayer, Eviner, Jeschke, & Pace, 2006). Ecosystem adaption entails strengthening the resilience of an ecosystem to climate change, thereby to some extent

reducing the ability of some invasive species to spread as rapidly (Burgiel & Muir, 2010). Government and citizen awareness and involvement will be instrumental in developing programs that analyze the relationship between climate change and invasive species, as well as developing a platform to research future potential solutions (Crowl, Crist, Parmenter, Belovsky, & Lugo, 2008).

Food Security

Population growth and the correlated increase in food consumption threaten to create a deficit in the food supply as demand grows beyond what can be produced (Godfray, Beddington, Crute, Haddad, Lawrence, Muir, Pretty, Robinso, Thomas, & Toulmin, 2010). The World Health Organization revealed that more than three billion people globally are considered malnourished (Pimentel, 2005). A study done on household food security revealed that there has been a decrease in food security in the United States (Nord, Andrews, & Carlson, 2005). Food security encompasses not only access to food sources, but also to clean water and proper sanitation (Pinstrup-Andersen, 2009). By impacting the climate and ecosystem which they invade, invasive species can have a dire impact on food security; crop losses due to invasive species including pathogens, weeds, and insects amount to over $60 billion in the United States (Ziska, Blumenthal, Runion, Hunt, & Diaz-Soltero, 2011).

Based on current trends, invasive species of pests and pathogens will have reached many food-producing countries within the next few decades (Bebber, Holmes, & Gurr, 2014). Invasive species not only affect the yield and quality of crops, but also they impact how efficiently resources are used in the environment (Lucas, 2011). For

instance, invasive species that do not directly affect a crop might harbor diseases that subsequently impact the productivity of the ecosystem, including crops. Disease emergence and the invasion of nonnative species have many parallels; analyzing the similarities may offer insight into how and where they may spread as well as control and management that may be multidisciplinary (Hatcher, Dick, Dunn, & Perkins, 2012). Innovative crop species are potentially invasive and could present a myriad of problems to the region they are introduced into, as well as in regions in which they are already established (Sheppard, Gillespie, Hirsch, & Begley, 2011). Unfortunately, the geographical distribution of pests is poorly understood and in countries where studies are completed a true picture of the invasive species may not develop due to lack of funds (Bebber, Holmes, Smith, & Gurr, 2014).

Control of Invasive Species

An issue with control is the economic cost associated with implementing methods (Buhle, Margolis, & Ruesink, 2005). It is important to identify at what stage the invasive species is most susceptible to control methods, as well as to take into account extraneous factors that might influence success of the control method, in order to approach control in a cost effective manner (Buhle et al., 2005). One biological control method that has been employed is to introduce natural enemies in order to reduce population numbers; however, there is debate about whether this has an unintentional negative effect on nontarget species (Messing & Wright, 2006). While invasive species are opportunistic and can survive in many types of habitats, nutrient rich environments are more likely to have proliferous populations of invasive species because there are

provisions to support the growth of the population (Funk & Vitousek, 2007). Whether to target core populations or outliers first depends on budget and species, but determining if there is a stage that might be more susceptible can increase the effectiveness of a control program (Taylor & Hastings, 2004). When possible it is beneficial to identify an invasive species when it is first entering an area; population numbers are lower so successful control is more likely (Mehta, Haight, Homans, Polasky, & Venette, 2007).

Previous Research On Attitudes Regarding Invasive Species

A study was conducted in Oregon that used the Theory of Planned Behavior (Ajzen, 1985) as a framework for investigating how different recreation groups assess and implement behaviors to reduce the spread of invasive species. This study identified belief barriers and suggested that targeted education and communication may be the most effective methods of influencing current norms and beliefs (Prinbeck, Lach, & Chan, 2011).

Educational Programs on Invasive Species

A study was conducted in Portugal regarding perception of invasive plant species. Identification and control of invasive plant species, as well as competition between native and invasive species, were covered in a workshop; then, a year later a questionnaire was sent to participants. This questionnaire revealed an increase in workshop participants' knowledge, suggesting that practical informal education activities may be effective educational tools (Reis, Marchante, Freitas, & Marchante, 2011).

Another program employed an online citizen science teaching method in order to increase data collection and monitoring of invasive species. However, it was determined that online training may not be sufficient for imparting the knowledge and skills the training was hoping to accomplish (Newman, Crall, Laituri, Graham, Stohlgren, Moore, Kodrich, & Holfelder, 2010). An educational program that sought to increase the scientific literacy of citizen volunteers saw some success in the use of multi-item contextual instruments (Cronje, Rohlinger, Crall, & Newman, 2011).

Wild Pigs as an Invasive Species

The National Wild Pig Committee has adopted the term "wild pig" as the common name to describe North American populations of feral pigs, feral hogs, feral swine, wild boars, and other populations of the family Suidau (Mayer & Brisbin, 1991). Wild pigs are considered an invasive species in Texas, with approximately 2.6 million head occupying 85% or more of the counties in Texas (Higginbotham, Clary, Hysmith, & Bodenchuk, 2008). Rollins, Higginbotham, Cearley, and Wilkins (2007) reported Texas has the largest population of wild pigs of any state in the United States. European wild hogs and European-feral crossbreeds are the types of wild pigs located in Texas (Taylor, 1991). Texas landowners need information on how to best manage wild pigs on their property (Adams et al., 2005). Studies have shown the population of wild pigs in Texas has more than doubled from 1 million (Taylor, 1991) to over 2 million (Rollins et al., 2007) in fifteen years. As of 2013, there are estimated to be over 5 million wild pigs in the United States, with the largest concentrations of wild pigs located in the western and southern states (Plasters, Hicks, Gates, & Titchenell, 2013). Adams and Lindsey

(2005) suggested wild pig control methods which address the long-term, proactive management of wildlife in urban settings.

Existing Wild Pig Educational Programs

In Texas, the Animal Plant Health Inspection Service (APHIS), Wildlife Services (WS) has the goal of providing leadership and expertise in dealing with wildlife damage. This service conducts research, provides assistance, and helps manage and resolve issues between humans and wildlife ("Texas Wildlife Services," 2014). The Texas Wildlife Damage Management Program is a program sponsored by the Wildlife Services program of the United States Department of Agriculture, Animal and Plant Health Inspection Service, the Texas Wildlife Damage Management Service, and the private Texas Wildlife Damage Management Association. These serve as educational institutions aimed at providing organized management activities with a focus on wild pigs to local, state, and federal government agencies and to individuals (Chambers, 1999). Other states have similar programs; for instance, the United States Department of Agriculture Animal Plant Health Inspection Service, Wildlife Services Program in Missouri is responsible for addressing many wildlife damage issues, including offering assistance statewide to landowners, farmers, and business and local governments regarding wild pigs as a nuisance animal (Pierce, Martensen, & Swafford, 2011).

In 1995, farmers in Williamson County, Texas, requested assistance from the Texas Wildlife Services in the development of a wild pig control program. As a result, a public meeting was held during which the extent of damage, previous attempted control efforts, obstacles to successful control programs, and other topics were discussed.

Farmers and landowners offered a variety of opinions and had a range of concerns. By listening to these opinions, a cooperative control program was implemented that has resulted in over 300 pigs removed and decreased reports of pig damage (Muir & McEwen, 2007).

In 2012, the Texas A&M AgriLife Extension Service sponsored the eXtension Wild Pigs Community of Practice webinar series. This series focused on the control, adaptive management, biology, economics, disease risks, and human interface of wild pigs across the United States ("AgriLife Extension Wildlife & Fisheries", n.d.). Topics covered included the history and biology of wild pigs in the United States, control and management techniques, disease issues, and current and future wild pig research. Higginbotham et al. (2008) defined direct control as "on-site technical assistance" (p. 1). Indirect control was identified as group educational events that stressed the use of effective landowner established control methods (Higginbotham et al., 2008).

Control Programs

The Wild Pig Damage Abatement Pilot Project was conducted over a two-year span beginning in January 2006 with funding provided by the Texas Department of Agriculture. This program sought to utilize both direct and indirect control methods of wild pigs and resulted in significant monetary savings over the span of the program (Higginbotham et al., 2008). The focus of the Wild Pig Damage Abatement Project was not necessarily the reduction of wild pig population size; rather, the true determinant of whether a control program was viewed as successful was the reduction of the economic impacts of wild pigs (B. Higginbotham, personal communication, April 20, 2015). Many

wild pig control programs have been unsuccessful due to inadequate funding, lack of clear objectives, unrealistic objectives, and fragmented control programs (Campbell & Long, 2009).

Wild Pig Conferences

The International Wild Pig Conference is held annually and coordinated by Mississippi State University. This conference, the only of its kind, brings together experts from all fields in order to provide stakeholders at the federal, state, and private levels information and initiate discussion about the implications of wild pigs in the United States (“About the conference,” 2014).

Signs of Wild Pigs

The most conspicuous signs indicating the presence of wild pigs are wallows; these are muddy areas near water sources (Pierce, 2009). After wallowing, hogs will usually rub on hard objects such as trees, leaving traces of mud and hair. Other signs, such as feces or tracks, are very similar to those left by deer (Pierce, 2009). Feeding signs vary depending on the food source and can serve as a sign of the prescence of wild pigs. Wild pigs actively scent mark, or leave behind an odoriferous substance, as a way of communication (“Wild pig field sign”, 2013). Scent mark identification can be difficult, but can be recognized by ground markings or trees with bark removed, which are both signs of scent marking (“Wild pig field sign”, 2013). Holes in fences marked with tufts of hair also signal the presence of wild pigs. Shallow depressions, areas where vegetation has been flattened, or dome-like structures are all nesting signs of wild pigs (“Wild pig field sign”, 2013).

Wild Pig Effect on Water

Wild pigs can have a detrimental effect on water quality by increasing levels of waterborne bacteria (Kaller, Hudson, Achberger, & Kelso, 2007). A study conducted by Kaller and Kelso (2006) found that wild pig activity in a coastal plain stream in Louisiana resulted in a change in the composition of the stream, thus leading to an increase in pathogens in the water. In Australia, it was found that natural behaviors of wild pigs can increase the turbidity, or clarity, of the water as well as transmit diseases that threaten drinking water quality (Hampton, Spencer, Elliot, & Thompson, 2006). Foraging can also have a negative effect on aquatic plants (Ditchkoff & West, 2007). Wild pig grazing and trampling can cause significant disturbances to wetland areas, especially during dry periods (Arrington, Toth, & Koebel, 1999).

Wild Pig Effect on Crops

An association has been noted between wild pig rooting and the occurrence of specific plant species upon regrowth. This could be attributed to increased nutrient release due to wild pig rooting (Gates, 2014). A study was conducted over a span of ten years that examined the effects of wild pigs on protected experimental plant plots. It was determined that recently burned plots were less likely to have wild pig invasion, whereas plots that had nitrogen were more likely to be invaded. Plots that experienced wild pig rooting transitioned from wetland priaires to a monotypic stand (Boughton & Boughton, 2014). Rooting by wild pigs can result in two to eight inches of soil being plowed up; several acres can be damaged by a group of wild pigs in a short time period (Pierce, 2009). The rooting and wallowing tendencies of wild pigs can result in holes and ruts

that can lead to equipment damage as well as pose a threat to equipment operators or unwary individuals traversing the fields (Hamrick, Smith, Jaworowski, & Strickland, 2011). Management of wild pigs that are damaging crops can have distinct issues such as difficulty in seeing wild pigs in the crops due to dense foliage cover, proximity of crops to heavy cover such as brush or woods which enhances the ability to escape, and the likelihood of wild pigs running into adjacent properties owned by other landowners who may not allow access onto their property (Muir & McEwen, 2007).

Seward, VerCauteren, Witmer, and Engeman (2004) state that wild pigs cost the United States approximately $800 million in agricultural crop damage per year. This estimate is likely conservative because it does not include other effects wild pigs have on their environment (Seward et al., 2004). In 2011, it was reported that wild pigs cause more than $1 billion in crop damage and predation of livestock (Bevins, Pedersen, Lutman, Gidlewski, & Deliberto, 2014). In Texas, 75% of participants in a survey identified damage to agricultural crops as their most significant concern in relation to wild pigs (Seward et al., 2004). Higginbotham et al. (2008) estimated that wild pigs cause $52 million in agricultural damage in Texas each year.

Wild Pig Effect on Other Species

Wild pigs are opportunistic omnivores and will feed on nearly anything, especially when resources are scarce. According to Giuliano (2010), this competition creates a limiting factor for other species. Wild pigs have been known to prey upon the nests and young of herpetiles such as turtles, ground-nesting birds, and mammals such as deer fawns (Giuliano, 2010). Young domestic livestock have also been predated upon by

wild pigs. Almost any agricultural crop is susceptible to wild pig foraging, as are tree seeds and seedlings (Giuliano, 2010; Mapston, 2007).

Wild Pig Interactions with Humans

Vehicle, train, and aircraft collisions with wild pigs have been documented. Vehicle collisions are the most common, and can be potentially very serious due to the size and low center of gravity of wild pigs. Single pig collisions are the most common, although it has been reported that in one collision 23 animals were involved. Accidents can occur year round and at any time during a 24 hour period, but are more likely to take place in the fall and winter and at night ("Vehicle collisions with wild pigs – eXtension," 2013).

Wild pigs are known to harbor "bacterial and viral diseases that can infect wild animals, livestock, and humans" (Centner & Shuman, 2014, p. 121). The Centers for Disease Control and Prevention state that disease contraction can occur when field dressing, butchering, or eating undercooked wild pigs ("CDC – Hunters: Protect yourself from Brucellosis," 2012). Two common diseases, swine brucellosis and pseudorabies, can be avoided by wearing proper safety equipment, such as gloves and eye protection, and washing hands when field dressing a wild pig ("CDC", 2012; "Texas Parks and Wildlife – Feral Hogs, 2015). These diseases can also be passed on to other animals and livestock (Centner & Shuman, 2014; Hill, Dubey, Baroch, Swafford, Fournet, Hawkins-Cooper, Pyburn, Schmit, Gamble, Pedersen, Ferreira, Verma, Ying, Kwok, Feidas, & Theodoropoulous, 2014).

Spread of Wild Pigs

States that have never had a wild pig problem are being gradually invaded. This is largely due to the illegal transportation and release of wild pigs. Often, these translocations are for hunting purposes (Lang, 2007). In Texas, the transportation, holding, and release of wild pigs is regulated by the Texas Animal Health Commission. The Texas Parks and Wildlife Deparment has jurisdiction over sport hunting of wild pigs. Certified holding facilities can legally hold male or female wild pigs for up to seven days in secure pens or trailers (Timmons, Cathey, Dictson, & McFarland, 2011). Percieved incentives of introducing wild pigs are instrumental in the spread of wild pig populations. These incentives often include increased hunting opportunties and the resulting monetary gains (Plasters et al., 2013). According to The Ohio State University Extension (2014), while wild pigs are most abundant in the southeastern portion of the United States, states as far north as Ohio are dealing with wild pig populations. The last 20 years in particular have have seen a dramatic expansion of wild pig ranges across the United States (Hamrick et al., 2011).

When considering the spread of wild pigs in Texas, it is pertinent to understand the variablility of the climate and ecosystem within the state. The physical regions in Texas include the Gulf Coast Plains, Interior Lowlands, Great Plains, Basin and the Range Province ("Physical Regions of Texas", n.d.). Each of these regions possesses unique characteristics that make them suitable for specific farming or ranching endeavors ("Physical Regions of Texas", n.d.). According to Rowan and White (1994), "As ranch location progressed from east (humid) to west (arid) ranches became larger,

the proportion of livestock income increased, and rancher's reliance on off-ranch employment decreased" (p. 338). Agriculture is an instrumental industry in the Texas and United States economies; however, average farm sizes in Texas have been decreasing in the past twenty years (Gleaton & Anderson, 2008; Gleaton & Anderson, 2012; Texas A&M IRNR, 2014).

Natural Predators of Wild Pigs

Man is the predominant predator of invasive wild pigs. Natural predators in Texas include the American alligator, turkey vultures, red-tailed hawks, golden eagles, owls, feral dogs, coyotes, red wolves, red and gray foxes, black bears, bobcats, ocelots, and mountain lions. Wild pigs have also been known to prey on each other; this situation is not ordinary, but when it occurs immature animals are usually the target. Other species may currently or eventually prey on wild pigs, but at this point there is no documentation of such predation. Despite these current and potential predators, wild pig populations are largely not impacted by predation ("Natural predators of wild pigs – eXtension," 2012).

Control of Wild Pigs

Lethal and nonlethal methods of wild pig control exist. However, nonlethal methods, which include exclusion fences and guard animals to protect livestock, are often ineffective or expensive. Lethal methods, including trapping, snaring, shooting, and dogging, are more practical and as a result are used more often (Hamrick et al., 2011; B. Higginbotham, personal communication, December 2, 2015). Societal opposition to lethal control methods is the impetus for various agencies to produce effective nonlethal control methods (Beringer, Hansen, Demand, & Sartwell, 2002;

Massei et al., 2011; McCann & Garcelon, 2008; Reidy et al., 2008). Studies by wildlife management agencies in Europe identified several methods of controlling wild pigs, including intensive harvest, baiting animals away from fields in order to make it easier to hunt them and to protect crops, and constructing electrical fences around the perimeter of fields (Geisser, Reyer, & Krausman, 2004). More recently, studies have shown that immunocontraception is a possible alternative to lethal control methods that results in suppressed reproduction rates of boars while incurring no long-term residcual effects on the animal's physiology or behavior (Massei, Cowan, Bellamy, Quy, Pietravalle, Brash, & Miller, 2012). An issue that arises in the eradication process is determining whether true extermination has been achieved or if the wild pig population became better at avoiding detection (Morrison, Macdonald, Walker, Lozier, & Shaw, 2007).

Overabundant wild pig populations could lead to apparent competition, which occurs when a prey species helps sustain the population of a predator species, indirectly causing the decline of other prey species the predator feeds on (Gibson, 2006). Pre-baiting, placing bait in empty traps in order to draw in target species, is considered largely ineffective in the trapping of small mammals due to unintentional trapping of nontarget species (Edalgo & Anderson, 2007). There have been feeding systems developed to decrease nontarget species consumption of toxicants, such as the Hog-Hopper™ (Lapidge, Wishart, Staples, Faerstone, Campbell, & Eismann, 2012).

Wild pigs were completely eradicated from Santiago Island in the Galapagos Archipelago, Ecuador by hunting and poisoning (Cruz, Josh Donlan, Campbell, & Carrion, 2005). Although eradication is not possible in many southeastern states with

current lethal control methods, more strategic control efforts are necessary to reduce damage by wild pigs. For example, track plots have been utilized in Florida to monitor distribution and relative abundance of wild pigs, which allows control methods to be applied more strategically and success to be more easily evaluated (Engeman, Constantin, Schwiff, Smith, Woolard, Allen, & Dunlap, 2007).

In 2014 the United States Department of Agriculture appointed $20 million to Wildlife Services to be used to implement a national wild pig management program. This program is intended to address wild pig issues in all 39 states that are recognized as having a wild pig problem. The goal of this program is to work in conjunction with entities at all levels of government to reduce wild pig populations in an effort to preserve agricultural and natural resources, property, animal health, and human health and safety ("Wildlife Damage," 2014).

In Texas, wild pigs are a non-native species and thus can be harvested year-round. Toxicant control, however, is currently illegal in Texas and the United States. The Texas Department of Agriculture is working with agencies in Australia to research a toxicant that could potentially be used to control wild pigs. This research is also being analyzed to identify the effects of the toxicant on nontarget species in Texas (Aaronson, 2011). Other research in Texas regarding the effect toxicants, especially sodium nitrite, have on non-target species has been conducted in an effort to secure more cost-effective wild pig control measures (Foster, 2011). The United States Department of Agriculutre/Animal and Plant Health Inspection Service/ Wildlife Sciences is also conducting research on sodium nitrite as a potential wild pig toxicant. Contraceptive

vaccines are also being researched as a potentially species-specific method to reduce wild pig populations with minimal collateral damage (Samoylova, Cochran, Samoylov, Schemera, Breiteneicher, Ditchkoff, Petrenko, & Cox, 2012).

While there are many control methods utilized in the mitigation of wild pig populations, trapping is the most commonly used method due to its relative effectiveness as a control technique (Stevens, 2010; Williams, Holtfreter, Ditchkoff, & Grand, 2011). Advances in wireless technology have resulted in the development of corral traps with gates that have the ability to be monitored and controlled from a remote device such as a computer or cellular device (Tyson, 2013). Higginbotham (2010) reports that there are at least five companies that offer this technology. One example is the Noble Foundation's BoarBuster™, which was introduced to the market in early 2015; according to the Noble Foundation's news release regarding the BoarBuster™, this new trapping system utilizes remote trigger technology to provide unparalleled wild pig population control (The Samuel Roberts Noble Foundation, 2015). However, Higginbotham (2010) wrote that the high costs associated with remote trigger trapping technology may inhibit adoption by many landowners.

Risks/Aversions to Control

When implementing control programs, especially those that involve oral baits containing pharmaceuticals, a disproportionate number of non-target animals were affected (Campbell, Lapidge, & Long, 2006). The public generally views the use of toxicants as inhumane, and while there have been withdrawals of pharmaceutical baits

due to valid animal welfare concerns, often the symptoms of toxicant induced death are less adverse than the side effects of other control methods (Lapidge et al., 2012).

Areas in Texas Affected by Wild Pigs

Wild pigs have been documented in all Texas counties with the exception of El Paso county in far west Texas (B. Higginbotham, personal communication, December 2, 2015). Wild pigs have expanded their territory into the Davis Mountains and the Chihuahuan Desert of Texas. While the diet of wild pigs in the Davis Mountains is known, little is known about their impact on the fragile ecological communities in the Chihuahuan Desert (Adkins, Harveson, & Jones, 2006). Approximately 22,000 acres of land in Williamson County, Texas have been monitored since 1995. It has been noted that in this area wild pig damage is related to amount and timing of rainfall; during wet years damage decreased, but during dry years wild pigs were drawn to water availability near the site studied. While damage was reported on pasture land and other properties, the bulk of the damage in this area was reported in corn and grain sorghum crops (Muir & McEwen, 2007).

Perceptions and Uses of Wild Pigs

Perception of wild pigs depends on the role of the individual; landowners who experience negative consequences of wild pigs are adverse to their presence, whereas those who enjoy hunting or observing wild pigs find them beneficial. Individuals who are removed from the effects of wild pigs tend to be ambivalent about their presence (“Perceptions of feral hogs in the U.S.”, 2013; “Wild pig field sign,” 2013).

Wild pigs have already impacted several markets that could eventually be lucrative for landowners. Trapping and selling live wild pigs for human consumption domestically and abroad or exotic hunting purposes yield varying amounts of profit (Hawkes, 2013). The Texas Parks and Wildlife Department regulates hunting of wild pigs, while the Texas Animal Health Commission regulates the translocation of live wild pigs ("Feral Swine Regulations, 2015).

Wild pigs are considered an exotic game animal, and can be hunted year round in Texas with no bag limit as long as the landowner's consent has been given ("Texas Parks and Wildlife – Nongame, exotic, endangered, threatened and protected species", 2015). The desire to increase profits from hunting sometimes drives landowners to transport live wild pigs onto their land. However, this can aid the spread of disease and has been a factor in the spread of wild pig populations ("Feral Swine Regulations", 2015; Rollins et al., 2007).

The hunting industry in Texas is an important source of income and often supports sustainable agricultural operations (Bach & Conner, 2015; Forrest, 1968; Nielson, Wagstaff, & Lytle, 1986; Steinbach, Conner, Glover, & Inglis, 1986; Terrill, 1975). Wild pigs are a part of this industry, and have resulted in revenues in excess of $500 per wild pig (Bach & Conner, 2015). Leased hunting does entail a few drawbacks, including loss of time and privacy for the landowner, concern for other wildlife, and poor behavior of hunters (Duda & Brown, 2001; Reinhold, 1985). A Texas landowner conducted an experiment on his property that revealed lease hunting alone was not as successful at removing wild pigs as a combined control method approach (Henley,

2013). The amount of wild pig presence on a property can have a relation to the hunting pressure landowners administered (Tisdell, 2013).

There is much concern about the quality of meat that is produced by wild pigs, especially as it relates to the possibility of harboring infectious diseases (Gilmore, 2014; Lawhorne, n.d; Witmer, Sanders, & Taft, 2003). Despite these apprehensions, there are fledgling markets opening up in the United States for niche restaurants and markets (Hawkes, 2013; West, Cooper, & Armstrong, 2009). Additionally, European and Asian markets have long been a target market for wild pig meat (Garner, 2006; Hawkes, 2013; Rollins et al., 2007). The meat harvested from wild pigs tends to be less fatty than domestic swine, but it is also less tender (Hawkes, 2013; Sales & Kotrba, 2013). There is also an opportunity that is being explored that involves partnerships between landowners and food banks or homeless shelters (Fields, 2014; Gilmore, 2014; Simmons, 2014).

Customer Satisfaction with Extension

The mission of Texas A&M AgriLife Extension is to "provide quality, relevant outreach and continuing educational programs and services to the people of Texas" ("Compact with Texans," n.d., Mission section, para. 1). Customer satisfaction is of utmost importance to Texas A&M AgriLife Extension; as such, an annual survey is administered to determine customer satisfaction levels regarding five aspects of Extension events ("Compact with Texans," n.d.). The Department of Agricultural Leadership, Education, and Communications at Texas A&M University defines customer satisfaction as "the degree to which there is a match between the customer's

expectations of the product and the actual performance of the product" ("Customer satisfaction," n.d., para. 1).

A study conducted by Strong and Israel (2009) sought to determine whether factors such as gender, race, age, and education levels had an effect on the relationship between county Extension agents and their clientele. They found that while some of these factors do influence customers' perceptions of Extension, overall, customers had very positive opinions regarding their experience with Extension. Annual customer satisfaction surveys were shown to be feasible and economical, especially when potential impacts and benefits to the organization are considered (Strong & Israel, 2009).

Large amounts of data from customer satisfaction surveys have been provided to county Extension agents to improve program delivery and to better address clients' needs (Radhakrishna, 2002). Involving customers in program evaluation allows them to relay their experiences regarding the effectiveness of Extension (Warnock, 1992). Terry and Israel (2004) found that agents' performance and experience has a weak relationship with customer satisfaction levels. Customer satisfaction surveys can indicate how accurate, current, and relevant information is to current situations; they also reveal those customers who plan to use the information gained to resolve an issue or concern, which indicates that the customer is inclined to adopt the recommended practice (Radhakrishna, 2002).

The Net Promoter Score (NPS) is an index of the effectiveness of a program or company that is based on *The Ultimate Question* by Fred Reichheld (2006). The NPS index measures an "entity's or program's growth engine and efficiency" by identifying a

program's promoters and detractors (Higginbotham et al., 2008, p. 18). Promoters are those who are likely to recommend the program to others and rate the program highly; detractors are those who rate the program low and are not likely to recommend the program or its providers to others (Higginbotham et al., 2008; Reichheld, 2006). In the Wild Pig Damage Abatement Project, the program in question was the Texas Cooperative Extension (now Texas A&M AgriLife Extension) as a source of information and technical assitance regarding wild pigs and their control (Higginbotham et al., 2008). According to Higginbotham et al. (2008), an NPS of 50% or higher is indicative of a successful, efficient company or program. Participants in Texas A&M AgriLife Extension's wild pig damage abatement educational and awareness programs (indirect control efforts) scored on average 51%, which reveals that these methods were effective (Higginbotham et al., 2008). The NPS for direct control methods conducted by Wildlife Services was 71%, higher than indirect control methods presumably because direct control resulted in personnel working directly on cooperator's properties in conjunction with the landowner (Higginbotham et al., 2008). The Wild Pig Damage Abatement Project was the first Texas A&M AgriLife Extension program to utilize the NPS; as a result, Texas A&M AgriLife Extension has adopted NPS in their analysis of the success of their various programs (B. Higginbotham, personal communication, April 20, 2015). Additonally, in 2015 both Purdue and Mississippi State University Extension programs intend to integrate the NPS in their evaluatuions of their respective programs (B. Higginbotham, personal communication, April 20, 2015).

CHAPTER II

THEORETICAL AND CONCEPTUAL FRAMEWORK

Rogers' Diffusion of Innovations: Basic Premise

Rogers' (2003) theory of diffusion of innovations seeks to explain how, why, and at what rate new ideas and technology spread through cultures. Diffusion is defined by Rogers (2003) as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5).There are four key elements to this theory: an innovation must be perceived as new, communication channels must be in place, time must pass, and a social system must be involved.

Four Key Elements

According to Rogers (2003), "an innovation is an idea, practice, or object that is perceived as new" (p. 137). The characteristics of innovations deemed important in the adoption process are relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). According to Rogers (2003), relative advantage is how much better an innovation is than its predecessor. Compatibility relates to whether the innovation is consistent with the values, ideals, and experiences of the social system (Rogers, 2003). Complexity is how difficult an innovation is to use or understand (Rogers, 2003). If an innovation is able to be tested before it is adopted, it is said to have a degree of trialability (Rogers, 2003). Observability is whether a social system is able to see the results of the innovation. Reinvention can occur, which is how an innovation is

altered during the adoption process (Rogers, 2003). These factors will affect the rate of adoption of an innovation.

In order for an innovation to be spread, it must be communicated through channels over time within a social system. According to Rogers (2003), communication is how a message is passed from one individual to another. A communication channel, then, is the path by which this message is transferred. Mass media is the most prominent and massively influential communication channel for the spread of knowledge regarding innovations (Rogers, 2003). Individual communication channels are more effective at influencing attitudes regarding innovations (Rogers, 2003).

Time is an important concept in this theory because diffusion is a process. Time is a factor in many stages of diffusion, including the innovation-decision process, innovativeness, and the rate of adoption (Rogers, 2003). Rate of adoption is the speed at which an innovation is adopted (Rogers, 2003).

A social system is a "set of interrelated units engaged in accomplishing a common goal" (Rogers, 2003, p. 37). How a social system is structured can have an impact on the diffusion of innovations within that particular system. Whether an innovation is adopted or rejected can have consequences for the social system.

The Innovation-Decision Process

The innovation-decision process is how an innovation moves through the stages of first knowledge, formation of attitudes toward the innovation, decision to adopt or reject, implementation of the innovation if it is adopted, and finally to confirmation of the adoption decision. The first of these stages, knowledge of the innovation, occurs

when an individual or group learns of an innovation and how it works (Rogers, 2003). Persuasion occurs when an innovation is evaluated by an individual or group and attitudes are formed regarding the innovation (Rogers, 2003). One of the goals of the persuasion stage is to gather information on the innovation. Rogers (2003) states that the decision stage is the point at which the decision to either adopt or reject the innovation is made. Reinvention, the adaptation of an innovation to best suit the needs of a population, can occur at the implementation stage, which is the point at which the innovation is actually put into use (Rogers, 2003). The higher the degree of reinvention for an innovation, the higher the degree of sustainability, which is how well an innovation can be continued over time (Rogers, 2003). The final stage of the innovation-decision process, confirmation, is the point at which use of an innovation is solidified. This is also the point at which use may be discontinued due to dissatisfaction or the appearance of a different innovation that is perceived as better than the first (Rogers, 2003). In addition, Rogers (2003) states that an innovation that was previously rejected can be adopted during the confirmation stage.

Adopter Categories

The five adopter categories are innovators, early adopters, early majority, late majority, and laggards (Rogers, 2003). Members of a social system fall into these categories based on their innovativeness, which is determined by how quickly an individual adopts or rejects an innovation in relation to other members in the social system (Rogers, 2003). Innovators are venturesome and play the role of launching new ideas; these individuals are gatekeepers in the social system by controlling the flow of

new ideas into the system (Rogers, 2003). Early adopters are characterized by having the highest degree of opinion leadership; they command respect and help enact the critical mass (Rogers, 2003). The early majority category has many interactions with other members, but they often have a low degree of opinion leadership. The decision to adopt an innovation is very deliberate for those in this category (Rogers, 2003). According to Rogers (2003), the late majority is often skeptical of the innovation; adoption may be a necessity for them, or may be a result of peer pressure. Uncertainty must be minimized in order for this group to adopt an innovation. The final category, laggards, is the last to adopt an innovation. They are often suspicious of innovations and change agents, and often their scarce resources make them unwilling to invest in an innovation (Rogers, 2003). According to Rogers (2003), there are significant differences in socioeconomic status, personality, and communication behaviors between these groups. This allows for segmentation of a social system, which allows customized communications in order to reach the different categories and thus increase the rate of adoption of an innovation (Rogers, 2003).

Change Agents

A change agent is one who overtly attempts to sway opinions of others regarding an innovation in a particular direction that is desired by the change agency (Rogers, 2003). Social marginality and information overload are two issues that change agents encounter (Rogers, 2003). Change agents must develop a need for change, form an information exchange relationship, diagnose problems, encourage the customer to change, transform change intentions into actions, ensure adoption is not discontinued,

and finally achieve a terminal relationship with those they work with (Rogers, 2003). According to Rogers (2003), the effort a change agent expends trying to get an innovation adopted is positively related to their success, as is the change agent's credibility, empathy, and the degree to which the change agent is similar to the clientele. Outside factors that influence a change agent's success include customer orientation to the innovation, compatibility of the innovation with needs of the customers, whether or not opinion leaders are involved, and customer's ability to evaluate innovations (Rogers, 2003).

In the context of this study, county Extension agents at the county, multi-county, regional, and state levels, Extension Specialists, and Wildlife Services personnel acted as change agents. These groups were integral in the education and implementation of key wild pig control techniques during the Wild Pig Damage Abatement Project. According to Mwangi (1998), success of county Extension agents is related to their ability to "understand farmers' learning needs, problems, priorities, and opportunities as well as the psychological, process, semantic, physical, and economic barriers to adoption" (p. 63). The primary responsibility of a county Extension agent is technology transfer; this is accomplished via training programs and workshops, and the use of tools that contain recommended practices for effective diffusion (Dragon, 2005). King and Rollins (1995) found that the educational processes used by county Extension agents to diffuse and implement innovations are an important aspect of Extension Services. Furthermore, the attitudes of county Extension agents involved in the education of a society regarding a new technology have an impact on whether the innovation is adopted (King & Rollins,

1995). According to Rogers (2003), a change agent attempts to influence opinions of others regarding an innovation; county Extension agents in the Wild Pig Damage Abatement Project provided educational, outreach, and technical assistance regarding wild pigs and their damage to Texas agriculture (Higginbotham et al., 2008).

Opinion Leadership

Rogers (2003) states that opinion leadership is how much informal influence an individual has over the attitudes or behaviors of others in regards to an innovation; opinion leaders, therefore, are individuals who have significant influence on the spread of positive or negative attitudes about an innovation. The success of change agents in the adoption of an innovation is positively related to how much the change agent works in conjunction with opinion leaders (Rogers, 2003). By working through opinion leaders, change agents are able to magnify their efforts while reserving scarce personal resources such as time and energy (Rogers, 2003). Change agents differ from innovators because they have followers, whereas innovators are usually considered deviants due to their advanced adoption of new ideas or technologies (Rogers, 2003).

Identifying Opinion Leaders

Opinion leaders are typically more involved in innovative activities than other members of society (Corey, 1971). For instance, those who are opinion leaders in the arena of wild pig control are likely those who are more proactive in adopting wild pig damage abatement techniques. Corey (1971) also wrote that opinion leaders are more knowledgeable about improvements or developments in their area of expertise. Active consumers of printed media are more likely to be opinion leaders (Corey, 1971).

Differences in demographics between opinion leaders and nonleaders must be taken into account when identifying opinion leaders; those who are too far separated from others based on socioeconomic or educational status might have diminished leadership capacity due to being out of touch with the nonleaders (Corey, 1971). While self-reporting is likely a useful tool in identifying opinion leaders, a degree of error is to be expected (Corey, 1971). An article published by Valente and Pumpuang (2007) identified ten methods of identifying opinion leaderes; which method to use is based on setting, availability of opinion leaders, and resources.

Ajzen's Theory of Planned Behavior

The Theory of Planned Behavior attempts to predict an individual's intention to complete a specific behavior which they have some, but not total, control over (Ajzen, 1985). It can be used to predict and explain a wide variety of behaviors and intentions. A central concept of the Theory of Planned Behavior is the individual's intention to perform a behavior (Ajzen, 1991). Intentions, which are indications of how much effort an individual is willing to exert to perform a given behavior, encompass motivational factors that influence behavior and are direct antecedents of the behavior (Ajzen, 1991). According to Ajzen (1991), the stronger the intention the more likely a behavior will occur. The Theory of Planned Behavior also takes into account non-motivational factors that the individual does not have control over; these factors represent actual control over the behavior (Ajzen, 1991). The Theory of Planned Behavior takes into account both intention and behavioral control (Ajzen, 1991).

Attitudes toward the behavior, subjective norms, and perceived behavioral control can predict intentions to perform a behavior (Ajzen, 1991). Attitude toward the behavior is described as how favorable or unfavorable an individual views the behavior in question (Ajzen, 1991). Subjective norms incorporate a social factor; this predictor of intention refers to "the perceived social pressure to perform or not perform the behavior" (Ajzen, 1991, p. 188). Perceived behavioral control is the individual's perception of their ability to perform a behavior, or how easy or difficult performing a behavior is perceived to be based on past experience as well as future obstacles (Ajzen, 1991). Perceived behavioral control in conjunction with intention can directly predict achievement of the behavior (Ajzen, 1991). According to Ajzen (1991), the more favorable these three concepts are viewed by the individual, the stronger the individual's intention to perform that specific behavior will be. How important each of the three determinants of intention is varies according to the behavior in question (Ajzen, 1991).

The three kinds of salient beliefs in the Theory of Planned Behavior are behavioral beliefs, normative beliefs, and control beliefs about the behavior (Ajzen, 1991). These three are direct antecedents of attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). An individual can have many beliefs regarding a behavior, but the most pertinent beliefs are those that are considered to be determinants of an individual's intentions and actions (Ajzen, 1991). Behavioral beliefs correspond with attitudes toward the behavior; attitudes are formed by the beliefs people hold (Ajzen, 1991). The stronger the belief regarding whether a behavior or the outcomes of a behavior will be positive or negative, the stronger the attitude toward that behavior.

Normative beliefs deal with whether referent individuals approve or disapprove of a behavior; this belief relates to subjective norms (Ajzen, 1991). Beliefs regarding control of resources and access to opportunities underlie perceived behavioral control (Ajzen, 1991). Ajzen (1991) posits that control beliefs are based on past experiences relating to a behavior as well as information gather from others who have experienced the behavior and any other factors that influence the perceived difficulty of performing the behavior. The fewer anticipated obstacles, the greater an individual's perceived control (Ajzen, 1991).

Knowles' Theory of Andragogy

Andragogy as defined by Knowles (1980) is "the art and science of how adults learn" (p. 43). This concept was juxtaposed to pedagogy, the teaching of children; according to Knowles (1980) pedagogical teaching methods are often ineffective for adult learners. Later works by Knowles, Holton, and Swanson (2012) stated that whereas pedagogy has many hallmarks of andragogy, andragogy is a model of assumptions; determining the distinction between the two is necessary to put the two models in perspective. Based on this premise, "educators now have the responsibility to check out which assumptions are realisitc in a given situation" and determine whether pedagogical or androgogical strategies best suit the learner, the situation, and the goal (p. 68). There are six assumptions in Knowles' Theory of Andragogy: the learner's need to know, self-directed learning, prior experiences of the learner, readiness to learn, orientation to learning and problem solving, and motivation to learn (Knowles et al., 2005).

A learner's need to know is indicative of the need to create a collaborative learning environment in which adult learners are included in the planning process for their learning (Knowles et al., 2005). There are three dimensions within the assumption of the learners' need to know; these are "how the learning will be conducted, what learning will occur, and why the learning is important" (Knowles et al., 2005, p. 184).

The second assumption, that adults are self-directed learners, has received much attention, and Knowles et al. (2005) identifies two prevalent conceptions of self-directed learning: learners are self-teaching in that they are able to take command of teaching themselves a subject and self-directed learning is related to personal autonomy, or the ability to take ownership of the learning experience. These two dimensions may overlap, but they are largely independent of each other; an individual with personal autonomy may prefer to learn in a highly prescriptive environment (Knowles et al., 2005). According to Merriam, Caffarella, and Baumgartner, as individuals mature they transition from dependent learners to self-directing learners (2007).

There are four ways adults' experiences can impact learning. First of all, experiences create more differences in individuals (Knowles et al., 2005). Experiences are also a rich resource for learning (Knowles et al., 2005). According to Knowles et al. (2005), the last two ways experiences influence adult learning are by creating biases that affect new learning and experiences provide the foundation on an adult's self-identity.

Knowles et al. (2005) state that the assumption of adults' readiness to learn relates to instances where life situations create a need for the adult to know something new. Life situations also have an impact on whether adults are at a stage where they are

receptive to andragogical learning experiences (Knowles et al., 2005). For adults, readiness to learn is related to the evolution of the social roles of early adulthood, middle age, and later maturity (Knowles, 1980).

Whereas children expect to use what they learn at a future time, adults view education as a method to cope with issues that they are currently facing (Knowles, 1980). As such, adults tend to prefer learning that is more problem-solving oriented rather than subject-centered (Knowles et al., 2005). Additionally, adults "learn best when new information is presented in real-life context" (Knowles et al., 2005, p. 197).

The final assumption of Knowles' Theory of Andragogy takes into account the motivation of adults to learn. According to Knowles et al. (2005), adults are more motivated to learn if learning results in a solution to a problem or some internal reward. The most effective motivators are those that are internal, such as quality of life and increased self-esteem (Knowles et al., 2005). External motivators can also be influential, but their effect is not as great as internal motivators (Knowles et al., 2005).

CHAPTER III

RESEARCH METHODOLOGY

Research Design

The study was a quantitative study with a survey research design. Data from the Statewide Wild Pig Damage Abatement Pilot Project, conducted from 2006-2007, as well as data collected subsequently using the modified Pilot Project instrument, were analyzed. The purpose of this study was to determine knowledge gained and plans to adopt practices for wild pig control in the framework of Rogers' (2003) theory of diffusion of innovations, Ajzen's (1985) Theory of Planned Behavior, and Knowles' (1980) Theory of Andragogy. The Wild Pig Damage Abatement Pilot Project was the impetus for additional funding to be granted to the Texas A&M AgriLife Extension Service, which is the state agency in Texas best suited to educate landowners on wild pigs and the agricultural damage they cause (Higginbotham et al., 2008). The objectives of this study are as follows:

1. Describe the negative impacts caused by wild pigs on respondents' property in the past year;
2. Describe the control methods used by landowners prior to the program;
3. Determine total economic losses on property(s) due to wild pigs during the year prior to the program;
4. Determine landowner estimates of future losses on property(s) due to wild pigs during the year after the program;

5. Quantify income made by landowners by trapping and selling wild pigs and/or leasing hog hunting rights in the year prior to the program;
6. Determine whether landowners perceive they gained knowledge of wild pigs and their control from attending the program;
7. Describe the change in landowners' knowledge in the areas of wild pig biology, legal control options, efficient trap/bait techniques, and types/extent of hog damage after taking the program;
8. Describe landowners' planned adoption of innovations to manage wild pigs after participating in the program;
9. Describe landowners' likelihood of recommending Texas A&M AgriLife Extension Service (including Wildlife Services) to family and friends as a contact for information on wild pigs and their control;
10. Describe the relationship between knowledge gained and practices adopted; and
11. Investigate the influence of independent variables (areas on landowners' property(s) negatively impacted by wild pigs; control methods currently used; economic losses the year prior to attending the program; expected economic losses the year after attending the program; income made by trapping and selling hogs and/or leasing hog hunting rights in the year prior to attending the program; perceived increase of general knowledge regarding wild pigs and their control practices; perceived knowledge before and after attending the program in specific areas; and likelihood of

recommending Texas A&M AgriLife Extension, including Wildlife Services, to family and friends) on adoption of practices.

Population and Sample Technique

A sample of *N*=21,752 landowners had participated in the study from 2006-2014. Of those, aggregate data was available at the regional level for 13,054 participants (2006-2014) ("Feral Hogs Tableau Application", n.d.). The data analyzed at the individual level in this study resulted from 10,721 completed individual surveys from 275 programs conducted from calendar year 2008 to 2014 (P. Pope, personal communication, March 12, 2015). The educational programs consisted of "group education events" (Higginbotham et al., 2008, p. 1). Educational events occurred statewide and focused on indirect control, such as encouraging adoption of landowner-initiated control techniques. Educational events were a minimum of one hour in length. Participants were administered a survey immediately post-program to determine overall economic impact of the initiative. Data collected from these surveys led to additional funding. Surveys were administered following programs held by Texas A&M AgriLife Extension Service addressing wild pig life history, behavior, and control information. Wildlife and Fisheries Sciences also conducted wild pig programs across the state and administered Texas A&M AgriLife Extension's survey at the conclusion of their programs.

The target population of this study included all landowners in Texas. Convenience sampling was used to collect data for this study. This type of sample consists of individuals who are easy to access (Fraenkel & Wallen, 2009).

Data Collection and Instrumentation

Data collected during the Statewide Wild Pig Damage Abatement Pilot Project from 2006-2014 was used for the purposes of this study. In 2007, the survey instrument utilized by the Wild Pig Damage Abatement Pilot Project was modified with the addition of four questions: How much income did you make by trapping and selling hogs and/or leasing hog hunting rights last year?; Did you increase your knowledge of feral hogs and their control by attending this program?; Rate your knowledge before and after the program on these subjects. Mark only one number for each answer choice with 1 = no/little knowledge, 3 = some knowledge, 5 = high level of knowledge.; Please mark all practices that you plan to adopt in order to better manage feral hogs on your property.; and, Based on the information provided at the program, what is the likelihood that you would recommend Texas A&M AgriLife Extension Service (includes Wildlife Services) to your family and friends as a control contact for information on feral hogs and their control? Mark one number below with 0 = not likely and 10 = likely.

Data Analysis

Descriptive statistics allow a multitude of scores to be represented by a select few indices (Fraenkel & Wallen, 2009). Due to the nature of this study and the large amount of data available, descriptive statistics were useful in the analysis and reporting of pertinent information. Mean scores are the average scores in a distribution; every data point that is collected is included in this calculation, making it representative of the data set (Fraenkel & Wallen, 2009). Fraenkel and Wallen (2009) posit that standard deviation is the most applicable measure of variability. Standard deviation is a single number that

measures variability, or the spread of data between highest and lowest points (Fraenkel & Wallen, 2009). By factoring deviation into a statistical analysis, the researcher is able to determine a distribution curve, which gives a visual representation of the data collected. In sum, descriptive statistics seek to transform data into a summated version that is readily understood by research consumers. These two statistical scores were calculated in order to make the data easier to manipulate and comprehend.

Regression analyses were conducted in order to test the effects of the independent variables on the dependent variable. Fraenkel and Wallen (2009) state that a regression line is a line that comes the closest to all of the scores found in a scatterplot. This line can then be used to predict future scores (Fraenkel & Wallen, 2009). A regression analysis is used to predict a dependent variable based on its relationship to one or more independent variables.

Further, the study used a correlational research design to accomplish several of the objectives. Correlation seeks to identify relationships among variables (Fraenkel & Wallen, 2009). However, it is important to note that a correlation between two variables does not determine a causal relationship between those two variables (Fraenkel & Wallen, 2009). Correlation coefficients express the degree of relationship between two variables; they can also be used as measures of reliability and validity (Fraenkel & Wallen, 2009). When used to determine relationships between variables, correlation coefficients may be used to develop scatterplots. Scatterplots are a visual representation of degree of correlation between variables (Fraenkel & Wallen, 2009).

Internal validity is a measurement of whether observed differences on the dependent variable, adoption of control techniques, are directly related to the independent variables rather than an extraneous variable (Fraenkel & Wallen, 2009). Threats to internal validity must be taken into consideration when conducting research. A major concern in correlation research is that extraneous variables may affect results by skewing data (Fraenkel & Wallen, 2009). Calculating partial correlations help to determine what is truly causing a relationship between variables (Fraenkel & Wallen, 2009). In this study, participants who complete the questionnaire may feel obligated to take the survey, which may influence the types of responses they give. Texas A&M AgriLife Extension Service may not be admired by all participants, and if a landowner has a dislike for the Service, that may bias his or her responses to the survey. To address these threats to internal validity, extraneous variables must be measured and partial correlation used to determine how much participants are unduly influenced (Fraenkel & Wallen, 2009).

Inferential statistics encompass methods of analyzing data that allow the researcher to make inferences about a population based on data collected from a sample (Fraenkel & Wallen, 2009). In this study, there were several independent variables that impacted the dependent variable, adoption of wild pig control practices. In cases where there are more than one independent variable, an ANOVA, or analysis of variance, can be used to determine if there are significant differences between the means of more than two groups" (Fraenkel & Wallen, 2009, p. 232). According to Mertler and Vannatta (2002), an ANOVA determines the significance of group differences but does not

identify which specific groups are significantly different; as such, ANOVA tests are often conducted in conjunction with post hoc tests.

CHAPTER IV

RESULTS

Data from 2006-2007 were available in summarized form at the county level only; data from 2008-2014 were available on an individual basis. As such, data from 2008-2014 was analyzed using Statistical Package for the Social Sciences (SPSS); data from the first year (2006-2007) were analyzed separately at the aggregate level and then compared to the aggregated data from the following years (2008-2014).

Since data for the first two years of the program were not available at the individual level, aggregate data were analyzed in order to make comparisons across all years. The data were analyzed at the regional level for the purposes of readability and comprehension. The regions are based off of districts recognized by Extension and were Central, East, North, South, Southeast, and West. There are two additional categories. One is Wildlife and Fisheries Sciences; the surveys included in this category are those administered by Wildlife and Fisheries Sciences-TAMUS across the state of Texas for all years of the program (2006-2014). The other category is Unknown, consisting of surveys whose origins are not specified. The results are reported in Figures 1 and 2 and Tables 1-8.

The response rates by region are displayed in Figure 1. Areas colored dark green represent response rates of 75 – 100 %. The next lighter shade represents regions with response rates of 50 – 74%. Response rates of 25 – 40% are light green in color. The regions with the lowest percentage of response rates, 1 - 24%, are gray.

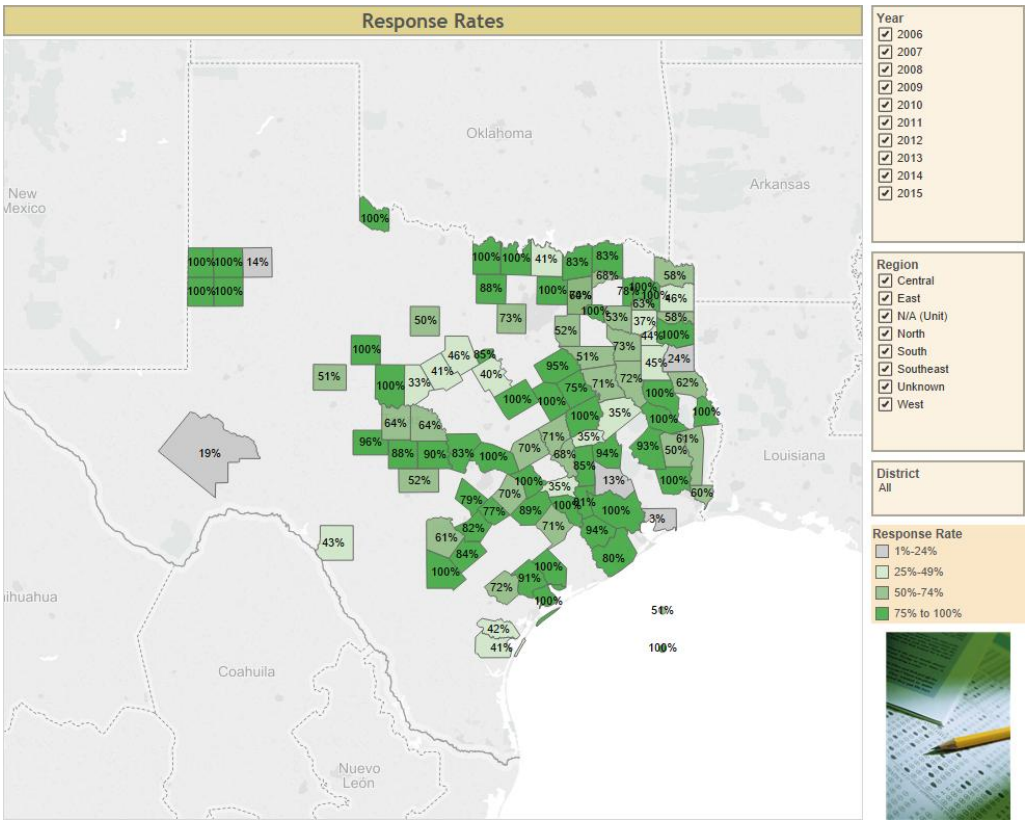

Figure 1. *Response rates by region ("Feral Hogs Tableau Application", n.d.).*

Response rate per region are indicated in Table 1. The category of Unknown had the highest response rate (*n* = 19, *f*=19, 100.0%), followed by South (*n* = 1,995, *f*=1,495, 74.9%), and Central (*n* = 1,604, *f*=1,194, 74.4%). West (*n* = 716, *f*=479, 66.9%), Southeast (*n* = 2,674, *f*=1,780, 66.6%), East (*n* = 4,795, *f*=3,055, 63.7%), and Wildlife and Fisheries Sciences (*n* = 9,765, *f*=4,956, 50.8%) reported average response rates. The North region (*n* = 184, *f*=76, 41.3%) had the lowest response rate. The total response rate for all years of the Extension program indicate that over half of participants completed a survey (*n* = 21,752, *f*=13,054, 60.0%).

Table 1
Descriptive Data of Participants, Completed Surveys, and Response Rate per Region

Region	Participants (*n*)	Completed Surveys (*f*)	Response Rate (%)
Unknown	19	19	100.0%
South	1,995	1,495	74.9%
Central	1,604	1,194	74.4%
West	716	479	66.9%
Southeast	2,674	1,780	66.6%
East	4,795	3,055	63.7%
Wildlife and Fisheries Sciences	9,765	4,956	50.8%
North	184	76	41.3%
Totals	21,752	13,054	60.0%

Note: *Data were collected 2006 – 2014*

Descriptive data for instances of loss due to wild pigs according to region are represented in Table 2. Participants in Wildlife and Fisheries Sciences programs reported the highest amount of losses (12,655), followed by the Eastern region (9,394). The region designated as Unkown (71) reported the lowest instances of loss due to wild pigs. These data may be skewed based on number of participants in respective regions.

A more accurate angle to view this data from would be which categories of loss are reported the most across all regions. Pastures (P = 9,454) had the highest instances of loss across all regions, followed by owner or employee time (O = 4,910) and fences, water troughs, or other improvements (F = 4,882). Personal injuries (Pe = 329) and stored commodities (St = 580) are the types of damage least experienced across all regions throughout all years of the program. The total for all types of losses in all counties (T = 36,935), indicates that the 13,054 respondents reported an average of 2.83 areas of loss.

C = *Commodity crop losses*
Sp = *Specialty crop losses*
St = *Stored commodities*
P = *Pastures*
W = *Wetlands*
Li = *Livestock*
F = *Fences, water troughs, or other improvement*
E = *Equipment or vehicles*
Pe = *Personal injuries*
La = *Loss of land value*
Le = *Loss of lease value, damage to food plots/feeders*
O = *Owner or employee time*
T = *Total losses for all types*

Table 2
Descriptive Data of Instances of Loss Due to Feral Hogs by Type

Region	C	Sp	St	P	W	Li	F	E	Pe	La	Le	O	T
Central	442	193	70	894	222	144	530	203	32	223	267	395	3,615
East	773	458	135	2,408	808	271	955	682	81	828	677	1,318	9,394
Wildlife and Fisheries Sciences	1,094	616	210	3,282	930	405	1,658	722	101	1,021	874	1,742	12,655
North	27	11	7	44	9	10	30	12	2	9	18	21	200
South	355	207	49	1,175	245	169	688	188	33	273	222	554	4,158
Southeast	530	315	74	1,322	344	202	656	420	72	363	369	694	5,361
Unknown	4	3	1	14	5	7	12	2	1	2	9	11	71
West	162	60	34	315	78	83	353	37	7	48	129	175	1,481
Totals	3,387	1,863	580	9,454	2,641	1,291	4,882	2,266	329	2,767	2,565	4,910	36,935

Note: *Data was collected 2006 - 2014*

Frequencies for instances of loss due to wild pigs by type are displayed in Figure 2 and Table 3. Based on the data, pastures (P = 72%) suffered the highest instances of loss across all regions and years of the program. The category of stored commodities (St = 4%) experienced the lowest percentage of loss. When the regions are analyzed individually, pastures consistently had the highest percentage of instances of loss for all regions. Instances of loss to stored commodities were the lowest for every region.

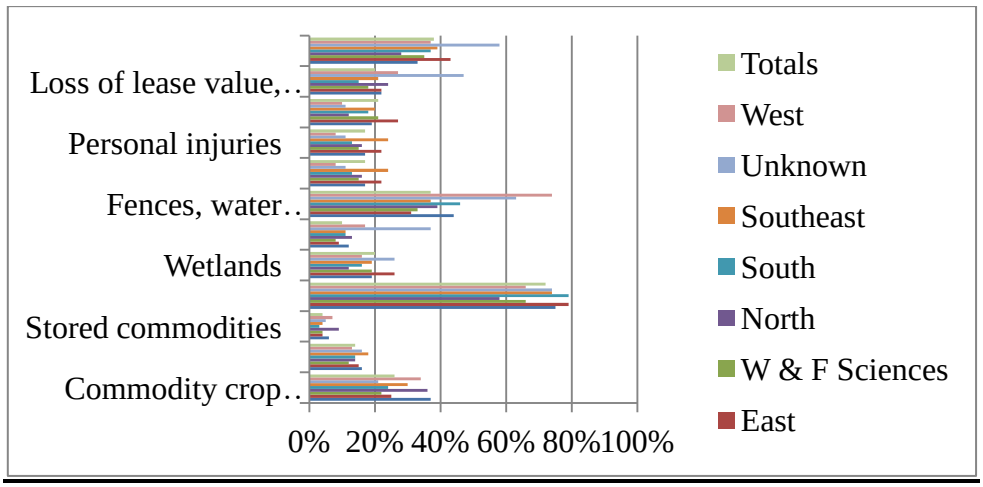

Figure 2. *Losses—Percentage of respondents by type of loss and by region ("Feral Hogs Tableau Application", n.d.).*

C = *Commodity crop losses*
Sp = *Specialty crop losses*
St = *Stored commodities*
P = *Pastures*
W = *Wetlands*
Li = *Livestock*
F = *Fences, water troughs, or other improvement*
E = *Equipment or vehicles*
Pe = *Personal injuries*
La = *Loss of land value*
Le = *Loss of lease value, damage to food plots/feeders*
O = *Owner or employee time*

Table 3
Frequencies for Instances of Loss Due to Feral Hogs by Type

Region	C	Sp	St	P	We	Li	F	E	Pe	La	Le	O
Central	37%	16%	6%	75%	19%	12%	44%	17%	17%	19%	22%	33%
East	25%	15%	4%	79%	26%	9%	31%	22%	22%	27%	22%	43%
Wildlife and Fisheries Sciences	22%	12%	4%	66%	19%	8%	33%	15%	15%	21%	18%	35%
North	36%	14%	9%	58%	12%	13%	39%	16%	16%	12%	24%	28%
South	24%	14%	3%	79%	16%	11%	46%	13%	13%	18%	15%	37%
Southeast	30%	18%	4%	74%	19%	11%	37%	24%	24%	20%	21%	39%
Unknown	21%	16%	5%	74%	26%	37%	63%	11%	11%	11%	47%	58%
West	34%	13%	7%	66%	16%	17%	74%	8%	8%	10%	27%	37%
Totals	26%	14%	4%	72%	20%	10%	37%	17%	17%	21%	20%	38%

Note: Data was collected 2006 – 2014

Descriptive data of control methods for wild pigs according to type of control method are represented in Table 4. Wildlife and Fisheries Sciences (Tcm = 7,096) reported the highest use of control methods as a whole. Unknown regional surveys (Tcm = 36) reported the lowest use of control methods as a whole. The most frequently used control method for all regions was trapping and destroying (Td = 6,668), followed by owner/employee hunting (Oe = 6,438). The control method used the least by regions as a whole was other (snares, aerial gunning) (Ot = 1,055). The grand total of control methods used by all regions over all years of the program was (Tcm = 20,495).

The Central region reported the highest use of owner/employee hunting (Oe = 632) and the lowest use of other (snares, aerial gunning) (Ot = 94). The Eastern region used trapping and destroying (Td = 1,653) the most and other (snares, aerial gunning) (Ot = 199) the least. Trapping and destroying (Td = 2,302) is used most by participants in programs conducted by Wildlife and Fisheries Sciences, while lease hunting (Lh = 361) is used the least. The Northern region utilized owner/employee hunting (Oe = 48) the most and trapping and moving wild pigs (Tm = 4) the least. Participants in the South report using trapping and destroying (Td = 839) the most and trapping and moving (Tm = 145) the least. Trapping and destroying (Td = 964) is also used the most by those in the Southeast, while other (snares, aerial gunning) (Ot = 123) was reported as used the least. Participants who fall into the Unknown category used trapping and destroying (Td = 13) the most frequently and trapping and moving the least (Tm = 0). The Western region reported the highest usage of owner/employee hunting to control wild pigs (Oe = 284) and control method reported as used the least was use of dogs (U = 47).

Td = *Trapped & destroyed*
Tm = *Trapped & moved*
Ts = *Trapped & sold*
Oe = *Owner/employee hunting*
Lh = *Lease hunting*
U = *Use of dogs*
Ot = *Other (snares, aerial gunning)*
Total = *Totals for all types of control methods*

Table 4
Descriptive Data of Control Methods for Feral Hogs by Type

Region	Td	Tm	Ts	Oe	Lh	U	Ot	Total
Central	618	126	189	632	118	194	94	1,971
East	1,653	440	442	1,519	231	603	199	5,087
Wildlife and Fisheries Sciences	2,302	459	570	2,253	361	732	419	7,096
North	36	4	10	48	15	15	7	135
South	839	145	151	809	109	218	130	2,401
Southeast	964	181	219	881	146	388	123	2,902
Unknown	13	0	1	12	4	4	2	36
West	243	48	66	284	98	47	81	867
Total for All Regions	6,668	1,403	1,648	6,438	1,082	2,201	1,055	20,495

Note: Data was collected 2006 – 2014

Frequencies for control methods for wild pigs by type are reported in Figure 3 and Table 5. Based on the Grand Totals, frequencies for control methods used for wild pigs by type indicate that the control method used the most by all regions was trapping and destroying (Td = 51%). The control method types used the least frequently by all regions were lease hunting (Lh = 8%) and other (snares, aerial gunning) (Ot = 8%).

The Central region reported the highest use of owner/employee hunting (Oe = 53%) and the lowest use of other (snares, aerial gunning) (Ot = 8%). The Eastern region had the highest usage of trapping and destroying (Td = 54%) and the lowest usage of other (snares, aerial gunning) (Ot = 7%). Trapping and destroying (Td = 46%) is used most by those who participated in programs conducted by Wildlife and Fisheries Sciences, while lease hunting (Lh = 7%) is used the least. The Northern region utilized owner/employee hunting (Oe = 63%) the most and trapping and moving wild pigs (Tm = 5%) the least. Participants in the South report using trapping and destroying (Td = 56%) the most and trapping and moving (Tm = 7%) the least. Trapping and destroying (Td = 54%) is also used the most by those in the Southeast, while other (snares, aerial gunning) (Ot = 7%) was reported as used the least. Participants who fall into the Unknown category used trapping and destroying (Td = 63%) the most frequently and trapping and moving the least (Tm = 0%). The Western region reported the highest usage of owner/employee hunting to control wild pigs (Oe = 59%). The two control method reported the least used were use of dogs (U = 10%) and trapping and moving (Tm = 10%).

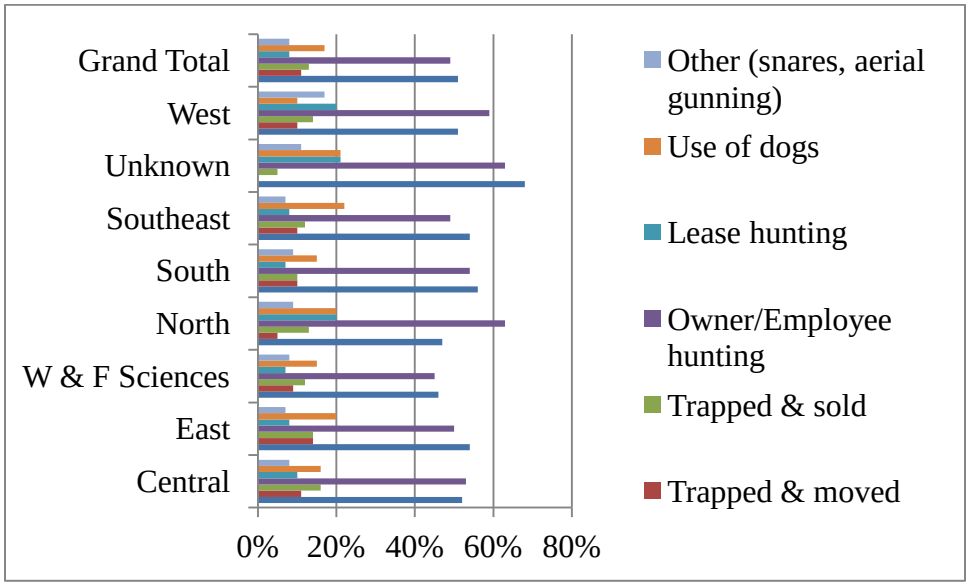

Figure 3. *Percentage of control measures by type of control and region ("Feral Hogs Tableau Application", n.d.).*

Td = *Trapped & destroyed*
Tm = *Trapped & moved*
Ts = *Trapped & sold*
Oe = *Owner/employee hunting*
Lh = *Lease hunting*
U = *Use of dogs*
Ot = *Other (snares, aerial gunning)*

Table 5
Percentages for Control Methods for Feral Hogs by Type

Region	Td	Tm	Ts	Oe	Lh	U	Ot
Central	52%	11%	16%	53%	10%	16%	8%
East	54%	14%	14%	50%	8%	20%	7%
Wildlife and Fisheries Sciences	46%	9%	12%	45%	7%	15%	8%
North	47%	5%	13%	63%	20%	20%	9%
South	56%	10%	10%	54%	7%	15%	9%
Southeast	54%	10%	12%	49%	8%	22%	7%
Unknown	68%	0%	5%	63%	21%	21%	11%
West	51%	10%	14%	59%	20%	10%	17%
Grand Total	51%	11%	13%	49%	8%	17%	8%

Note: Data was collected 2006 – 2014

Economic losses prior to attending a program and post-program are displayed using several different metrics, including the number of participants; percent economic losses; and the monetary amount of losses [see Table 6]. The Grand Totals for all regions reported by participants indicate economic losses in the previous year (*n* = 8,285, 63%, ($39,465,953)). Economic losses in the upcoming year after attending a program (*n* = 7,055, 54%, ($24,730,885)) were also included in the measurement. Based on these measures, the Grand Total for reduction of losses in all regions ($14,735,068) indicates an overall reduction of negative impacts.

The Central region reported losses in the previous year (*n* = 750, 63%, ($3,332,730)) and losses in the upcoming year (*n* = 609, 51%, ($2,401,758)), resulting in a loss reduction ($930,972). Losses in the year prior to attending a program in the Eastern region (*n* = 2140, 70%, ($10,870,304)) were greater than the losses expected in the upcoming year (*n* = 1,814, 59%, ($5,677,784)), resulting in an overall reduction in losses ($5,192,520). Participants in programs conducted by Wildlife and Fisheries Sciences reported previous year losses (*n* = 2,859, 58%, ($12,527,301)) and estimated upcoming losses (*n* = 2,287, 46%, ($7,551,607)), with an outcome of reducing loss for participants ($4,975,694). The Northern region reported previous losses (*n* = 47, 62%, ($308,650)) and upcoming losses (*n* = 43, 57%, ($235,930)), indicating an expected reduction in loss ($72,720). The Southern region had losses in the previous year (*n* = 1,042, 62%, ($308,650)) and expected losses in the upcoming year (*n* = 919, 61%, ($3,168,035)). The difference between the two years indicates an expected reduction in losses ($1,002,131). Those who participated in a program in the Southeast reported previous year losses (*n* =

1,139, 64%, ($6,649,940)) and losses expected in the year after attending a program (*n* = 1,030, 58%, ($4,746,249)), resulting in an overall loss reduction ($1,903,691). Participants whose surveys fell into the Unknown category reported losses in the year prior to attending a program (*n* = 10, 53%, ($18,300)) and expected losses in the upcoming year (*n* = 104, 547%, ($87,399)), indicating an increase in losses (($69,099)). The Western region indicated losses in the previous year (*n* = 298, 62%, ($1,588,562)) and losses expected in the upcoming year (*n* = 249, 52%, ($862,123)), resulting in a loss reduction ($726,439).

Pp = *Participants with Economic Losses (Previous Year)*
Ep= *Economic Losses (Previous Year) – Percent*
El = *Economic Losses Previous Year*
Pu= *Participants with Economic Losses (Upcoming Year)*
Eup = *Economic Losses (Upcoming Year) – Percent*
Eu = *Economic Losses Upcoming Year*
R = *Reduction of Losses*

Table 6
Economic Measures

Region	Pp	Ep	El	Pu	Eup	Eu	R
Central	750	63%	($3,332,730)	609	51%	($2,401,758)	$930,972
East	2,140	70%	($10,870,304)	1,814	59%	($5,677,784)	$5,192,520
Wildlife and Fisheries Sciences	2,859	58%	($12,527,301)	2,287	46%	($7,551,607)	$4,975,694
North	47	62%	($308,650)	43	57%	($235,930)	$72,720
South	1,042	70%	($4,170,166)	919	61%	($3,168,035)	$1,002,131
Southeast	1,139	64%	($6,649,940)	1,030	58%	($4,746,249)	$1,903,691
Unknown	10	53%	($18,300)	104	547%	($87,399)	($69,099)
West	298	62%	($1,588,562)	249	52%	($862,123)	$726,439
Grand Total	8,285	63%	($39,465,953)	7,055	54%	($24,730,885)	$14,735,068

Note: Data was collected 2006 - 2014

The reductions of loss by region are displayed in Figure 4. Areas colored dark green represent reduction of losses of $1,000,000 or more. The next lightest shade represents regions with loss reductions of $500,000 – $749,999. Loss reductions amounts of $250,000 – $499,999 are white-green in color. The gray areas represent regions with losses reduced by $1 - $249,999. The regions with the lowest reduction of losses, $0 or greater, are pink.

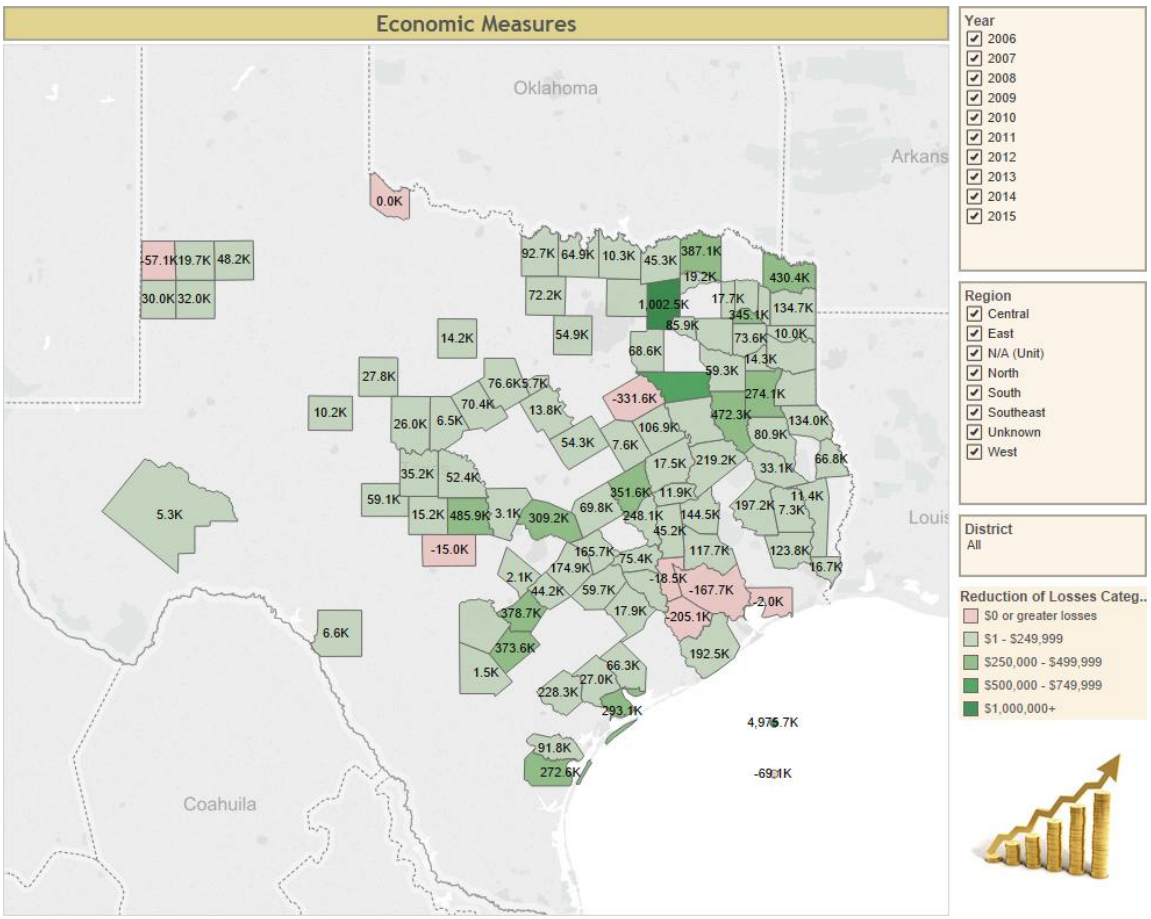

Figure 4. *Reductions of loss by region ("Feral Hogs Tableau Application", n.d.).*

The frequencies for amount of promoters, passives, detractors, and the resulting NPS are indicated in Table 7. The number of promoters (*n*=8,012) was greater than the number of passives (*n*=2,260) and detractors (*n*=1,129). The total number of respondents who contributed to the NPS score (*n*=11,401), resulting in an NPS score of 60.4 across all years and regions in which a program was conducted.

Table 7
Frequencies for Net Promoter Score (NPS)

NPS Groups—Frequencies	
Promoters	8,012
Passives	2,260
Detractors	1,129
NPS—Total N	11,401

Note: Data was collected 2006 – 2014

The percentage of respondents who fall into each of the NPS groups [Table 8] indicate that the percentage of respondents who were promoters (*f*=70.3%) outnumbered the other categories. Passives (*f*=19.8%) and detractors (*f*=9.9%) together made up less than a third of the participants. This is a goal (NPS = % Promoters - % Detractors, NPS greater than 50%) that programs strive to attain.

Table 8
Percentages for Net Promoter Score (NPS)

NPS Groups—Percentages	
Promoters	70.3%
Passives	19.8%
Detractors	9.9%

Note: Data was collected 2006 – 2014
Note: NPS = Promoters – Detractors
NPS = 70.3 – 9.9 = 60.4

Data collected from 2008-2014 was analyzed at the individual level. The results of these analyses are reported in Tables 9-60.

The first objective was to describe the areas landowners perceived as having the greatest negative impact due to wild pigs in the year previous to their attendance at a wild pig workshop or field day. Table 9 demonstrates the areas in which landowners felt they experienced negative impacts from wild pigs based on the data from 2008-2014. 70.5% (*f* = 7,557) of participants indicated that wild pigs negatively impacted their pastures. This is a far greater percentage than any other any other option. Owner and employee time was the second most negatively impacted area, with 36.2% *(f* = 3,879) of landowners choosing this option. Damage on fences, water troughs, and other improvements was acknowledged by 35.4% *(f* = 3,794) of participants. Growing or planting commodity crop losses (*f* = 2,616, 24.4%), loss of land value (20.2%, *f* = 2,162), negative impact to wetlands (*f* = 1,993, 18.6%), loss of lease value or damage to food plots or feeders (*f* = 1,836, 17.1%), damage to equipment or vehicles (*f* = 1,685, 15.7%), and negative impacts to growing or planting of specialty crops (*f* = 1,377, 12.8%) constituted other damages related to damages to physical land. Injury, death, and disease of livestock was reported by 9.1% (*f* = 980) of landowners. 4.0% (*f* = 424) of participants reported stored commodities being negatively impacted by wild pigs. Lastly, only 2.1% (*f* = 229) of participants reported personal injuries due to wild pigs.

Table 9
Frequencies for Areas In Which Feral Hogs Had A Negative Impact

Areas	*f*	%
Pastures	7557	70.5
Owner or employee time	3879	36.2
Fences, water troughs, or other improvements	3794	35.4
Growing or planting commodity crop losses	2616	24.4
Loss of land value	2162	20.2
Wetlands	1993	18.6
Loss of lease value, damage to food plots/feeders	1836	17.1
Equipment or vehicles	1685	15.7
Growing or planting specialty crop losses	1377	12.8
Livestock (Injury, death, diseases)	980	9.1
Stored commodities	424	4.0
Personal injuries	229	2.1

Note: n=10721

Descriptive statistics for negative impacts on properties are reported in Table 10. On average, a significantly greater percentage of landowners reported negative impacts of feral hogs on pasture land (*M*=.70, *SD*= .46). Loss of owner or employee time (*M*=.36, *SD*=.48) and damage to fences, water troughs, or other improvements (*M*=.35, *SD*=.48) were the next most reported negative impacts due to feral hogs. Growing or planting commodity crop losses (*M*=.24, *SD*= .43), loss of land value (*M*=.20, *SD*= .40), damage to wetlands (*M*=.19, *SD*= .39), loss of lease value and damage to food plots/feeders (*M*=.17, *SD*= .38), damage to equipment or vehicles (*M*=.16, *SD*= .36), and growing or planting specialty crop losses (*M*=.13, *SD*= .34) constituted the middle range of scores related to feral hog damage. The lowest scoring items were injury, death, or disease to livestock (*M*=.09, *SD*= .29), negative impacts to stored commodities (*M*=.04, *SD*= .20), and personal injuries (*M*=.02, *SD*= .15) [see Table 10].

Table 10
Descriptive Statistics for Negative Impacts on Property

Negative impact of feral hogs on your property in the past year	*n*	*M*	*SD*
Pastures	10721	.70	.46
Owner or employee time	10721	.36	.48
Fences, water troughs, or other improvements.	10721	.35	.48
Growing or planting commodity crop losses	10721	.24	.43
Loss of land value	10721	.20	.40
Wetlands	10721	.19	.39
Loss of lease value, damage to food plots/feeders	10721	.17	.38
Equipment or vehicles	10721	.16	.36
Growing or planting specialty crop losses	10721	.13	.34
Livestock (injury, death, diseases)	10721	.09	.29
Stored commodities	10721	.04	.20
Personal injuries	10721	.02	.15

A significance level of α=.05, confidence interval 95% was used for this study. The alpha coefficient for this test was α=.72, which indicates a high level of internal consistency (Drost, 2011; Nunnally 1978). The alpha levels if items were deleted are reported in Table 11. Negative impacts of feral hogs on landowners' property, specifically to personal injuries, in the past year reported an alpha level of α=.72. This construct had the least effect on the reliability of the question. Growing or planting commodity crop losses, growing or planting specialty crop losses, and stored commodities all had an alpha level of α=.71. Damage to pastures; damage to wetlands; injury, death, and diseases affecting livestock; damage to fences, water troughs, or other improvements; damage to equipment or vehicles; loss of land value; and loss of lease value and damage to plots/feeders all had a marginally high level of internal consistency (α=.70). Owner or employee time (α=.68) contributed to the greatest reduction of

reliability. This could be cause for concern, for this same construct was reported by 36.2% of landowners as having a negative impact as a result of feral hogs [see Table 9].

Table 11
Reliability Coefficients for Negative Impacts on Property

Negative impact of feral hogs on your property in the past year	*Alpha Levels*
Personal injuries	.72
Growing or planting commodity crop losses	.71
Growing or planting specialty crop losses	.71
Stored commodities	.71
Pastures	.70
Wetlands	.70
Livestock (injury, death, diseases)	.70
Fences, water troughs, or other improvements	.70
Equipment or vehicles	.70
Loss of land value	.70
Loss of lease value, damage to plots/feeders	.70
Owner or employee time	.68

The second objective, which correlates to the second question on the instrument, relates to what methods landowners were already using prior to attending a wild pig program [see Table 12]. Trapping and destroying feral hogs (*f* = 5,347, 49.9%) and owner/employee hunting (*f* = 5,122, 47.8%) are by far the most commonly used methods of wild pig management by the sample of landowners in Texas. This relates to the information found in the first objective; landowners reported loss of landowner or employee time as the second highest negative impact of wild pigs. Use of dogs (*f* = 1,694, 15.8%), trapping and selling wild pigs (*f* = 1,265, 11.8%), and trapping and removing wild hogs from the premise (*f* = 1,092, 10.2%) constitute the middle range of methods used by landowners prior to attending a program. Other forms of control, such

as snares and aerial gunning (*f* = 946, 8.8%), and lease hunting (*f* = 797, 7.4%) were the least commonly used methods of wild pig control by landowners.

Table 12
Frequencies for Control Methods Used By Landowners Prior to the Program

Areas	*f*	%
Trap & destroyed	5347	49.9
Owner/employee hunting	5122	47.8
Use of dogs	1694	15.8
Trapped & sold	1265	11.8
Trapped & moved from premise	1092	10.2
Other (snares, aerial gunning)	946	8.8
Lease hunting	797	7.4

Note: n=10721

Descriptive statistics regarding the control methods landowners used prior to a wild pig program are indicated in Table 13. The items earning the highest scores were trapping and destroying wild pigs (*M* = .50, *SD* = .50) and owner/employee hunting (*M* = .48, *SD* = .50). Use of dogs (*M* = .16, *SD* = .37), trapping and selling wild pigs (*M* = .12, *SD* = .32), and trapping and removing wild pigs from the premise (*M* = .10, *SD* = .30) comprise the next largest segment of control methods utilized by landowners. The items scoring the lowest included other control methods such as aerial gunning and snares (*M* = .09, *SD* = .28) and lease hunting (*M* = .07, *SD* = .26)

Table 13
Descriptive Statistics for Control Methods Used by Landowners Prior to the Program

Control methods	*n*	*M*	*SD*
Trapped & destroyed	10721	.50	.50
Owner/employee hunting	10721	.48	.50
Use of dogs	10721	.16	.37
Trapped & sold	10721	.12	.32
Trapped & moved from premise	10721	.10	.30
Other (snares, aerial gunning)	10721	.09	.28
Lease hunting	10721	.07	.26

All of the control methods are generally independent of one another. As a result, the constructs cannot very well be combined to get any kind of measure of internal consistency. Attempting to measure internal consistency would result in the following. The alpha coefficient for this test was α=.45, which indicates a low level of internal consistency. Table 14 displays the alpha coefficients of the question if items were deleted. Owner or employee hunting (α=.45) had the least effect on the reliability of the question; removing this question does not alter the quality of the question. However, it is concerning that this is such a low alpha level. This indicates that this question needs to be further analyzed to improve its internal validity, which would make the instrument a more sound judgment of the impact of wild pig management programs. Lease hunting (α=.44), other control methods (snares, aerial gunning) (α=.43), trapping and removing wild pigs from the premise (α=.42), and trapping and selling wild pigs (α=.40) had relatively minimal effects on the alpha level of this question. Trapping and destroying wild pigs (α=.36) has the greatest impact on the internal consistency of the question.

Table 14
Reliability Coefficients for Control Methods Used

Control Methods	*Alpha Levels*
Owner/employee hunting	.45
Lease hunting	.44
Other (snares, aerial gunning)	.43
Trapped & removed from premise	.42
Trapped & sold	.40
Use of dogs	.38
Trapped & destroyed	.36

The third objective was to determine total economic losses on landowners' property(s) due to wild pigs during the year prior to participation in the Extension program [see Table 15]. 33.1% (*f*=2,254) of participants estimated that wild pigs caused $2,999 to $1,000 of damage on their land in the year prior to their partaking in a wild pig management program. The next largest percentage of landowners (*f*=1,796, 26.4%) reported losses of $999 to $1. Landowners estimated losses of $6,999 to $3,000 (*f*=1,229, 18.0%) and $7,000 or more (*f*=938, 13.8%) less frequently. Only 8.8% (*f*=598) of landowners reported no economic losses due to wild pigs during the previous year. For this construct, 36.4% (*f*=3,906) did not respond to the question.

Table 15
Frequencies for Estimated Economic Losses due to Feral Hogs During the Previous Year

Losses	*f*	*%*
$2,999 to $1,000	2254	33.1
$999 to $1	1796	26.4
$6,999 to $3,000	1229	18.0
$7,000 or more	938	13.8
None	598	8.8

Note: n=3906 did not answer the question, resulting in 36.4% not responding

The average amount of estimated economic losses during the previous year are reported in Table 16 (*M*=$4,861.98, *SD*=$19,054.04). While the average amount of losses was around $5,000, reported losses extend much lower (to none) and higher than this value (with some amounts reported exceeding $50,000 in losses!). This indicates that landowners experience varying impacts from feral hogs, which may have implications for intended adoption.

Table 16
Descriptive Statistics for Estimated Economic Losses due to Feral Hogs During the Previous Year

	n	*M*	*SD*
Economic losses—Previous year	6815	$4,861.98	$19,054.04

Note: n=3906 did not answer question, resulting in 36.4% not responding.

The fourth objective sought to determine landowner estimates of future losses on property(s) due to wild pigs during the year after the program [Table 17]. The two most reported ranges of expected losses in the year after attending a program were from $999 to $1 (*f*=1,956, 35.3%) and from $2,999 to $1,000 (*f*=1,550, 28.0%). No losses in the coming year (*f*=738, 13.3%) and losses ranging from $6,999 to $3,000 (*f*=733, 13.2%) were the third and fourth most reported ranges. Participants least expected losses of $7,000 or higher (*f*=567, 10.2%) in the coming year.

Table 17
Frequencies for Estimated Economic Losses due to Feral Hogs During the Upcoming Year

Losses	*f*	%
$999 to $1	1956	35.3
$2,999 to $1,000	1550	28.0
None	738	13.3
$6,999 to $3,000	733	13.2
$7,000 or more	567	10.2

Note: n=5177 did not answer the question, resulting in 48.3% not responding

The average amount of estimated economic losses during the previous year are reported in Table 16 (*M*=$4,861.98, *SD*=$19,054.04). While the average amount of losses was around $5,000, reported losses extend much lower (to none) and higher than this value (with some amounts reported exceeding $50,000 in losses!). This indicates that landowners experience varying impacts from feral hogs, which may have implications for intended adoption.

Table 18
Descriptive Statistics for Estimated Economic Losses due to Feral Hogs During the Upcoming Year

	n	*M*	*SD*
Economic losses—Upcoming year	5544	$3,863.09	$21,392.10

Table 19 compares estimated economic damages from the previous year to those expected in the coming year. Based on the data, most participants expected fewer losses in the upcoming year than they experienced during the year prior to the program (*f*=2,941, 42.8%). Other participants felt that the amount of losses they expected in the upcoming year would not change from the estimated losses of the last year (*f*=2,060,

30.0%). Some participants reported a value of estimated losses from the previous year, but did not answer the question regarding expected losses in the upcoming year (*f*=1,334, 19.4%). Comparisons of losses post and prior to the program indicated that some landowners expected more losses in the upcoming year than in the previous year (*f*=480, 7.0%). The least amount of participants indicated an amount for losses during the upcoming year but neglected to specify estimated losses during the previous year (*f*=63, 0.9%). When objectives three and four are compared, there is a combined nonresponse rate of 35.8% (*f*=3,843).

Table 19
Comparison of Estimated Economic Damage Due to Feral Hogs

Losses	*f*	%
Q4 (Upcoming) less than Q3 (Previous)	2941	42.8
Q4 (Upcoming) same as Q3 (Previous)	2060	30.0
Q3 (Previous) has value but Q4 (Upcoming) missing	1334	19.4
Q4 (Upcoming) more than Q3 (Previous)	480	7.0
Q3 (Previous) missing but Q4 (Upcoming) has value	63	0.9

Note: n=3843 did not answer question, resulting in 35.8% not responding

Data collected in relation to objective five is reported in Table 20. This objective sought to determine approximately how much income landowners make from trapping and selling wild pigs and/or leasing wild pig hunting rights during the year prior to the program they attended. A large majority of participants reported making no income at all from these methods (84.6%, *f*=2,254). Landowners who reported making under $1,000 of income made up 10.5% (*f*=1,796) of the participants in the program who responded. 4.9% (*f*=1,229) of participants indicated that they made $1,000 or more from trapping

and selling and/or leasing hunting rights. This construct had a nonresponse rate of 58.0% (*f*=6,220).

Table 20
Frequencies for How Much Income from Trapping and Selling Hogs and/or Leasing Hog Hunting Rights Last Year

Areas	*f*	%
None	2254	84.6
Under $1,000	1796	10.5
$1,000 or more	1229	4.9

Note: n=6220 did not answer question, resulting in 58.0 % not responding.

Descriptive statistics for how much income that was made from trapping and selling wild pigs and/or leasing wild pig hunting rights in the last year are described in Table 21 (*M*= $589.33, *SD*=$13,391.40). The average amount of income earned was less than $600; however, there is a large spread in the amounts reported by participants who responded to this question. It is important to keep in mind that there was a 58.0% (*n*=6,220) nonresponse rate for this question.

Table 21
Descriptive Statistics for How Much Income from Trapping and Selling Hogs and/or Leasing Hog Hunting Rights Last Year

	n	*M*	*SD*
Income—Previous Year	4504	$589.33	$13,391.40

Note: n=6220 did not answer question, resulting in 58.0 % not responding.

The sixth objective was to determine whether landowners perceive they gained knowledge of wild pigs and their control from attending the program [see Table 22]. A

large majority of participants (*f* = 9,804, 98.8%) reported a perceived increase in knowledge after completion of the program. There was a much smaller percentage of participants who reported they did not believe they had increased their knowledge by attending a program (*f* = 122, 1.2%). It is important to note that *n*=795 (7.4%) did not respond to this question. Even so, participants report an increase in knowledge as a result of the educational programs organized by Texas A&M AgriLife Extension.

Table 22
Frequencies for Perceived Increase in Knowledge

Areas	*f*	%
Yes	9804	98.8
No	122	1.2

Note: n=795 did not answer question, resulting in 7.4 % not responding.

Objective seven of this study was to describe the change in landowners' knowledge in the areas of wild pig biology; legal control options; efficient trap/bait techniques; and types/extent of hog damage after taking the program [see Tables 23 to 41]. Participants were asked to rate their level of knowledge prior to attending the program on a scale from 1 to 5, with 1 = *no/little knowledge*, 3 = *some knowledge*, and 5 = *high level of knowledge*.

Frequencies for knowledge level of feral hog biology of participants before participating in the Extension program. The majority of participants marked 3, or some knowledge, (*f*=3,490, 34.7%) and 2 (*f*=2,887, 28.7%). No/little knowledge, or 1, was chosen by 19.1% (*f*=1,918) of respondents. The lowest percentage of respondents indicated their level of knowledge was 4 (*f*=1,382, 13.8%) and (*f*=368, 3.7%) indicated

high level of knowledge [see Table 23]. There was a 6.3% (*n*=676) nonresponse rate for this part of the question.

Table 23
Frequencies for Knowledge Level Prior to the Program: Feral Hog Biology

Level of Knowledge (Before): Feral Hog Biology	*f*	*%*
3 (Some)	3490	34.7
2	2887	28.7
1 (No/little)	1918	19.1
4	1382	13.8
5 (High)	368	3.7

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*
Note: n=676 did not answer question, resulting in 6.3 % not responding.

Knowledge level regarding feral hog biology after the program was conducted is reported in Table 24. This was measured using a five point scale, with 1 representing no or little knowledge, 3 indicating some knowledge, and 5 meaning high level of knowledge. Most respondents reported 4 (*f*=4,789, 47.7%) or 5, high level of knowledge, (*f*=4,077, 40.6%) as their knowledge level after the program. The third most selected knowledge level was 3, or some knowledge (*f*=1,004, 10.0%). The lowest frequency of respondents indicated 2 (*f*=126, 1.3%) and 1, no/little knowledge (*f*=49, 0.5%). There was a 6.3% (*n*=676) nonresponse rate for this part of the question.

Table 24
Frequencies for Knowledge Level After the Program: Feral Hog Biology

Level of Knowledge (After): Feral Hog Biology	*f*	*%*
4	4789	47.7
5 (High)	4077	40.6
3 (Some)	1004	10.0
2	126	1.3
1 (No/little)	49	0.5

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*
Note: n=676 did not answer question, resulting in 6.3 % not responding.

The change in knowledge level of wild pig biology was overwhelmingly positive (*f*=9,007, 89.7%). This signifies that there was a gain in knowledge for this construct. No change in knowledge level occurred for 9.5% (*f*=953) of participants. There was a negative change in knowledge regarding feral hog biology for 0.8% (*f*=85) of respondents. Some respondents appear to have felt like they lost knowledge on this subject; this could be attributed to confusion or conflicting information. A total of 10,045 (93.7%) participants responded to this construct of knowledge, which means that there were 676 (6.3%).

Table 25
Frequencies for Before-After Change Level: Feral Hog Biology

Level of Knowledge (Before-After): Feral Hog Biology	*f*	*%*
Positive movement	9007	89.7
No change	953	9.5
Negative movement	85	0.8
Total	10045	93.7

Note: n=676 did not answer question, resulting in 6.3 % not responding.

The second area of knowledge that Extension was interested in was legal control options for wild pigs. As with the previous construct for knowledge gained, this concept was measured based on a five point scale. Knowledge levels prior to the program [Table 26] show that higher frequencies of respondents felt they had 3, some knowledge, (*f*=2,988, 30.0%) regarding legal control options. The next highest percentages of respondents marked 2 (*f*=2,309, 23.2%) or 1, no or little knowledge (*f*=2,086, 21.0%). The lowest percentages of respondents marked 4 (*f*=1,835, 18.5%) or 5, high level of knowledge (*f*=727, 7.3%). For this construct of knowledge, 7.2% (*n*=776) of participants did not respond.

Table 26
Frequencies for Knowledge Level Prior to the Program: Legal Control Options

Level of Knowledge (Before): Legal Control Options	*f*	%
3 (Some)	2988	30.0
2	2309	23.2
1 (No/little)	2086	21.0
4	1835	18.5
5 (High)	727	7.3

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*
Note: n=776 did not answer question, resulting in 7.2 % not responding.

Knowledge level regarding legal control options of wild pigs after participating in the Extension program is displayed in Table 27. Subsequent to participation in the program, 52.7% (*f*=5,237) of respondents indicated a 5, or high level of knowledge, on the five point scale. The next most commonly chosen answer was 4 (*f*=3,827, 38.5%). The remaining choices were chosen far less frequently; only 7.5% (*f*=744) of respondents chose 3, or some knowledge, while 0.9% (*f*=88) chose 2 and 0.5% (*f*=49)

chose 1, no or little knowledge of legal control options. There was a 7.2% (*n*=776) nonresponse rate for this part of the question.

Table 27
Frequencies for Knowledge Level After the Program: Legal Control Options

Level of Knowledge (After): Legal Control Options	*f*	*%*
5 (High)	5237	52.7
4	3827	38.5
3 (Some)	744	7.5
2	88	0.9
1 (No/little)	49	0.5

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*
Note: n=776 did not answer question, resulting in 7.2 % not responding.

There was an increase in knowledge regarding legal control options of wild pigs was positive [Table 28]. Positive movement for this measurement of knowledge moved in a positive direction for 84.5% (*f*=8,407) of respondents. No change in knowledge level occurred among 14.6% (*f*=1,455) of participants who answered this question. Of those who attended the program and participated in this survey, 0.8% (*f*=83) felt they had a negative change in knowledge regarding legal control options for wild pigs. Altogether, the before-after change level of knowledge regarding this particular part of the program had a total of 92.8% (f=9,945) of respondents. A small percentage of participants 7.2% (*f*=776) did not respond to this part of the question.

Table 28
Frequencies for Before-After Change Level: Legal Control Options

Level of Knowledge (Before-After): Legal Control Options	*f*	*%*
Positive movement	8407	84.5
No change	1455	14.6
Negative movement	83	0.8
Total	9945	92.8

Note: n=776 did not answer question, resulting in 7.2 % not responding.

The third construct of knowledge that this study analyzed related to understanding of efficient trap/bait techniques [Tale 21]. As with the first two knowledge categories, a five point scale was used to determine landowners' self-perceived knowledge levels. Most participants chose either 3, some level of knowledge, (*f*=3,362, 33.9%) or 2 (*f*=2,618, 24.4%). The next most frequently chosen anchors were 1, no or little knowledge (*f*=1,786, 18.0%), and 4 (*f*=1,682, 17.0%). Very few respondents felt they had a high level of knowledge of efficient trap/bait techniques before the program (*f*=463, 4.7%). Of the participants who attended the programs and completed a survey, 7.6% (f=810) did not respond to this part of the knowledge question.

Table 29
Frequencies for Knowledge Level Prior to the Program: Efficient Trap/Bait Techniques

Level of Knowledge (Before): Efficient Trap/Bait Techniques	*f*	*%*
3 (Some)	3362	33.9
2	2618	26.4
1 (No/little)	1786	18.0
4	1682	17.0
5 (High)	463	4.7

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*
Note: n=810 did not answer question, resulting in 7.6 % not responding.

Data on efficient trap/bait technique knowledge levels post-program indicate that there were significant gains in this area [Table 30]. Over half of respondents marked 5, (*f*=5,245, 52.9%) high level of knowledge, in response to their comprehension of this concept after the program. The next greatest percentage of respondents chose 4 (*f*=3,853, 38.9%). The frequencies the remaining anchors were chosen were considerably less than these first two. 6.8% (*f*=673) of participants chose 3, some knowledge, while 1.0% (*f*=100) chose 2 and 0.4% (*f*=40) chose 1, no or little understanding of efficient trap/bait techniques. There was a 7.6% (*n*=810) nonresponse rate for this part of the question.

Table 30
Frequencies for Knowledge Level After the Program: Efficient Trap/Bait Techniques

Level of Knowledge (After): Efficient Trap/Bait Techniques	*f*	*%*
5 (High)	5245	52.9
4	3853	38.9
3 (Some)	673	6.8
2	100	1.0
1 (No/little)	40	0.4

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*
Note: n=810 did not answer question, resulting in 7.6 % not responding.

The change in knowledge pre-program and post-program is represented in Table 31. For the majority of participants, there was a positive movement in knowledge of efficient trap/bait techniques for wild pigs (*f*=8,875, 88.6%). Some of the landowners who responded to this question reported no change in their knowledge (*f*=1,045, 10.5%), and a few indicated that there was negative movement in their knowledge level (*f*=81, 0.8%). A total of 92.4% (*f*=9,911) of landowners who attended the Extension program responded to this question, resulting in 7.6% (*n*=810) not responding.

Table 31
Frequencies for Before-After Change Level: Efficient Trap/Bait Techniques

Level of Knowledge (Before-After): Efficient Trap/Bait Techniques	*f*	*%*
Positive movement	8785	88.6
No change	1045	10.5
Negative movement	81	0.8
Total	9911	92.4

Note: n=810 did not answer question, resulting in 7.6 % not responding.

Knowledge of types/extent of hog damage was the fourth knowledge area studied using the same five point scale described above. The data revealed that prior to attending an Extension program, the majority of participants indicated the anchor 3, some knowledge of wild pigs (*f*=3,329, 34.1%). Participants reported a 4 (*f*=2,467, 25.3%) or 2 (*f*= 1,790, 18.3%) as their level of knowledge regarding this topic prior to the program. The fewest respondents chose 5, high level or knowledge, (*f*=1,092, 11.2%) or 1, no/little knowledge (*f*=1,086, 11.1%). This construct had an 8.9% (*n*=957) nonresponse rate [see Table 32].

Table 32
Frequencies for Knowledge Level Prior to the Program: Types/Extent of Hog Damage

Level of Knowledge (Before): Types/Extent of Hog Damage	*f*	*%*
3 (Some)	3329	34.1
4	2467	25.3
2	1790	18.3
5 (High)	1092	11.2
1 (No/little)	1086	11.1

Scale: 5 = *high level of knowledge,* 3 = *some knowledge,* and 1 = *no/little knowledge.*
Note: n= 957 did not answer question, resulting in 8.9% not responding

Knowledge level of types/extent of wild pig damage after attending a program, as reported in Table 33, reveals 53.4% (*f*=5,217) responded with a 5, high level of knowledge, and 38.1% (*f*=3,720) indicated a 4. The remaining respondents chose 3, some knowledge (*f*=694, 7.1%), 2 (*f*=83, 0.9%), or 1, no/little knowledge (*f*=50, 0.5%). For this component of knowledge after an Extension program, 957 (8.9%) of the participants did not respond.

Table 33
Frequencies for Knowledge Level After the Program: Types/Extent of Hog Damage

Level of Knowledge (After): Types/Extent of Hog Damage	*f*	*%*
5 (High)	5217	53.4
4	3720	38.1
3 (Some)	694	7.1
2	83	0.9
1 (No/little)	50	0.5

Scale: 5 = *high level of knowledge,* 3 = *some knowledge,* and 1 = *no/little knowledge.*
Note: n=957 did not answer question, resulting in 8.9 % not responding.

The change in reported knowledge level or participants was largely positive [see Table 34].It is interesting to note that of the four measurements of knowledge, this topic

experienced the lowest degree of positive movement. Three-quarters of respondents (*f*=7,432, 76.1%) experienced positive movement in their knowledge level regarding types/extent of wild pig damage. Approximately a fourth of the respondents (*f*=2,243, 23.0%) reported no change in their knowledge. Only a few (*f*=89, 0.9%) indicated negative movement in their knowledge of types/extent of hog damage. The total number of respondents to this question (*f*=9,764, 91.1%) was lower than the previous three constructs [see Tables 25, 28, and 31]. A nonresponse rate of 8.9% (*f*=957) was recorded for this construct.

Table 34
Frequencies for Before-After Change Level: Types/Extent of Hog Damage

Level of Knowledge (Before-After): Types/Extent of Hog Damage	*f*	*%*
Positive movement	7432	76.1
No change	2243	23.0
Negative movement	89	0.9
Total	9764	91.1

Note: n=957 did not answer question, resulting in 8.9% not responding.

The average responses and percent change in knowledge for the four constructs are reported in Table 35. Percent change in knowledge was calculated using percent change = ((post mean – pre mean)/ 4) * 100. The average reported score of knowledge prior to the program for efficient trap/bait techniques had the highest percent change (44.7%). Legal control options (43.5%) and feral hog biology (43.2%) had the next highest levels of percent change in knowledge based on pre and post means. Types/extent of wild pig damage (34.0%) resulted in the lowest percent change in knowledge.

Table 35
Pre Means, Post Means, and Percent Change

Knowledge level	*Mean Before*	*Mean After*	*Percent Change*
Efficient trap/bait techniques	2.64	4.43	44.7
Legal control options	2.68	4.42	43.5
Feral hog biology	2.54	4.27	43.2
Types/extent of hog damage	2.64	4.43	34.0

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*
*Percent Change = ((Post Mean – Pre Mean) / 4) * 100*

Based on the five point scale used to measure the four constructs of knowledge, the anchors 4 and 5 indicated the highest two levels of knowledge. The seventh question, which measure knowledge, had all four of the constructs placed on this five-point scale. The two highest markers for knowledge, 4 and 5, could be chosen a minimum of zero times and a maximum of four times on one individual's survey. Prior to attending a program, over half of participants (*f*=5,608, 55.2%) marked zero items at the 4 or 5 level. This signifies a general lack of knowledge regarding feral hog biology, legal control options, efficient trap/bait techniques, and types/extent of hog damage prior to the program. One (*f*=1,687, 16.6%) or two (*f*=11.5%, 1,169) items were indicated to be at knowledge levels of 4 or 5 by respondents. Four items, the maximum possible, were reported to be at a knowledge level of 4 or 5 (*f*=903, 8.9%) prior to the program, while three items were indicated at this level prior to the program by 7.8% (*f*= 793) of respondents. Nonresponse for this item was minimal (*f*=561, 5.2%).

Table 36
Total Number of Knowledge Items at Level 4 or 5 (Out of 4 Possible) Prior to the Program

Total Number of Knowledge Items at Level 4 or 5—Pre	*f*	*%*
0	5608	55.2
1	1687	16.6
2	1169	11.5
4	903	8.9
3	793	7.8

Note: n=561 did not answer question, resulting in 5.2 % not responding.

The frequency of participants indicating their knowledge level at a 4 or 5, high level of knowledge, after the program is indicated in Table 37. Most participants responded with a 4 or 5, high level of knowledge, to all four knowledge questions (*f*=7,780, 76.6%). Three (*f*=1,169, 11.5%) constructs were rated at a 4 or 5 level the second most. Two (*f*=527, 5.2%), zero (*f*=400, 3.9%), or one (*f*=284, 2.8%) anchor at the 4 or 5 level represented the rest of the respondents' knowledge level post-program. There was a nonresponse rate of 5.2% (*n*=561) for this construct.

Table 37
Total Number of Knowledge Items at Level 4 or 5 (Out of 4 Possible) After the Program

Total Number of Knowledge Items at Level 4 or 5—Post	*f*	*%*
4	7780	76.6
3	1169	11.5
2	527	5.2
0	400	3.9
1	284	2.8

Note: n=561 did not answer question, resulting in 5.2 % not responding.

Positive movement indicates that respondents reported lower levels of knowledge prior to the program and higher levels of knowledge post-program. There were four items that measured knowledge, so a minimum of zero items and a maximum of four items could display positive movement [see Table 38]. Most respondents reported positive movement in knowledge levels for four items (*f*=6,448, 63.5%). The second most frequent numbers of items with positive movement was three (*f*=1,807, 17.8%), followed by two (*f*=953, 9.4%) and one (*f*=512, 5.0%). A small percentage of participants demonstrated no positive movement in their knowledge levels, with zero (*f*=440, 4.3%) out of a possible four items showing an increase on the scale. Nonresponse for this item was minimal (*f*=561, 5.2%).

Table 38
Items with Positive Movement (Out of 4 Possible)

Items with Positive Movement	*f*	%
4	6448	63.5
3	1807	17.8
2	953	9.4
1	512	5.0
0	440	4.3

Note: n=561 did not answer question, resulting in 5.2% not responding.

The items earning the highest scores for knowledge prior to the program were types/extent of hog damage (*M*=3.07, *SD*=1.15) and legal control options (*M*=2.68, *SD*=1.20). efficient trap/bait techniques (*M*=2.64, *SD*=1.10) and feral hog biology (*M*=2.54, *SD*=1.06) earned the lowest scores [see Table 39].

Table 39
Descriptive Statistics for Knowledge Prior to the Program

Knowledge level—Before	*n*	*M*	*SD*
Types/extent of hog damage	9764	3.07	1.15
Legal control options	9945	2.68	1.20
Efficient trap/bait techniques	9911	2.64	1.10
Feral hog biology	10045	2.54	1.06

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*

The items earning the highest scores for knowledge after the program were efficient trap/bait techniques (*M* = 4.43, *SD* = .70) and types/extent of hog damage (*M* = 4.43, *SD* = .71). The items earning the lowest scores were legal control options (*M* = 4.42, *SD* = .71) and feral hog biology (*M* = 4.27, *SD* = .73) [see Table 40].

Table 40
Descriptive Statistics for Knowledge Gained from Participating in the Extension Program

Knowledge level—After	*n*	*M*	*SD*
Efficient trap/bait techniques	9911	4.43	.70
Types/extent of hog damage	9764	4.43	.71
Legal control options	9945	4.42	.71
Feral hog biology	10045	4.27	.73

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*
Note. Overall M = 4.39, SD = .72.

The alpha coefficient for this test, which analyzed knowledge levels before and after the program, was α=.84, which indicates a high level of internal consistency. Knowledge after the program for all four items (α=.81) had the least effect on the reliability of the question; removing this question does not alter the quality of the question. Knowledge before the program (α=.83) had a slightly greater impact on the

internal validity of the question. However, high alpha levels overall signify that this is a reliable question.

Table 41
Reliability Coefficients for Knowledge Before/After the Program

Knowledge level	*Alpha Levels*
(Before)—feral hog biology	.81
(After)—feral hog biology	.83
(Before)—legal control options	.81
(After)—legal control options	.83
(Before)—efficient trap/bait techniques	.81
(After)—efficient trap/bait techniques	.83
(Before)—types/extent of hog damage	.81
(After)—types/extent of hog damage	.83

The eighth objective was to describe participants' planned adoption of innovations to manage wild pigs after participating in the Extension program. This construct was measured using a multiple choice question where participants marked which of the eight possible methods they planned to adopt. Participants could mark none or all of the options, or any combination therein. Using larger traps (*f* = 5,464, 51.0%) was the most identified innovation participants planned to adopt as a result of the program. Pre-bait traps to encourage consistent hog visits (*f* = 5,073, 47.3%) and scout for hog signs (*f* = 5,027, 46.9%) were the second and third most identified innovations that participants planned to adopt as a result of the program. Participants indicated that wearing eyewear and gloves during field dressing would be the least likely innovation adopted (*f* = 1,788, 16.7%). This may have been due to the small percentage of respondents planning to process wild pigs for human consumption.

Table 42
Frequencies for Practices Planned to Adopt

Practices you plan to adopt	*f*	*%*
Use larger traps	5464	51.0
Pre-bait traps to encourage consistent hog visits	5073	47.3
Scout for hog sign (tracks, wallows, rubs, hair)	5027	46.9
Market trapped hogs to processors to recoup losses	4002	37.3
Use baits with scent appeal	3757	35.0
Set traps whenever fresh sign appears	3569	33.3
Vary/change baits at different locations	3044	28.4
Wear eyewear and gloves during field dressing	1788	16.7

Note: n=10721

The items earning the highest scores for practices planned to adopt as a result of the program were use larger traps (*M* = .51, *SD* = .50) and pre-bait traps to encourage consistent hog visits (*M* = .47, *SD* = .50). Scout for hog sign (tracks, wallows, rubs, hair) (*M* = .47, *SD* = .50) and market trapped hogs to processors to recoup losses (*M* = .37, *SD* = .48) were the next highest scoring items. Use baits with scent appeal (*M* = .35, *SD* = .48) and set traps whenever fresh sign appears (*M* = .33, *SD* = .47) scored on the lower end for practices planned to adopt. The items earning the lowest scores were vary/change baits at different locations (*M* = .28, *SD* = .45) and wear eyewear and gloves during field dressing (*M* = .17, *SD* = .37) [see Table 43].

Table 43
Descriptive Statistics for Practices Planned to Adopt (n=10721)

Practices you plan to adopt	*M*	*SD*
Use larger traps	.51	.50
Pre-bait traps to encourage consistent hog visits	.47	.50
Scout for hog sign (tracks, wallows, rubs, hair)	.47	.50
Market trapped hogs to processors to recoup losses	.37	.48
Use baits with scent appeal	.35	.48
Set traps whenever fresh sign appears	.33	.47
Vary/change baits at different locations	.28	.45
Wear eyewear and gloves during field dressing	.17	.37

Scale: 5 = *high level of knowledge*, 3 = *some knowledge*, and 1 = *no/little knowledge.*

The total number of practices planned to adopt by (*n*=10,721) participants scored (*M* = 2.96, *SD* = 2.35). Of the eight wild pig control practices included in the survey, participants planned to adopt two to three practices. There was a fairly high amount of variation, with as few as zero practices and as many as six practices falling within one standard deviation of the mean [see Table 44].

Table 44
Total Number of Practices Planned to Adopt (n=10721)

Items	*M*	*SD*
Total Number of Practices Planned to Adopt	2.96	2.35

There was a wide range in the number of practices participants planned to adopt. The largest percentage planned to adopt 0 practices (*f*=1,912, 17.8%). The next largest percentage of practices planned to adopt was 2 (*f*=1,644, 15.3%), followed by 1 practice (*f*=1,630, 15.2%), 3 practices (*f*=1,506, 14.0%), and 4 practices (*f*=1,288, 12.0%). Participants who planned to adopt 5 practices (*f*=946, 8.8%), 6 practices (*f*=698, 6.5%), 7

practices (*f*=558, 5.2%), and 8 practices (*f*=539, 5.0%) made up the lowest frequencies of practices planned to adopt [see Table 45].

Table 45
Frequencies Total Number of Practices Planned to Adopt

Practices you plan to adopt	*f*	%
0	1912	17.8
2	1644	15.3
1	1630	15.2
3	1506	14.0
4	1288	12.0
5	946	8.8
6	698	6.5
7	558	5.2
8	539	5.0

Note: n=10721

The alpha coefficient for this test was α=.78, which indicates a high level of internal consistency. Vary/change baits at different locations reported an alpha level of α=.78. This construct had the least effect on the reliability of the question. Scout for hog sign (tracks, wallows, rubs, hair) reported the second highest alpha level (α=.77). Set traps whenever fresh sign appears, wear eyewear and gloves during field dressing, and market trapped hogs to processors to recoup losses had slightly lower alpha levels (α=.76). The items that had the lowest alpha levels for this question were use larger traps (α=.75), use baits with scent appeal (α=.73), and pre-bait traps to encourage consistent hog visits (α=.73) [see Table 46].

Table 46
Reliability Coefficients for Practices Planned to Adopt

Practices you plan to adopt	*Alpha Levels*
Vary/change baits at different locations	.78
Scout for hog sign (tracks, wallows, rubs, hair)	.77
Set traps whenever fresh sign appears	.76
Wear eyewear and gloves during field dressing	.76
Market trapped hogs to processors to recoup losses	.76
Use larger traps	.75
Use baits with scent appeal	.73
Pre-bait traps to encourage consistent hog visits	.73

The ninth objective was to determine the likelihood to recommend Texas A&M AgriLife Extension programs about wild pig management to others in order to calculate the NPS score. This objective was measured using an eleven point scale, with 0 = not likely and 10 = likely. Over half of respondents reported a 10, likely to recommend (*f*=6,066, 58.7%). The items that had the next highest frequencies were 8 (*f*=1,413, 13.7%) and 9 (*f*=1,375, 13.3%). The anchors subsequently indicated by the respondents were 7 (*f*=615, 5.9%), 5 (*f*=351, 3.4%), and 6 (*f*=279, 2.7%). In general, the lower half of the measurement scaled represented a very small percentage of answers from participants. Anchor 4(*f*=82, 0.8%), 3 (*f*=55, 0.5%), 0, not likely to recommend Extension (*f*=44, 0.4%), 2 (*f*=34, 0.3%), and 1 (*f*=27 0.3%) made up this lower quadrant of participants' likelihood to recommend Extension [see Table 47].

Table 47
Frequencies for Likelihood to Recommend Texas A&M AgriLife Extension Service (n=10.721)

Likelihood to Recommend	*f*	*%*
10	6066	58.7
8	1413	13.7
9	1375	13.3
7	615	5.9
5	351	3.4
6	279	2.7
4	82	0.8
3	55	0.5
0	44	0.4
2	34	0.3
1	27	0.3

Note: n=561 did not answer question, resulting in 5.2% not responding.

The total number of practices planned to adopt by (*n*=10,341) participants scored (*M* = 8.96, *SD* = 1.68). On the eleven point scale used to measure participants' likelihood to recommend an Extension program, the average response was (*M*=8.96, *SD*=1.68). Participants are likely to be report an anchor in the 7 to 10 range based on standard deviation [see Table 48].

Table 48
Descriptive Statistics for Likelihood to Recommend Texas A&M AgriLife Extension Service (n=10,341)

Items	*M*	*SD*
What is the likelihood that you would recommend Texas A&M AgriLife Extension Service to your family, friends and colleagues as a contact for information on feral hogs and their control?	8.96	1.68

Scale: 10 = *likely* and 0 = *not likely*.

Objective ten sought to describe the relationship between knowledge gained and practices landowners planned to adopt as a result of the program. Tables 49 through 52 display the results of correlation analyses of each construct of knowledge individually against practices planned to adopt. Table 53 displays correlational data when all variables are run together.

All correlations between knowledge gained and regarding feral hog biology and practices planned to adopt were significant, $p < .05$ [see Table 49]. Correlations between knowledge gained and planned adoption were negligible ($r \leq .09$). Use baits with scent appeal, set traps whenever fresh sign appears, and vary/change bait at different locations earned the highest correlation ($r = .07$). Scout for hog sign (tracks, wallows, rubs, hair) earned the lowest correlation ($r = .04$).

Table 49
Correlation Between Knowledge Gained in Feral Hog Biology and Practices Planned to Adopt (n = 10,045)

	Knowledge Gained: Feral Hog Biology	
Practices Planned to Adopt	*r*	*p*
Use baits with scent appeal	.07	.00*
Set traps whenever fresh sign appears	.07	.00*
Vary/change baits at different locations	.07	.00*
Wear eyewear and gloves during field dressing	.06	.00*
Pre-bait traps to encourage consistent hog visits	.06	.00*
Market trapped hogs to processors to recoup	.06	.00*
losses	.05	.00*
Use larger traps		
Scout for hog sign (tracks, wallows, rubs, hair)	.04	.00*

Note. Magnitude: $.01 \leq r \leq .09$ = Negligible, $.10 \leq r \leq .29$ = Low, $.30 \leq r \leq .49$ = Moderate, $.50 \leq r \leq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

All correlations between knowledge gained and regarding legal control options and practices planned to adopt were statistically significant, $p < .05$ [see Table 50]. The correlations between knowledge gained and planned adoption were negligible ($r = .09$). Use baits with scent appeal, vary/change baits at different locations, pre-bait traps to encourage consistent hog visits, and market trapped hogs to processors to recoup losses earned the highest correlation ($r = .09$). Use larger traps earned the lowest correlation ($r = .05$).

Table 50
Correlations Between Knowledge Gained in Legal Control Options and Practices Planned to Adopt (n = 9,945)

	Knowledge Gained: Legal Control Options	
Practices Planned to Adopt	*r*	*p*
Use baits with scent appeal	.09	.00*
Vary/change baits at different locations	.09	.00*
Pre-bait traps to encourage consistent hog visits	.09	.00*
Market trapped hogs to processors to recoup losses	.09	.00*
Set traps whenever fresh sign appears	.07	.00*
Wear eyewear and gloves during field dressing	.07	.00*
Scout for hog sign (tracks, wallows, rubs, hair)	.06	.00*
Use larger traps	.05	.00*

Note. Magnitude: $.01 \leq r \leq .09$ = Negligible, $.10 \leq r \leq .29$ = Low, $.30 \leq r \leq .49$ = Moderate, $.50 \leq r \leq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

All correlations between knowledge gained and regarding efficient trap/bait techniques and practices planned to adopt were significant, $p < .05$ [see Table 51]. The correlations between knowledge gained and planned adoption at the most were low ($r \geq .10$). Pre-bait traps to encourage consistent hog visits and use baits with scent appeal

earned the highest correlations ($r \leq .12$). The item earning the lowest correlation was scout for hog sign (tracks, wallows, rubs, hair) ($r \leq .06$).

Table 51
Correlation Between Knowledge Gained in Efficient Trap/Bait Techniques and Practices Planned to Adopt (n = 9,911)

	Knowledge Gained: Efficient Trap/Bait Techniques	
Practices Planned to Adopt	*r*	*p*
Pre-bait traps to encourage consistent hog visits	.12	.00*
Use baits with scent appeal	.12	.00*
Vary/change baits at different locations	.11	.00*
Wear eyewear and gloves during field dressing	.10	.00*
Use larger traps	.09	.00*
Market trapped hogs to processors to recoup losses	.08	.00*
Set traps whenever fresh sign appears	.07	.00*
Scout for hog sign (tracks, wallows, rubs, hair)	.06	.00*

Note. Magnitude: $.01 \leq r \leq .09$ = Negligible, $.10 \leq r \leq .29$ = Low, $.30 \leq r \leq .49$ = Moderate, $.50 \leq r \leq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

All correlations between knowledge gained and regarding types/extent of hog damage and practices planned to adopt were significant, $p < .05$ [see Table 52]. Correlations between the knowledge and planned adoption at the most were low ($r \geq .10$). The item earning the highest correlation was use baits with scent appeal ($r \leq .10$). Use larger traps earned the lowest correlation ($r \leq .06$).

Table 52
Correlation Between Knowledge Gained in Types/Extent of Hog Damage and Practices Planned to Adopt (n = 9,764)

	Knowledge Gained: Types/Extent of Hog Damage	
Practices Planned to Adopt	*r*	*p*
Use baits with scent appeal	.10	.00*
Vary/change baits at different locations	.09	.00*
Pre-bait traps to encourage consistent hog visits	.09	.00*
Wear eyewear and gloves during field dressing	.09	.00*
Set traps whenever fresh sign appears	.07	.00*
Market trapped hogs to processors to recoup losses	.07	.00*
Scout for hog sign (tracks, wallows, rubs, hair)	.07	.00*
Use larger traps	.06	.00*

Note. Magnitude: $.01 \leq r \leq .09$ = Negligible, $.10 \leq r \leq .29$ = Low, $.30 \leq r \leq .49$ = Moderate, $.50 \leq r \leq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

When all variables are run together, all correlations between knowledge gained and practices planned to adopt were significant, $p < .05$ [see Table 53]. Correlations between knowledge and planned adoption were all low. Efficient trap/bait techniques ($r \geq .15$) reported the highest correlation of the four constructs. Correlation was the weakest between knowledge of feral hog biology and practices planned to adopt ($r \geq .10$).

Table 53
Correlation Between Knowledge Gained and Practices Planned to Adopt

		Practices Planned to Adopt	
Knowledge Gained	*N*	*r*	*p*
Efficient trap/bait techniques	9911	.15	.00*
Types/extent of hog damage	9764	.13	.00*
Legal control options	9945	.12	.00*
Feral hog biology	10045	.10	.00*

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

The tenth objective of the study was to investigate the effect of knowledge on total number of practices participants planned to adopt. The regression model for the tenth objective was significant and indicated a good fit, with $F = 60.64$, $p < .05$. Efficient trap/bait techniques, types/extent of feral hog damage, and feral hog biology were significant $p < .05$ on practices participants planned to adopt.

As knowledge of efficient trap/bait techniques increased one unit, practices participants planned to adopt increased .41 [see Table 54]. As knowledge of types/extent of feral hog damage increased one unit, practices participants planned to adopt increased .17. As feral hog biology increased one unit, practices participants planned to adopt increased .09. The regression model for this study was illustrated as: practices planned to adopt = .58 + .41 efficient trap/bait techniques + .17 types/extent of feral hog damage + .09 feral hog biology + .08 legal control options. Overall, the model accounted for (2%) of the variance in the number of practices participants planned to adopt to control wild pigs.

Table 54
The Effect of Knowledge Gained on Total Number of Practices Participants Planned to Adopt

	B	*SE B*	*P*
Intercept	.58	.17	
Efficient Trap/Bait Techniques	.41	.05	.00
Feral Hog Biology	.09	.05	.05
Types/Extent of Hog Damage	.17	.05	.00
Legal Control Options	.08	.05	.13

Note. $R^2 = .03$; *Adjusted* $R^2 = .02$.

Correlations between likelihood to recommend Extension and knowledge prior to the program regarding efficient trap/bait techniques, feral hog biology, and types/extent of hog damage were significant, $p < .05$ [see Table 55]. The correlation between likelihood to recommend and legal control options was not significant, $p > .05$. Correlations between likelihood to recommend Extension and knowledge prior to the program were negligible ($r \geq .03$). The correlations between likelihood to recommend Extension and efficient trap/bait techniques, feral hog biology, and legal control options were negative; thus, the lower participants felt their knowledge was prior to the program the more likely they were to recommend Extension programs to others.

Table 55
Correlation Between Knowledge Before and Likelihood to Recommend Texas A&M AgriLife Extension

	Likelihood to Recommend Texas A&M AgriLife Extension		
Knowledge Before	*N*	*r*	*p*
Efficient trap/bait techniques	9783	-.03	.00*
Feral hog biology	9905	-.03	.00*
Types/extent of hog damage	9648	.03	.01*
Legal control options	9816	-.00	.76

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

All correlations between likelihood to recommend Extension and knowledge gained were statistically significant, $p < .05$ [see Table 56]. Correlations between likelihood to recommend Extension and knowledge prior to the program were low ($r \leq .30$). The item earning the highest score was legal control options ($r \leq .25$). Efficient trap/bait techniques and feral hog biology earned the lowest correlations ($r \leq .23$).

Table 56
Correlation Between Knowledge After and Likelihood to Recommend Texas A&M AgriLife Extension

	Likelihood to Recommend Texas A&M AgriLife Extension		
Knowledge After	*N*	*r*	*p*
Legal control options	9816	.25	.00*
Types/extent of hog damage	9648	.24	.00*
Efficient trap/bait techniques	9783	.23	.00*
Feral hog biology	9905	.23	.00*

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

All correlations between likelihood to recommend Extension and practices planned to adopt were statistically significant, $p < .05$ [see Table 57]. Correlations between likelihood to recommend Extension and practices participants planned to adopt were low at best ($r < .29$). The item earning the highest score was marketing trapped hogs to processors to recoup losses ($r = .12$). Use larger traps earned the lowest correlation ($r = .05$).

Table 57
Correlation Between Planned Adoption and Likelihood to Recommend Texas A&M AgriLife Extension (n= 10,341)

	Likelihood to Recommend Texas A&M AgriLife Extension	
Practices Planned to Adopt	*r*	*p*
Market trapped hogs to processors to recoup losses	.12	.00*
Scout for hog sign (tracks, wallows, rubs, hair)	.11	.00*
Vary/change baits at different locations	.10	.00*
Use baits with scent appeal	.09	.00*
Pre-bait traps to encourage consistent hog visits	.09	.00*
Wear eyewear and gloves during field dressing	.07	.00*
Set traps whenever fresh sign appears	.06	.00*
Use larger traps	.05	.00*

Note. Magnitude: $.01 \leq r \leq .09$ = Negligible, $.10 \leq r \leq .29$ = Low, $.30 \leq r \leq .49$ = Moderate, $.50 \leq r \leq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

The eleventh objective of the study was to investigate the effect of independent variables on total number of practices participants planned to adopt. All correlations between practices planned to adopt and independent variables, except income made by trapping and selling hogs and/or leasing hog hunting rights last year, were significant, $p < .05$ [see Table 58]. The correlation between practices planned to adopt and income made by trapping and selling hogs and/or leasing hog hunting rights last year was not

significant, $p > .05$. Correlations between practices planned to adopt and the independent variables were at the most moderate ($r \geq .49$). The items earning the highest scores were total number of negative impacts on the property in the last year and total number of control methods use on property ($r \leq .39$). The item earning the lowest correlation was income made by trapping and selling hogs and/or leasing hog hunting rights last year ($r \leq -.01$). Several items, estimated total economic losses due to feral hogs during the previous year ($r \leq -.06$); estimated expected losses due to feral hogs during the upcoming year ($r \leq -.04$); and income made by trapping and selling hogs and/or leasing hog hunting rights last year ($r \leq -.01$), reported negative correlations to practices planned to adopt. The constructs that estimated loss were recorded as negative indices when being analyzed, which could account for why they report negative correlations.

Table 58
Correlation Between Practices Planned to Adopt and Independent Variables

	Practices Planned to Adopt		
Independent Variables	*N*	*r*	*p*
Total number of negative impacts on the property in the last year	10721	.39	.00*
Total number of control methods used on property	10721	.39	.00*
Knowledge gained— Efficient trap/bait techniques	9911	.15	.01*
Likelihood to recommend Texas AgriLife Extension Service	10341	.14	.00*
Knowledge gained— Types/extent of hog damage	9764	.13	.00*
Knowledge gained— Legal control options	9945	.12	.00*
Knowledge gained— Feral hog biology	10045	.10	.00*
Estimated total economic losses due to feral hogs during the previous year	6815	-.06	.00*
Estimated expected losses due to feral hogs during the upcoming year	5544	-.04	.00*
Income made by trapping and selling hogs and/or leasing hog hunting rights last year	4504	-.01	.61

Note. Magnitude: $.01 \geq r \geq .09$ = Negligible, $.10 \geq r \geq .29$ = Low, $.30 \geq r \geq .49$ = Moderate, $.50 \geq r \geq .69$ = Substantial, $r \geq .70$ = Very Strong (Davis, 1971).
*$p < .05$.

The regression model for the eleventh objective was significant and indicated a good fit, with $F = 84.12$, $p < .05$, R^2=.21 . Efficient trap/bait techniques; total number of control methods used; total number of negative impacts on the property in the last year; and likelihood to recommend Texas A&M AgriLife Extension Service, $p < .05$, were significant on practices participants planned to adopt. Types/extent of hog damage; legal control options; estimated total economic losses due to feral hogs during the previous year; expected total economic losses due to feral hogs during the upcoming year were not significant. There was an inverse relationship between practices planned to adopt and the independent variables.

As knowledge of efficient trap/bait techniques increased one unit, practices participants planned to adopt decreased .48 [See Table 59]. As total number of control methods used increased one unit, practices participants planned to adopt decreased .43. As knowledge of feral hog biology increased one unit, practices planned to adopt decreased .21. As total number of negative impacts on the property in the last year increased one unit, practices participants planned to adopt decreased .20. As likelihood to Recommend Texas AgriLife Extension Service increased one unit, practices participants planned to adopt decreased .18.

Although the following constructs are not significant, they are reported here in order to provide a holistic view of their relationship with the intent to adopt wild pig management practices. As knowledge of types/extent of hog damage increased one unit, practices participants planned to adopt decreased .09. As knowledge of legal control options increased one unit, practices participants planned to adopt decreased .03. As estimated total economic losses due to feral hogs during the previous year increased one unit, practices participants planned to adopt increased -3.017E-6. As income made by trapping and selling and/or hunting rights in the last year increased one unit, practices participants planned to adopt increased -5.549E-6. As expected total economic losses due to feral hogs during the upcoming year increased one unit, practices participants planned to adopt increased -7.495E-7. The constructs that estimated loss were recorded as negative indices when being analyzed, which could account for why they report negative variances.

The regression model for this study was illustrated as: practices planned to adopt = -1.32 + .48 efficient trap/bait techniques + .43 total number of control methods used + .21 feral hog biology + .20 total number of negative impacts on the property in the last year + .18 likelihood to recommend Texas A&M AgriLife Extension Service + .09 types/extent of hog damage + .03 legal control options + -3.017E-6 estimated total economic losses due to feral hogs during the previous year + -5.549E-6 income made by trapping and selling and/or hunting rights in the last year + -7.495E-7 expected total economic losses due to feral hogs during the upcoming year. Overall, the model accounted for (21%) variance in practices participants planned to adopt to control wild pigs.

Table 59
Summary of Multiple Regression Analysis of Practices Planned to Adopt and Independent Variables (n = 3165)

	B	*SE B*	*P*
Intercept	-1.32	.29	
Knowledge of efficient trap/bait techniques	.48	.07	.00
Total number of control methods used	.43	.03	.00
Knowledge of feral hog biology	.21	.07	.00
Total number of negative impacts on the property in the last year	.20	.02	.00
Likelihood to recommend Texas A&M AgriLife Extension Service	.18	.02	.00
Knowledge of types/extent of hog damage	.09	.07	.21
Knowledge of legal control options	.03	.07	.65
Estimated total economic losses due to feral hogs during the previous year	-3.017E-6	.00	.26
Income made by trapping and selling and/or hunting rights in the last year	-5.549E-6	.00	.05
Expected total economic losses due to feral hogs during the upcoming year	-7.495E-7	.00	.71

Note. $R^2 = .21$; *Adjusted* $R^2 = .21$

The ninth question on the survey instrument requested that respondents rank their likelihood to recommend Extension to others from 0 (*not likely*) to 10 (*likely*). Responses to this question were then used to calculate an NPS score. Promoters, those that assign a score of 9-10, were described as loyal enthusiastic clientele, passives, those that assign a score of 7-8, were satisfied but unenthusiastic clientele, and detractors, those that assign a score of 0-6, were those clientele who were unhappy (Higginbotham et. al., 2008). The NPS score for programs conducted was calculated: = % promoters - % detractors, with a maximum score possible of 100 and a minimum score possible of -100.

The majority of respondents were classified as promoters of wild pig programs hosted by Extension (*f*=7,441, 72.0%). Passives comprised 19.6% (*f*=2,028) and detractors of the program made up the remaining 8.4% (*f*=872). This resulted in an NPS score for wild pig programs developed by Extension of 63.6% [see Table 60].

Table 60
Distribution of Landowner Categories

	f	%
Promoters	7441	72.0
Passives	2028	19.6
Detractors	872	8.4

Note: NPS = Promoters – Detractors
NPS = 72.0%– 8.4% = 63.6%

CHAPTER V

LIMITATIONS, CONCLUSIONS, AND RECOMMENDATIONS

Limitations

A limitation of this study is the discrepancy in available data from the beginning of the program versus subsequent years. Data collected from 2006-2007 was only available in pre-scan form, thus no individual participant records were obtainable for those years. For the purpose of this study, aggregate data at the county level were used to compare the 2006-2007 data to subsequent years. Data from the later years of the program had to be reduced to the same aggregate level in order to be compared to the first two years. This results in the loss of some detail in the analysis of the data. Furthermore, the survey used for the purpose of this study was altered in 2007 to gather more detailed information from participants. The differences in the original survey used from 2006-2007 and subsequent years limited the comparableness of these two aspects of the survey.

Programs for the Wild Pig Damage Abatement Project ranged in length from a minimum of one hour to full day events. Many of the shorter, one hour programs were a part of pesticide recertification clinics, during which attendees received Continuing Education Units for their attendance. Individuals who needed these recertification credits in order to maintain a chemical applicator's license would have been in attendance, whether they personally experienced problems from wild pigs or not. Some full-day programs offered recertification credits as well. Thus, a limitation of this study was the

inability to separate non-target individuals from those who had wild pig problems during specific length programs. This could have had an effect on the response rate of items that were specific to negative wild pig impacts and experiences on the survey instrument. In the future, it may behoove researchers to add an item to the survey ascertaining whether the respondent is directly impacted by wild pigs or not.

Figure 1 & Table 1

The response rate for all years of the program at the regional level was 60.0% [See Table 1]. Programs conducted by the Extension Wildlife and Fisheries Department reported the highest number of completed surveys. The Eastern regions had the highest total number of completed surveys for programs conducted by Extension. The South and Central regions had the highest response rate. These areas may have climates and ecosystems more conducive to the rapid propagation of wild pig populations, which could possibly result in higher attendance and response rates as landowners seek solutions to their problem.

Research has shown that Extension is successful in creating positive interactions between county Extension agents and their clientele; the results of this study strengthen such previous research (Strong & Israel, 2009). Customer satisfaction surveys are important when determining the relevancy of a program, and the data collected from this program suggests that landowners are satisfied with the information they are receiving. According to Radhakrishna (2002), higher customer satisfaction with a program may be related to the accuracy, relevancy, and overall usefulness of the information; based on this information and the data collected here, it appears that Extension is providing a

useful program to landowners. This is reflected in the high response rate, as well as in the high NPS scores, which will be discussed in detail later.

Objective 1 (Tables 2, 3, & 9-11)

Data collected and analyzed from 2006-2007 at the regional level suggests that pastures are by far the area that experiences the most negative impacts from wild pigs. The second most negatively impacted area at this level of analysis was owner/employee time. Information gathered from 2008-2014 at the individual level reflects these results, with pastures and owner or employee time being reported by participants as the areas most negatively impacted by wild pigs. This makes practical sense, as pastures are a commonality among many landowners, as is personal time. These are two factors that can be shared across varying populations of farmers, ranchers, landowners, and etcetera. Personal injuries rank the lowest, which could be contributed to the avoidance of handling wild pigs. Overall, the measurement of this construct had a fairly high level of reliability, so conclusions can be drawn from the data gathered using the instrument.

When considering negative impacts of wild pigs, it is important to bear in mind that this program was conducted statewide. There are several biogeographic regions in such a large state, and not all areas are suitable for the same type of land-use ("Physical Regions of Texas", n.d.). For instance, not all areas of Texas are appropriate for raising livestock and not all of Texas can support improved pasture for grass or hay production. Rowan and White (1994) found that climates in some areas of Texas are less suitable for ranching pursuits, thus making income earned from non-ranching endeavors more important. A smaller number of livestock owners would equal a lower percentage of

livestock being reported as affected by wild pigs. This is reflected in the data; a small percentage of respondents indicated negative impacts to livestock (injury, death, diseases). Climate contributes to the extent of wild pig invasions, and it can play a part in not only how an area is negatively affected by wild pigs but also in how to best address the management of wild pigs (Funk & Vitousek, 2007; Jarnevich, et al., 2010; Lucas, 2011; Muir & McEwen, 2007; Ziska, et al., 2011). Funk and Vitousek (2007) emphasized that nutrient rich habitats are better equipped to support population growth of invasive species. Thus, county Extension agents should consider the area they are working in and how that may affect the presence and impact of wild pigs.

Based on the data collected from this study, one of the most commonly cited negative impacts of feral hogs is the loss of owner or employee time. Research has shown that implementing control methods is time consuming and costly to landowners (Buhle, et al., 2005; Olson, 2006). As such, county Extension agents, Extension Specialists, and Wildlife Services personnel who act as change agents must show the worth of expending time and energy to mitigate damage caused by wild pig populations. This can be accomplished by helping landowners understand the necessity of implementing innovative management techniques, and the change agents must assist in removing perceived barriers so that landowners are more willing to commit their time and resources (Mwangi, 1998; Prinbeck et al., 2011; Rogers, 2003). Cost versus benefit may be an important weapon in change agents' arsenals; while implementing new control methods may be costly in both time and money, the return on investment has the potential to be high. In regards to perceived barriers, change agents must identify what

these obstacles are in order to tailor their approach to landowners (Mwangi, 1998; Prinbech et al., 2011; Rogers, 2003).

The item of least concern to respondents was the infliction of personal injuries. This could be attributed in part to management from a distance, such as hunting or euthanizing with the safety of a trap between human and animal. Trapping is being revolutionized with the advancement of wireless technology that allows landowners to monitor and operate the trap from afar, which increases the ability of the landowner to maintain a safe distance (Tyson, 2013). However, the adoption of this technology may be cost prohibitive for many landowners. Furthermore, lethal control methods are the most practical and often the most effective at managing wild pigs, so they are more commonly used by landowners; a wild pig that is deceased cannot cause personal injuries to an individual (Hamrick, et al., 2011). However, this does not account for injuries that result from disease carried by wild pigs. County Extension agents should consider clarifying that injuries from wild pigs do not just come in the form of physical wounds. Wild pigs harbor swine brucellosis, which can cause harm to humans (Centner & Shuman, 2014; Hampton et al., 2006). Brucellosis can be transmitted during field dressing and butchering wild pigs (“CDC – Hunters: Protect yourself from Brucellosis”, 2012).

A large percentage of participants cited pasture damage as a primary loss due to wild pigs. This is in contrast to a previous study that showed that most damage is reported in crops (Muir & McEwen, 2007). Pastures are not a source of economic income unless landowners are using pastures for grazing land or producing hay for

livestock. When an economic cost is not associated with a problem it may be overlooked; however, landowners are indicating that damage to pastures is a big problem. Rogers (2003) indicates that tailoring programs enhances the success of programs. Tailoring wild pig programs to address specific concerns could be an important way to attract individuals to future wild pig management workshops. Understanding what landowners perceive as the greatest negative impacts caused by wild pigs, especially in relation to their particular biogeographical area, will allow those who conduct wild pig programs to create a program that is practical for participants (Mwangi, 1998). Data collected by Rowan and White (1994) suggests that certain areas are more conducive to raising livestock; understanding which areas rely most heavily on livestock may offer insight to the monetary value of that land versus areas where pastureland is for recreational, non-economic use. In those areas it will be important to emphasize that wild pigs are opportunistic feeders which will compete with livestock for limited resources (Giuliano, 2010).

Overall, the reliability of the measurement used to determine the negative impacts caused by wild pigs was high; however, it is important to note that the construct "owner or employee time" caused the greatest reduction in reliability. A relatively large percentage of respondents cited the loss of time spent collecting damage and/or removing wild pig signs as one of the greatest negative impacts, so if there is a problem with the reliability of this construct it may need to be addressed in future research.

By considering landowners' greatest concerns, program conductors are including them in the planning process for the programs; constructing a program that addresses

what participants need to know creates a healthy environment for adult learning (Knowles et al., 2005). This objective is important because adults have varying experiences, and this data reveals what some of those experiences are in relation to wild pigs (Knowles et al., 2005).

Objective 2 (Tables 4, 5, & 12-14)

Research shows that trapping is the most effective method of wild pig damage management (Hamrick, et al., 2011; Higginbotham, et al., 2008; Stevens, 2010; Williams, et al., 2011). As a result, this method was emphasized during the Extension programs. Based on data from 2008-2014, nearly half of participants indicated that they used trapping and destroying to mitigate wild pig damage prior to attending a program. Aggregate data collected from 2006-2014 reflected this number, with half of participants from all years reporting that they used trapping and destroying. The second most common control method was owner/employee hunting, which was also used by nearly fifty percent of participants. All other methods were used by less than a quarter of respondents.

Whether stakeholders wish to minimize the wild pig population or simply manage their population numbers to abate damage determines the type of control methods they are likely to implement (Massei et al., 2011). It is apparent that most participants want the wild pigs on their land completely dispatched, not simply moved to a different locale. This is reflected in the high numbers of participants who indicated trapping and destroying and owner/employee hunting, both of which are lethal methods. Lethal methods of control have been shown to be more effective at wild pig damage

management (Hamrick et al., 2011). If a landowner attempts to manage wild pig populations on his or her land, but the neighbors do not, then the wild pig population will likely continue to grow as the pigs would have a safe haven on the properties not implementing management techniques.

Wild pigs can be dangerous creatures, so fear may play a role in landowners' decisions to trap and destroy wild pigs in order to minimize contact (G. Briers, personal communication, December 2, 2015). This method would be most compatible with landowners' desire to maintain their physical safety by ensuring that the animal is disposed of prior to interacting with it, thus it makes sense that trapping and destroying wild pigs was indicated by such a high percentage of landowners (Rogers, 2003).

Euthanizing wild pigs not only removes them from the property, it also serves to reduce population numbers in the vicinity of the landowner's property. Issues between stakeholders may arise if neighboring property owners do not have the same goals when it comes to wild pig management. This is particularly true in counties that have a significant percentage of absentee landowners (B. Higginbotham, personal communication, December 2, 2015). Individuals who participate in Extension programs regarding wild pigs appear to want to eradicate wild pigs, but if their neighbors do not share the same goal then they may hinder the efforts of program participants (Massei et al., 2011; Shine & Doody, 2010). Encouraging cooperation between various interests will be important to the success of control programs promoted by Extension. Educating landowners who attend programs so that they may have more informed conversations with their neighbors should be a consideration for future Extension programs.

The fewest number of participants indicated they used lease hunting as a control method. Once again, different stakeholders have different goals for their land and how it is utilized (Massei et al., 2011; Shine & Doody, 2010). The population that attended Extension programs do not appear to have much interest in this particular control method, but there are individuals who conduct lease hunting. Furthermore, Dr. Billy Higginbotham (personal communication, December 2, 2015) indicates that sport hunting wild pigs seldom achieves damage abatement goals when used as the only control technique. Encouraging more of these individuals to attend programs may open up dialogue between the various groups, thus widening the possibilities for using a variety of wild pig control methods. These individuals would be considered early adopters of this particular control technique; as such, county Extension agents should consider how to implement their real-world experience into programs in order to educate their peers (Rogers, 2003).

It is important to consider what methods landowners currently use in order to assess what kind of information they need. In order to promote more effective methods of wild pig damage abatement, county Extension agents should illustrate how methods they promote fit the characteristics of innovations (Rogers, 2003). Trapping using larger corral traps has relative advantage in that this method allows several animals to be captured at once; other control methods are more singular in their effectiveness or are more costly than trapping. Snares only catch one animal at a time. Aerial gunning cannot be used statewide because of vegetative cover but is extremely cost effective when conducted by trained personnel. While research shows that trapping is the most effective

method, other research indicates that it is not the ultimate answer to abating wild pig damage. With time, wild pigs may become wise to the trap and learn to avoid it; as such, it is important to implement more than one control method and remind participants that while complete eradication may not be feasible, management of damage caused by wild pigs can be reduced (Massei, et al., 2011).

A focus during Extension programs is to encourage the use of trapping because it has been shown to be the most effective control method. However, because so many participants already utilize this method it is important for program coordinators to consider including information (best management practices) on how to improve trapping efforts. Non-target species being captured in traps can be an issue, so it may also be important to include information on how to best handle this situation when this situation occurs (Campbell, et al., 2006; Edalgo & Anderson 2007; Lapidge et al., 2012). A large percentage of participants use owner/employee hunting; while it may be important for programs to emphasize more efficient control methods, this method should not be ignored. A section of the program could be used to stress that while this is not the best method, if it is going to be used there are ways to do it to the best of the landowner's ability. As opposition to lethal control methods continues to grow, program coordinators will need to be prepared to adjust their program agenda accordingly (Massei, et al., 2011).

The least used control method as reported by participants was lease hunting. As previously stated, recreational hunting (lease hunting) is not successful at reducing wild pig damage when used as the sole control method. When it comes to lease hunting, some

landowners may not want to kill large numbers because they want to have animals to hunt in order to make their lease more attractive (Rollins et al., 2007). If there is an abundant population of animals to hunt, more outdoorsmen may be interested in the lease which would bring in more money for the landowner. Studies have shown that the hunting industry is an important source of income for many individuals in Texas (Bach & Conner, 2015; Forrest, 1968; Nielson, Wagstaff, & Lytle, 1986; Steinbach, Conner, Glover, & Inglis, 1986; Terrill, 1975). However, a limited number of individuals seem to be taking advantage of this opportunity. Many landowners indicate that they or their employees hunt; rather than expending their time and energy doing this, they may be wise to implement lease hunting. While researchers have reported that there are drawbacks to this method, it may be worth it to landowners to cut their time expenditure and possibly increase their income by lease hunting (Duda & Brown, 2001; Reinhold, 1985).This income could offset at least some of the damage caused by wild pigs.

There is a low level of internal consistency for this survey item. Additionally, the item that had the most effect on reliability was also the item that was indicated as the most used control method by participants. The purpose of this study is to determine the effect of attending a wild pig management on the adoption of effective management techniques. The construct that measures objective two determined what control methods landowners used prior to attending a program; if the question measuring this construct is not reliable, then the data gathered may not mean much. It may be important for future researchers to identify how to improve the reliability of this question.

Table 6, Figure 2 & Table 19

Data gathered at the aggregate level for all years of the program indicated that all regions expected overall reductions in loss [See Table 6]. Individual data collected from 2008-2014 indicated that nearly half of respondents expected to reduce economic impact in the upcoming year as compared to the previous year, and one-third of participants indicated they expected their losses to remain about the same [See Table 11]. A small portion of respondents expected losses to increase in the upcoming year. This expectation could be related to the exponential growth of wild pigs (Plasters et al., 2013; Rollins et al., 2007; Taylor 1991). Furthermore, if landowners have neighbors who are not interested in managing their wild pig population, then the landowner could anticipate that his or her costs will not be reduced due to the constant flux of unmitigated wild pig populations (Adams et al., 2005).

Objective 3 (Tables 15 & 16)

Most participants experienced losses of $2,999 to $1,000, although there were populations of individuals who experienced losses amounting far greater and far less than this range. The average amount of loss reported by participants was slightly less than $5,000. This indicates landowners experience varying amounts of financial impacts. This could be based on variables such as location, extent of wild pig presence, size of landholding, land use, or other factors. It is important to note that the nonresponse rate for this objective was high.

Studies have shown that the number of farms and the average farm size in Texas have been decreasing in the past twenty years (Gleaton & Anderson, 2008; Gleaton &

Anderson, 2012; Texas A&M IRNR, 2014). These trends may be of significance to the planning of future wild pig programs in terms of the target audience and the kind of control methods that are most suitable. Smaller land holdings could lead to smaller amounts of loss reported by individual landowners. This could lead to the fallacy that individuals are being less impacted by wild pigs when in reality they may be reporting less monetary loss because they have smaller resources from which to lose.

Knowles et al. (2005) stated that need to know is a direct antecedent of willingness of adults to learn. By discovering participants' perceived losses from the previous years, it may be possible to determine if monetary loss is a motivation for attending programs and consequently showing interest in adopting innovative management techniques. Illustrating how control methods can reduce losses may increase landowners' motivation to learn, and the first step in doing this effectively is to determine the losses incurred during the previous year in order to have an amount for comparison.

Literature states that economic cost associated with implementing wild pig control methods is a barrier to adopting such methods (Buhle et al., 2005; Hamrick et al., 2011; Higginbotham, 2010). Indeed, Dr. Billy Higginbotham (personal communication, December 2, 2015) has stated that Extension must provide landowners with the most efficient, cost-effective control methods for practice adoption to occur and wild pig damage to decrease. If landowners calculate current control costs and that figure is high, they may be unwilling to try new methods that will require additional capital. There is the additional issue of the lost investment of previous control methods that are

abandoned, or the exponential cost of operating previous methods in conjunction with new methods.

A third of participants did not answer this question. This could be attributed to landowner uncertainty. It may be difficult for participants to estimate their losses, especially if detailed records are not kept. As a result, they may choose to leave this section of the survey blank. Additionally, some losses may not be considered, such as the fuel used to travel to check traps. Factors such as loss of personal time may be difficult for landowners to quantify in monetary terms. If this is an area that future researchers are interested in, it may behoove them to encourage landowners to begin keeping records of their control methods and the costs associated so that the landowners are prepared to report these figures when they attend programs.

Future researchers should also consider how to minimize the amount of nonresponse. This could be done by standardizing how to classify losses, or by giving landowners ranges of dollar amounts to choose from. Adjusting how the question is framed may encourage higher response rates. Increasing preparedness by informing landowners to come to the program with some idea of their losses in mind may also help. Rather than getting a hurried response at the end of a program, encouraging landowners to be thinking about their losses prior to administering the instrument may result in higher response rates and more reliable data. However, use of retrospective surveys increase time and cost needs and may lower the response rate.

Wild pigs cost upwards of $52 million in agricultural damage alone in Texas each year (Higginbotham et al., 2008). Determining how this cost is spread among

landowners may be beneficial in the planning of wild pig programs. While this is a very large number overall, individual losses are a fraction of the amount; amount loss may be related to willingness to spend money on adopting new control practices. If landowners are not experiencing as great of an economic loss, they may not be as willing to implement expensive control tactics. However, the data shows that over half (*f*=51%, see Table 34) of participants planned to adopt at least one new control method. Practitioners should take this as a sign that landowners are interested in implementing the most efficient and cost effective control methods.

Farmers in Williamson County in 1995 sought help in the mitigation of their wild pig problem, and although this program was deemed successful population numbers of wild pigs have continued to grow (Muir & McEwen, 2007; Rollins et al., 2007; Taylor, 1991). This indicates that even when educational programs are successfully implemented and practices are adopted by landowners, wild pigs are still spreading rapidly. As wild pig populations continue to grow, extend their range, and damage properties practitioners should consider that amount off loss is relative, and what type of control methods are adopted may be influenced by estimated losses from the previous year. A landowner who only experiences a small amount of economical loss may be less willing to implement additional control methods. Overcoming this barrier and encouraging the application of new management techniques will be an important challenge for practitioners.

Objective 4 (Tables 17 &18)

The largest percentage of landowners estimates future losses to be between $999 to $1. This is a significant decrease from estimations of losses during the previous year. The category that most landowners were in based on previous year losses, $2,999 to $1,000, was the second most indicated range of losses expected in the upcoming year. The highest range of losses, $7,000 or more, was indicated by the fewest number of respondents, which is an improvement based on prior year estimations. The average amount of losses expected in the year after attending a program was slightly less than $4,000, which is a $1,000 improvement.

When comparing data from objective three and objective four, losses ranging from $999 to $1 and from $2,999 to $1,000 occupy the top two slots for both estimated losses in the past year and expected losses when looking forward to the coming year. Whereas a higher frequency of participants estimated losses of $2,999 to $1,000 in the year prior to the program, more participants indicated expected losses post program attendance of $999 to $1, with the range $2,999 to $1,000 being reported by the second highest frequency of participants. This makes sense because individuals in the $2,999 to $1,000 category would drop to the next lowest category.

Losses of "None" went from being indicated the least in the year prior to being reported (8.8%) to being the third highest range for estimated upcoming losses (13.3%) [See Tables 7 and 9]. This indicates that the program was successful in making participants believe they could significantly reduce their costs based on the information they gathered at the program.

Determining what expected costs are will help practitioners tailor their programs to address specific concerns. Literature implies that complete eradication is likely unattainable except under specific circumstances, and is not necessarily desired by all stakeholders (Adams et al., 2005; Cruz et al., 2005; Roy & Bunting, 2011). As such, programmers should consider that while there are significant amounts of participants who expect no losses from wild pigs as a result of the program, there are also individuals who do not want to be in that category. They may be willing to take some losses in order to maintain a manageable wild pig population for income-producing endeavors including lease hunting or marketing wild pigs (Bach & Conner, 2015 Forrest, 1968; Nielson, Wagstaff, & Lytle, 1986; Steinbach, Conner, Glover, & Inglis, 1986; Terrill, 1975). Programs should be structured so that those who want to attain a minimal pig presence and those who want to reduce losses are both addressed.

For this question *n*=5,177 did not respond, resulting in a 48.3% nonresponse rate. This rate is even higher than the nonresponse rate for objective three. As difficult as it is to approximate past losses, it is even more difficult to quantify losses that have not yet occurred. Participants may be unsure of how to answer this question, so they instead leave it blank. Furthermore, managing and decreasing populations of invasive species, such as wild pigs, is expensive (Olson, 2006). Landowners may be unsure of the costs that will be associated with control effort and the dividends that will come as a result of the control effort.

The standard deviation of monetary losses in the year prior to the program was less than the standard deviation of monetary losses expected in the year after attending a

program. This may be of interest to future researchers; why there is a greater spread in reported amounts of loss when predicting future losses may have implications for how to understand the information respondents provide. This observation may be attributed to the inability to accurately predict future losses. If future researchers are interested in the exact monetary loss reduction, it may be necessary to follow up with participants a year after the program to see if their actual losses are aligned with their predicted losses.

Objective four serves as goal setting in that landowners are subconsciously setting a target, or an acceptable amount of loss, that they can foresee incurring after attending a program. Practitioners should be aware that their program gives landowners confidence that they can decrease their losses in the upcoming year; however, supplementing the programs with follow up information and education may enable landowners to reach their goals.

Objective 5 (Tables 20 & 21)

Data regarding income made from trapping and selling wild pigs and/or leasing wild pig hunting rights in the year prior to the program reveals that the majority of respondents report making no money from these endeavors. A small percentage of respondents reported income under $1,000, and an even smaller percentage reported income greater than $1,000. The average amount of income disclosed was around $500, but this amount ranged greatly. For this construct, over half of participants neglected to provide an answer.

The vast majority of participants indicated making no income from trapping and selling wild pigs or by leasing hunting rights. As wild pig populations continue to grow,

it will be important to identify innovative control methods as well as determine ways to turn a nuisance into an asset. The data reveals that most landowners are either making no money or are unwilling or unable to report their income from wild pigs. Both of these circumstances have implications for researchers, landowners, and other parties.

Literature shows that while there are obstacles to marketing wild pigs, markets for this exotic meat are growing (Garner, 2006; Gilmore, 2014; Hawkes, 2013; Lawhorne, n.d.; Rollins et al., 2007; West, et al. 2009; Witmer et al., 2003). However, landowners are missing out on this opportunity to regain profit lost to wild pig damage. Landowners may be unaware of the opportunities that are available for marketing wild pigs, or they may be unwilling or unable to contact these organizations. It is also possible that some landowners may not have access to companies or organizations willing to purchase wild pigs. Furthermore, nearly half of participants indicated trapping and destroying and owner/employee hunting to be the control methods they utilize [see Table 4]. Companies only accept live wild pigs (Hawkes, 2013; Rollins et al., 2007; West, et al., 2009), therefore these landowners would not be able to market their wild pigs based on the control methods they currently use.

Lease hunting is used by a very small percentage of landowners [see Table 4]. Wild pigs may be hunted year round in Texas with the proper licensing ("Texas Parks and Wildlife – Nongame, exotic, endangered, threatened and protected species", 2015) or shot by the landowners and their designated agents without the need for a license. This endeavor has proven very successful for landowners in Texas, with lease hunting supplementing agricultural pursuits (Bach & Conner, 2015). Despite what the literature

shows to be a lucrative industry, few of the participants claim to take advantage of lease hunting. It could be that individuals who participate in Extension programs are more interested in mitigating wild pig impact rather than making a profit from them. Furthermore, sporthunting has been shown to be an inefficient wild pig damage abatement method (B. Higginbotham, personal communication, December 2, 2015). Research has shown that there are many different stakeholders in the issue of wild pigs; some of these groups wish to propagate wild pig populations, while others, especially farmers, want to remove wild pigs from their land completely (Bach & Conner, 2015). Landowners whose primary goal is to utilize wild pigs for hunting purposes may not be interested in a program regarding wild pig population management, thus the sample that is surveyed is skewed.

Researchers should consider the high nonresponse rate for this item. Over half of participants did not indicate how much income they made from marketing wild pigs; this could be attributed to the practice of securing cash payments for wild pig hunts. This income would be taxable, so landowners may not be willing to admit they have collected it. Anonymity of the survey should ensure their protection, but based on the characteristics of Texas landowners they may be suspicious of giving away too much information to an agency associated with the government.

This is an area of the program that Extension should consider expanding. Wild pigs are a significant, growing problem in Texas, and determining a productive purpose for this species would benefit the landowners, the economy, and more. Landowners seem to be missing an important opportunity to procure an additional source of income.

Wild pig meat could be utilized for food rather than going to waste in a field. However, it will be important for program coordinators to step outside their role as informants on wild pig management and enhance educational efforts on the most effective ways to utilize wild pig meat. This could include marketing wild pigs to Texas Department of Agriculture approved live pig buying stations and/or Texas Parks and Wildlife Department licensed shooting preserves. Program coordinators should take the information gathered here and begin to consider how to best make landowners aware so that the half who did not respond and the thousands that report no income are encouraged to participate in these growing markets.

If practitioners do increase awareness of trapping and selling wild pigs and/or leasing wild pig hunting rights, regulations regarding the legal transport of wild pigs may need to be reemphasized. Illegal transportation has aided the spread of wild pigs into new territories, and there are strict laws regarding transporting wild pigs in Texas (Lang, 2007; Timmons et al., 2011). Research has shown that when wild pigs are transported illegally, the motivation is often to enhance hunting opportunities in order to increase monetary gains (Plasters et al., 2013). Program coordinators should try to alleviate this tendency to intentionally spread wild pigs into new territories.

Objective 6 (Table 22)

Wild pig damage management programs conducted by Texas A&M AgriLife Extension over the span of nearly a decade have been very successful in transferring knowledge to landowners in Texas regarding wild pigs in general, as well as effective and legal control techniques. Nearly every participant responded to this question, and

there were only a few comparatively that felt they did not gain knowledge as a result of the program. This indicates the programs were successful in their goal of relaying pertinent information to landowners.

This objective is supported by the tenets of Knowles' Theory of Andragogy. Program coordinators have been successful thus far in identifying what it is participants need to know from a wild pig program. This is reflected in the consistent response that individuals felt they gained knowledge. Learners' prior experiences provide a rich resource for learning, and readiness to learn increases when there is a need created to know something new (Knowles et al., 2005). As wild pig populations continue to grow, the need for education increases due to their drastic influence on many agricultural aspects, including water quality; soil quality; and damage to pastures, crops, and livestock (Giuliano, 2010; Kaller et al., 2007; Mapston, 2007; Pasters et al., 2013; & Seward et al., 2004). Need for information appears to have translated into readiness to learn, which in turn seems to have resulted in participants believing their knowledge has increased as a result of attending a program.

Bremner and Park (2007) stated that public outreach programs designed to inform outside groups of a problem, as well as potential solutions, are important to minimizing barriers from concerned parties. The data shows that the Wild Pig Damage Abatement Project programs were successful at transferring knowledge to participants. There are outside pressure groups who have strong opinions about whether wild pig control methods are inhumane (Beringer et al. 2002; Lapidge et al., 2012; Massei et al., 2011; McCann & Garcelon, 2008; Reidy et al., 2008). The pressure groups involved

would be landowners who want to reduce wild pig populations; hunters who enjoy wild pigs for recreational purposes; and absentee landowners, who may be ignorant of the problems wild pigs are causing on their property (B. Higginbotham, personal communication, December 2, 2015). Enticing these groups to attend a program may be beneficial in getting the various stakeholders on the same page by educating them not only on the damage wild pigs can cause, but also on the regulations that are in place to make managing populations as humane as possible. Wild pigs are an invasive exotic species, so resistance from outside pressure groups, such as the media, have been minimal. This may be due to the general acknowledgement that wild pigs are detrimental to many aspects of the environment and economy (B. Higginbotham, personal communication, December 2, 2015).

Researchers in this field can infer that landowners desire information to help mitigate the wild pig problem they are facing. The data collected for the purpose of this study spanned over nearly a decade; in all this time, it appears landowners consistently felt their knowledge increased. Whether these are new individuals or individuals coming back to several programs, researchers should recognize that there is a need to innovate in this field. In order to keep the numbers high for this construct, new and improved information needs to be provided to landowners.

Previous research on educational programs involving invasive species revealed that practical information delivered one-on-one may stand a good chance of increasing knowledge in participants (Cronje et al., 2011; Newman et al., 2010; Reis et al., 2011). As adults, landowners made a conscious choice to spend their valuable time at a wild pig

program. If the information provided at these programs becomes repetitive or inapplicable, attendees' perceived increase in knowledge may begin to wane. In order to combat this and to continue to assist landowners with their wild pig issues, program coordinators should stay up to date on the latest research and developments so they may communicate changes and new information as swiftly as possible. The mission of Texas A&M AgriLife Extension is to provide relevant information to those who need it ("Compact with Texans," n.d.). Involving other agencies, such as Texas Parks and Wildlife, will bring in fresh perspectives. Additionally, relating back to the concept of making income from wild pigs [Objective 5], inviting buying station operators, processors, and/or hunting preserve operators to come speak will provide pertinent information regarding the potential benefits landowners could gain from marketing wild pigs. Reinventing the delivery of the program to match the needs of participants should also be a factor in the planning of these events. Gauging what information is needed is important, but determining how to most effectively present the information should also be considered.

Objective 7 (Tables 23-41)

Based on the findings of this research, the Statewide Wild Pig Damage Abatement Project was successful at transmitting knowledge to landowners regarding efficient wild pig control methods. For each of the four knowledge constructs, the data reveals that approximately one third of respondents felt they had some knowledge prior to the program [see Tables 15, 18, 21, & 24). The percentage of individuals who indicate this anchor is consistent, so it may be that the same participants are the ones in this

category for each construct. Nonresponse rates for the prior knowledge construct were fairly consistent, with knowledge regarding wild pig biology reporting the lowest nonresponse rate and knowledge regarding types/extent of hog damage reporting the highest nonresponse rate. All four constructs are combined into one question, so it appears that respondents were more likely to answer the knowledge construct that was listed first (wild pig biology) than the one listed last (types/extent of wild pig damage).

Over half of respondents indicated the anchor 5, high level of knowledge, for three of the constructs after attending a program [See Tables 19, 22, & 25]. The only construct to not have a majority of respondents indicate a 5, high level of knowledge, post- program was feral hog biology [See Table 16]. The nonresponse rates for knowledge level after the program were the same as nonresponse rates for the corresponding construct prior to the program. This indicates that if a respondent did not answer the first half of the question regarding their knowledge level prior to the program, then they also did not respond to their knowledge level after the program. It could be that the respondent did not feel this topic area was covered by the program, so they may not have felt the question was applicable.

The before-after change level in knowledge was overwhelmingly positive for all four knowledge level measurements [See Tables 17, 20, 23, & 26]. Feral hog biology reported the highest positive change level (89.7%), while types/extent of hog damage reported the lowest positive change level (76.1%). This could be attributed to more individuals already feeling they had knowledge regarding types/extent of wild pig

damage prior to the program; this is demonstrated in the data, as this construct had the highest percentage of respondents who indicated they had “some knowledge” or greater.

For this objective, participants were asked to rate their level of knowledge prior to attending the program on a scale from 1 to 5, with 1 = *no/little knowledge*, 3 = *some knowledge*, and 5 = *high level of knowledge*. The data suggests that efficient trap/bait techniques had the greatest percent change in knowledge level based on pre means and post means (44.7%) [See Table 27]. Types/extent of wild pig damage had the lowest percent change (34.0%). Over half of participants indicated no knowledge items at a level 4 or 5, high level of knowledge, prior to the program; this indicates that most participants did not feel they were experts about any of the four knowledge constructs prior to the program [See Table 28]. Based on reported knowledge levels post-program, more than three-quarters of respondents indicated all four constructs to be at a level 4 or 5, high level of knowledge [See Table 29]. This resulted in 63.5% of respondents reporting positive movement in all four knowledge areas [See Table 30].

Overall, the data reported for this objective revealed that while participants did come in with some level of knowledge, they did not come into the program feeling that they were experts. All four knowledge measurements experienced positive movement in knowledge level, indicating that respondents felt they gained knowledge as a result of attending a program. Based on reliability coefficients, this question was a good measurement of knowledge level [See Table 33.

Literature indicated trapping is the most efficient method of wild pig population management (Stevens, 2010; Williams et al., 2011). The research suggests this is the

area in which a high degree of knowledge gain occurred. This may be due to the fact trapping is emphasized in the programs because of its relative advantages over other forms of control. Rogers (2003) states that relative advantage is a key predictor in the adoption of an innovation and that an innovation does not have to be new to the world stage to be considered an innovation. Landowners who attend the wild pig programs may be exposed to this innovation for the first time, and because this particular method is stressed as being highly successful, they are able to gain the most knowledge in this area. Even those landowners who are familiar with trapping as a control method are able to gain knowledge from these programs because they are able to have the information updated and refreshed during the program. With at least 85% of counties in Texas being occupied by wild pigs as of 2008 (Higginbotham et al., 2008), it is likely that types/extent of hog damage may have a high rate of knowledge gained because landowners already have wild pig problems on their land; thus, they have a higher degree of practical knowledge in this area prior to the program.

While there was positive movement for all four of the constructs, knowledge of wild pig biology experienced the greatest positive movement. According to Taylor and Hastings (2004), what part of the population to target is an important consideration in control programs, and understanding the biology of wild pigs may enhance landowners' knowledge of when they are most susceptible to specific control efforts. Researchers should continue relaying information regarding which wild pigs within a population should be targeted first, and what control method that age group is most susceptible to.

Types/extent of wild pig damage reported the lowest frequency of positive movement. This may indicate that more information is needed requiring types/extent of hog damage. Program coordinators may not have done as well at conveying information on this topic. Literature shows that at least 85% of Texas counties are occupied by wild pigs, and that percentage has likely increased significantly (Higginbotham et al., 2008). As such, landowners who participate in a program likely are seeking remedies to their wild pig problems, which would mean they would already be familiar with some of the signs of wild pigs. Signs of wild pigs, such as wallows, are also fairly conspicuous (Pierce, 2009). Knowing this, program coordinators may not consider this topic as important as the other topics. Prior to the program, the anchor 5, high level of knowledge, was indicated by 11% of participants [See Table 26]. The other three knowledge constructs reported much lower percentages of landowners indicating 5, high level of knowledge. This corroborates the idea that landowners are coming into the program with real world experience, thus they have higher levels of knowledge regarding this construct prior to the program which results in lower positive movement.

The data paralleled Rogers' (2003) findings that knowledge leads to persuasion and persuasion leads to adoption. The study underscores the importance for county Extension agents to ensure that landowners learn about wild pig innovations. Without knowledge gain, innovations are more likely to be rejected. County Extension agents need routine professional development in the adoption and diffusion process including barriers that mitigate adoption or result in rejection.

Wild pigs are a common challenge for states across the southern region of American Association for Agricultural Education (AAAE). Future research should examine other Extension programs that seek to manage invasive species. Data from this study could offer insight into the importance of knowledge gained and the influence knowledge has on planned adoption. Future researchers should examine actual wild pig management innovations adopted and how the data corresponds to participants' planned adoption. Any differences between planned adoption and actual adoption would indicate a need to investigate factors that influenced landowner's change in behavior. Given the damage and nuisance wild pigs cause Texas, the context for study is not going away any time soon. The context opens up for potential lines of inquiry both from an agricultural education perspective and a wildlife perspective. This growing context for research is not state bound. Multiple southern states should collaborate and conduct larger studies associated with landowner's adoption of innovations to manage wild pigs.

Knowledge of legal control options came in very close to efficient trap/bait techniques and types/extent of hog damage; landowners who attend these programs are able to gain exposure to viable control options and ask questions about methods that may be illegal. Subjective norms, or the pressure to enact or not to enact a behavior, may explain the closeness of these two measurements (Ajzen, 1991). Landowners want to know what methods are most effective, and they gained a lot of knowledge in this area. They also demonstrated a desire to become more informed about legality issues. Participants may feel pressure from governmental organizations to abide by laws that the

landowners are not familiar with, so attending a program is an opportunity for landowners to educate themselves on the parameters in which they must operate.

While there was still a significant change in knowledge of feral hog biology, this construct trailed those mentioned previously in terms of knowledge gained. However, this is also the construct that garnered the most feedback (*n* = 10045). This indicates landowners have strong feelings regarding this topic because they are more vocal about the knowledge they felt they did or did not gain. This may be a component of the program that Texas A&M AgriLife Extension Service should focus on expanding.

Chemical (toxicant) control of wild pigs is currently illegal in Texas and the United States, but it is possible that this may change in the next few years (Aaronson, 2011; Samoylova et. al, 2012). Texas A&M AgriLife Extension should be prepared for this information in order to help landowner's make the most appropriate decisions for their property. This underscores the need to be proactive and up-to-date as it relates to toxicants to manage wild pigs in Texas.

Objective 8 (Tables 42-46)

Trapping and practices related to trapping are most likely to be adopted by landowners. Half of respondents indicated that they would likely use larger traps to manage wild pig populations. The practice that was least likely to be adopted was the use of eyewear and gloves when field dressing wild pigs. The reasons for using this equipment would be to protect the landowner from the potential contraction of zoonotic diseases (Higginbotham et al., 2008). The data show that only a small percentage of landowners surveyed identified disease transmission as a significant negative impact of

wild pigs [See Table 1]. Most participants who intended to adopt nw control methods planned on adopting two or three (*M*=2.96), although this number ranged from zero up to four or five control methods for most participants. In regards to the total number of practices landowners planned to adopt, a significant percentage of participants (17.8%) actually did not intend to adopt any new control methods at all. Perhaps landowners are already using the control technique they indicated they would most likely adopt. If this is the case, then they would not be adopting this method, for it is already in use. Based on the data, it appears this item is a good measure of participants' planned adoption of innovation to manage wild pigs as a result of participating in a program.

Wild pigs cause myriad negative impacts to water quality, crops, pastures, equipment, and more (Arrington et al., 1999; Boughton & Boughton, 2014; Ditchkoff & West, 2007; Gates, 2014; Hampton et al., 2006; Hamrick et al., 2011; Kaller & Kelso, 2006; Kaller et al., 2007; Pierce, 2009). Some landowners seem to be uninterested in adopting new control methods listed on the survey instrument as a result of attending a program. Translating intention into action may need to become a more integral part of wild pig programs. It is important to consider that the only practice that matters is the one that is adopted. The Boar Buster trap ranges in price from $2,500 to upwards of $10,000 (B. Higginbotham, personal communication, December 2, 2015). This may not be compatible with the norms, values, or experiences of the target population, so it is less likely to be adopted (Rogers, 2003). It is more important for practitioners to encourage the most efficient, cost effective application of their resources possible. If a

landowner has $500 to spend, that money should be used on the most efficient management technique available within that price constraint.

Ajzen (1991) posits that intentions are signifiers of the effort an individual is willing to exert to enact a behavior. Based on the data, participants show significant interest in adopting new or altered control techniques, yet they indicate actually planning to adopt very few, if any, methods. This disconnect could be attributed to perceived behavioral control. Beliefs about control of and access to resources are a component of perceived behavioral control (Ajzen, 1991). If a landowner feels that it is not worth their time, effort, or money to implement new or altered methods then they may decide to maintain their current control program.

The seventh objective revealed that the Statewide Wild Pig Damage Abatement Project succeeded in increasing knowledge regarding efficient trap/bait techniques. Ajzen (1991) connects strength of belief that a behavior will have a positive outcome to stronger attitudes toward that behavior; the more confidence that landowners have in the success of trapping as a control method, the more likely they are to adopt the method. Pre-baiting traps to encourage consistent hog visits had the second highest frequency (f = 5,073, 47.3%). However, Edalgo and Anderson (2007) reported that pre-baiting traps is largely ineffective and often results in unintentional trapping of nontarget species. The research conducted by Edalgo and Anderson may be outdated; bait technology may now be advanced enough to be more effective at targeting specific species. Regardless, the Texas A&M AgriLife Extension Service has found through numerous corral trapping result demonstrations that pre-baiting is an integral step as it trains wild pigs to the trap's

presence and determines the number of wild pigs in the sounder (through the use of remote sensing cameras) which dictates the size of the corral trap needed to capture the pigs (B. Higginbotham, personal communication, December 2, 2015).

Researchers have emphasized the danger of contracting disease from wild pigs ("CDC– Hunters: Protect yourself from Brucellosis", 2012; Centner & Shuman, 2014; "Texas Parks and Wildlife – Feral Hogs, 2015). However, based on objective eight relatively few landowners intend to adopt practices related to protection from disease, such as wearing eyewear and gloves during field dressing. Researchers should continue to gather information on the elements of disease transmission from wild pigs, and look for new ways to make this issue important to landowners who handle wild pigs.

Reis et al. (2011) found that practical informal education activities appear to be effective educational tools. The data collected from this study yielded similar results in regards to knowledge gain. These studies corroborate Knowles Theory of Andragogy in regards to adults requiring information that is problem-solving oriented.

Participants indicate a desire to adopt innovative control methods, yet they demonstrate that they will not actually adopt any new control methods. Researchers should continue to look for innovative control methods that landowners have not yet adopted, such as potential toxicants and pharmaceutical baits should they be legalized. Research conducted on toxicants illustrate that this method may have the potential to be both cost-effective and species-specific, but they are currently illegal to use in Texas (Aaronson, 2011; Foster, 2011). As more information is gathered on methods such as this, landowners may be more willing to implement new methods.

Practitioners should consider how reinvention could potentially play a role in participants' likelihood to adopt innovative control techniques. By providing alternative ways of using control methods that are already used by many landowners, such as trapping, program coordinators may encourage landowners to customize their control programs to best fit their individual needs (Rogers, 2003). Many of the participants do not actually plan to adopt any new control methods, but they indicate that if they did adopt a control method it would be a practice related to trapping. As such, county Extension agents should analyze trapping variations in terms of Rogers' characteristics of an innovation in order to encourage landowners to adopt innovative methods rather than adhering to the practices they currently implement. An example of this would be encouraging landowners to capitalize on the wild pig market; objective five revealed that most landowners make no income from this endeavor, although data shows that revenues of $500 and more have been reported from landowners who market live wild pigs (Bach & Conner, 2015). Demonstrating the relative advantage of using larger traps in order to increase catch, then subsequently marketing a bulk number of wild pigs in order to generate income or offset damage may encourage landowners to translate their intent to action.

Many of the programs conducted by the Wild Pig Damage Abatement Project are focused on knowledge transmission rather than practical application. It may be important for practitioners to begin to transition from awareness to on-site demonstrations in more programs. This may include field days and trap demonstrations.

The change agents who would work most closely with landowners would be county Extension agents. However, it seems that county agents are in need of professional development in order to address the concerns and questions that landowners have (G. Briers, personal communication, December 2, 2015). If it is not feasible to provide additional training to county Extension agents, then they must be able to act as a linkage between landowners and the specialists who have the information that landowners need (Rogers, 2003).

Objective 9 (Tables 7, 8, 47, 48, & 60)

Likelihood to recommend Texas A&M AgriLife Extension Service wild pig programs was positive overall. Data available after 2008 at the individual level reveals over half of participants chose 10, likely to recommend Extension. Anchors 8 and 9 were the next most chosen scale items. Likelihood to recommend is related to a program's NPS score. Individual responses from 2008-2014 reveal that 72% (*f*=7,441) of participants are promoters of the organization, which outstripped the number of passives and detractors, resulting in an NPS score of 63.6% for this time period of the program. Aggregate data for all years of the program also reveals that the majority of participants (*f*=8,012, 70.3%) would be classified as promoters of Extension programs about wild pigs. The percentage of promoters once again is greater than that of passives and detractors, resulting in an NPS score for the program as a whole of 60.4%. Although the NPS score is lower when calculated for all years at the aggregate level than when calculated only for years with data at the individual level, the data still shows that Extension programs regarding wild pigs are successful and efficient.

NPS scores are effective means of measuring the success of a program based on client feedback (Reichheld, 2006). Wild pig programs conducted by Extension have proven to be successful, with far more promoters than detractors. As the wild pig problem continues to grow, this program could serve as a model nationwide for how to best reach landowners with important information. Campbell and Long (2009) stated that programs are often unsuccessful due to lack of funding, unclear objectives, and disjointed programming efforts. The Wild Pig Damage Abatement Project seems to have overcome these obstacles by providing comprehensive information across the state. Funding from the state has supported this program, which has allowed a planned, statewide effort to be coordinated (Higginbotham et al., 2008). Participants in these programs are obviously responding well to the programs, as evidenced by the high NPS score and likelihood to recommend Extension. Based on this, funding should continue for the program due to its ability to transfer knowledge to attendees and influence their opinion on innovative control methods.

Extension is concerned with customer satisfaction, and the data from this program indicates wild pig programs are reaching this goal. The purpose of collecting customer satisfaction information is to allow Extension to improve the program in order to best address client's needs (Radhakrishna, 2002). If these needs are adequately met and the participant is satisfied with Extension, they are more likely to adopt the recommended practices (Radhakrishna, 2002). Objective eight reported strong intent to adopt wild pig control methods, which supports the idea that satisfaction, likelihood to recommend, and planned adoption may all be interconnected.

Likelihood to recommend a program is linked to the perceived quality of that program (Warnock, 1992). If the information being provided is useful, then it is more likely participants will be pleased with their experience. The information gathered for objective seven reveals that participants felt they gained a significant amount of knowledge as a result of attending a program. Had landowners felt they did not gain knowledge, the NPS score would likely have been lower. Based on Rogers' (2003) innovation-decision process, participants are likely in the information gathering or persuasion stage; the goal at these early stages is to gather information and form attitudes. Knowles et al. (2005) emphasize the importance of the learner's need to know. County Extension agents who conduct wild pig programs have been successful in assessing what information is important and utilizing speakers to present that information in a way that participants can understand and relate to.

The success of this program may open new avenues for researchers to expand their target audience. County Extension agents act as change agents in terms of introducing new knowledge and practices regarding wild pigs and their control to the public. Understanding that different stakeholders hold different views regarding wild pig practices may reveal a need for programs that are tailored to these other audiences (Massei et al., 2011; Shine & Doody, 2010). Wild pigs are detrimental to livestock forages, water quality, crops, livestock health, and more; current Extension programs are successful in satisfying the needs of landowners who experience these negative effects and are seeking remedies. However, those stakeholders that do not understand the severity of the issue at hand should be educated (e.g., urban audiences). County

Extension agents must consider what they are doing that is making this current program so successful, and translate it into a program that may entice opinion leaders in other areas to attend. As wild pig populations continue to grow and expand into new territory, the next step for educators is to broaden the scope of their impact by educating a larger audience. The purpose of this program may not be control or management; it may be strictly educational. This is an important goal because educating stakeholders on the negative impacts of wild pigs may encourage a better working relationship between those who wish to control or eliminate wild pig populations and those who do not.

At this juncture, there are more promoters than passives or detractors for Extension programs regarding wild pigs. Practitioners should capitalize on this by forming continuing relationships with participants. One such avenue that should be considered is developing a listserv to disseminate continuing education, research updates, and future program advertising via email. Indeed, the Wild Pig Community of Practice (http://articles.extension.org/feral_hogs) is one such tool that seeks to consolidate information on wild pigs and abating their damage on a national basis (B. Higginbotham, personal communication, December 2, 2015). While not all participants will have an email address, and not all may supply their information, it is worth consideration due to the potentially exponential spread of messages. Promoters are likely to recommend the program to others (Higginbotham et al., 2008; Reichheld, 2006), and providing a new opportunity for them to easily share information by forwarding emails to their friends and family may have implications.

Tables 55 & 56

The relationship between knowledge and likelihood to recommend suggests that the higher the perceived knowledge level the more likely participants will recommend Texas A&M AgriLife Extension. The connections between knowledge before the program and likelihood to recommend were weak, and had an inverse relationship for all but one knowledge construct, type/extent of hog damage. The correlations between knowledge gained after the program and likelihood to recommend Extension were slightly stronger, indicating that an increase in knowledge may be related to likelihood to recommend Extension. However, correlations were not very strong for either before or after the program, so it is difficult to determine if there is truly a connection between these two constructs and likelihood to recommend.

Objective seven determined that participants felt they gained knowledge as a result of the program; objective nine indicated a strong likelihood to recommend Extension programs. However, when the correlation between the two is analyzed it appears that there may not be a strong relationship between these two constructs. There is a moderate relationship between knowledge gained and likelihood to recommend, but other factors may influence how likely a participant is to suggest Extension to others. This may be of interest to future researchers. Future practitioners should consider their success in the individual areas of knowledge gained and likelihood to recommend and continue to conduct programs as they have been.

Table 57

Although the correlations between planned adoption of innovative wild pig control techniques and likelihood to recommend Texas A&M AgriLife Extension were significant, the strength of the relationship was low at best. This indicates that there may not be a relationship between landowners' intention to adopt control methods and their satisfaction with Extension. It is plausible that this factor, combined with knowledge gained, may together play a larger role on the overall attitude toward Extension; this is something that future researchers should consider analyzing.

The item that had the highest positive relationship with likelihood to recommend Extension was marketing trapped hogs to at least partially offset losses. As discussed earlier, this item has expansion potential for program coordinators. It seems that participants are interested in this concept, so creating content that capitalizes on this interest may abet customer satisfaction with wild pig programs. However, change agents should reemphasize regulations, such as where legal holding facilities are located and the legal transportation of wild pigs in order to ensure compliance from landowners (Timmons et al., 2011)

As discussed previously, trapping is a highly publicized control method due to its effectiveness; using larger traps was chosen as the technique most likely to be adopted by landowners (Hamrick et al., 2011; Stevens, 2010; Williams et al., 2011). Participants may have prior knowledge in this area due to the amount of attention it gets, so barriers to adopt are lower to begin with. Furthermore, planning to adopt this innovation may not have as much to do with the program specifically and it may have more to do with

common sense-type knowledge that participants already have going into the program. Behavioral beliefs, which correspond to attitudes about a given behavior, can help predict whether an individual will perform an action (Ajzen, 1991). Previous research conducted by Prinbeck et al. (2011) demonstrated that targeted education and communication enhances the ability of change agents to overcome belief barriers. The actions of Extension may do little more than solidify previously held beliefs, thus it may be of interest to change agents to determine whether beliefs regarding trapping are positive or negative prior to entering the program. These factors may account for the low relationship between planned adoption of this method and likelihood to recommend Extension.

Objective 10 (Tables 49-54)

The data suggested the Statewide Wild Pig Damage Abatement Project is successful in transferring knowledge to landowners, but this knowledge gain appears to have little relationship with the likelihood of landowners to adopt wild pig management practices. Knowledge gained in the four areas explains very little of the variance in planned adoption of wild pig control practices. Of the four constructs, the knowledge gained regarding efficient trap/bait techniques appears to be the strongest predictor of likelihood to adopt practices. This makes sense, because this is the area where landowners felt they gained most knowledge, and upwards of 30% of landowners plan to adopt some form of control method that involves trapping or baiting wild pigs. Types/extent of hog damage is the next best predictor of planned adoption; however, this construct has much less impact than efficient trap/bait techniques.

There are generally negligible to low positive correlations between knowledge gained in the four areas of interest (feral hog biology, legal control options, efficient trap/bait techniques, and types/extent of hog damage) and likelihood to adopt the wild pig management practices. This means that an increase in knowledge coincides with a small increase in the likelihood to adopt the various practices. While these correlations are not strong, they are statistically significant ($p < .05$).

The data reveals that marketing wild pigs falls in the middle for both frequency of use and correlation to knowledge gained. More information may need to be provided to farmers in order for them to see marketing wild pigs as a viable wild management pig practice (Hawkes, 2013; West et al., 2009). This control method may be of interest to future researchers and practitioners, as wild pigs are an abundant animal with a high reproduction rate that could contribute to minimizing hunger in under-nourished communities. Human population growth has led to a deficit in the food supply, and this gap is predicted to widen (Godfray et al., 2010; Pimentel, 2005; Nord et al., 2005). Wild pigs may be a viable option to contribute to the reduction of world hunger. Some organizations are already investigating the possibilities of partnering with food banks and homeless shelters (Fields, 2014; Gilmore, 2014; Simmons, 2014). The Wild Pig Damage Abatement Project has proven successful in transferring knowledge [see Tables 23-41], so there may be an opportunity for the change agents associated with programs to integrate information on how to market wild pigs for not only economic gain but also as a social contribution.

An obstacle that will have to be overcome is concern over the quality of meat produced by wild pigs and the possibility of disease transmission through the meat (Gilmore, 2014; Lawhorn, n.d; Witmer, Sanders, & Taft, 2003). In fact, meat harvested from wild pigs tends to be less fatty than domestic pig meat (Hawkes, 2013; Sales & Kotrba, 2013). Not only will researchers and program coordinators need to work with landowners to encourage them to market their trapped wild pigs, they will also have to educate the public to get domestic consumers on board with wild pigs as a food source. Rogers (2003) emphasizes the role of change agents as links between different factions; this would be an example of when change agents must demonstrate the benefits of related actions to individuals on both sides of an issue. Landowners will have to be convinced to market, and consumers will have to be convinced to purchase wild pig meat. This has not been as much of an issue for processed wild pork marketed internationally.

Scouting for wild pig sign generally had one of or the lowest correlation to knowledge gained. While some wild pig signs are conspicuous, other signs are much more difficult to discern (Pierce, 2009; “Wild pig field sign”, 2013). Landowners had already reported that loss of their time was one of the greatest negative impacts of wild pigs [See Table 1], so it is somewhat intuitive that even if they gain knowledge as to the benefits of this practice they will be unwilling to commit the extra time to combing their land for signs of wild pigs.

Using baits with scent appeal consistently linked to knowledge gain in the four areas; this practice had the highest correlation for all knowledge areas except efficient

trap/bait techniques, where it had the second highest correlation. While using baits with scent appeal was most highly correlated to knowledge gain, it was in the middle in terms of how many landowners planned to adopt this practice. Literature shows that pre-baiting is largely ineffective, so it could be that landowners are gaining knowledge about how this practice is not a productive use of time and resources, and as a result they are less likely to adopt it (Edalgo & Anderson, 2007).

Using larger traps was a practice that ranked at or near the bottom in terms of correlation to the four areas of knowledge gain. This is interesting because using larger traps was the most identified innovation participants planned to adopt as a result of the program [See Table 2]. Even though landowners did not perceive an increase in knowledge relatable to the use of this practice, they still intend to adopt it in their wild pig management programs.

Respondents' previous experience could relate to prior knowledge; landowners already understand the importance of trapping, so it becomes intuitive that larger traps would increase the effectiveness of the control method. One hindrance to using larger traps is the additional setup time required to setup coral traps versus box traps. Another factor to consider is the availability of resources to increase trap size. Traps are expensive to begin with, especially as new technology emerges (Higginbotham, 2010). A larger trap would equate to more money invested. However, Extension emphasizes the use of efficient least-cost traps and best management practices that are considerably cheaper than high technological traps (e.g., remote triggers) (B. Higginbotham, personal communication, December 2, 2015).

Research shows that many wild pig programs have been unsuccessful due to lack of funding, clear objectives, and continuity (Campbell & Long, 2009). The Wild Pig Damage Abatement Project has been able to combat these factors, and as a result has proven to be successful in transferring knowledge to participants. Researchers and Extension educators should note that while the correlations between knowledge gained and practices planned to adopt are not strong, they are significant. Such a large sample number could result in effect size accounting for a portion of the significance. However, knowledge gained does account for some variance in planned adoption of wild pig control practices. Thus, researchers and Extension educators should investigate what other factors play a role in landowners' decision to adopt or reject innovations related to wild pig control. Whether gender, landholding size, resources such as income, or some other factor plays a more significant role in landowners' planned adoption of innovations could have implications on how to best address the needs of the clientele.

Currently it seems that Extension is successful in transferring knowledge and fairly successful in encouraging adoption of practices; however, these two factors seem to be operating independently of one another. It could be that current programs focus on clinical knowledge rather than practical knowledge. Knowledge regarding current research and information on how an innovation works is important and seems to be successfully transferred to the attendees. However, how to apply knowledge in specific contexts may be more useful and may encourage a stronger connection between knowledge gain and intent to adopt wild pig management techniques. Connecting these two factors, in addition to determining what other factors are correlated to planned

adoption, could have implications on the success of not only Extension programs, but also on wild pig management programs conducted by landowners. Previous research has shown that involving clientele in program evaluation allows them to give insight into the effectiveness of the program (Warnock, 1992). While the current survey instrument unveils valuable information, more direct questions on how to improve the program may increase the correlation between knowledge gain and likelihood to adopt management practices.

Objective 11 (Tables 58 & 59)

The intention of landowners to adopt control techniques appears to be influenced by some, but not all, of the dependent variables. The only construct that was not significantly correlated to intention to adopt practices was income reported from trapping and selling hogs and/or leasing hog hunting rights in the last year. Losses estimated for the previous year and the upcoming year were negatively correlated to intention to adopt practices; this could be attributed to how these constructs were coded in SPSS. The two independent variables that had the greatest relation with intention to adopt practices were total number of negative impacts on the property in the last year and total number of control methods used on property. The other variables appear to have little relationship with the likelihood of landowners to adopt wild pig management practices.

Knowledge of efficient trap/bait techniques; total number of control methods used prior to the program; knowledge of feral hog biology; total number of negative impacts on the property in the last year; and likelihood to recommend Texas A&M

AgriLife Extension Service were the best predictors of intention to adopt. Of these, efficient trap/bait techniques and total number of control methods used accounted for the most variance in likelihood to adopt practices. All of the items analyzed accounted for less than one fourth of the variance in likelihood to adopt control methods.

The variables that were the least correlated and accounted for the least amount of variance were estimated total economic losses due to feral hogs during the previous year; income made by trapping and selling and/or hunting rights in the last year; and expected total economic losses due to feral hogs during the upcoming year. It appears that monetary impacts of wild pigs have little impact on the likelihood of landowners adopting control methods. As the amount of losses increase, there is a very minimal increase in likelihood to adopt control methods. The three constructs that measured monetary losses and gains were not significant.

Knowledge of efficient trap/bait techniques has a low correlation with intention to adopt, but it accounted for the most variance out of any of the constructs. As mentioned previously, trapping is touted as the most effective wild pig control method, so information that participants gain regarding how to make this method more effective appears to result in an increased likelihood of applying the knowledge gained in the field technique (Stevens, 2010; Williams, Holtfreter, Ditchkoff, & Grand, 2011). According to the regression analysis, the more knowledge individuals gained on efficient trapping techniques, the less likely they were to adopt control methods. This could be attributed to one of two things; firstly, greater knowledge of the effectiveness of trapping could discourage landowners from trying out other control methods. This would result in a

lower intention to adopt control methods in favor of maintaining trapping programs. Secondly, it could be that the more topics landowners participate in the various trapping and baiting techniques, the less they understand in a practical sense. A solution to this may be to make information on trapping and baiting more practical.

Total number of control methods used was both highly correlated with intention to adopt and accounted for a large amount of variance, although this was an inverse relationship. Based on this information, it appears that the more control methods a landowner currently uses, the less likely they are to adopt other control techniques. Economic losses attributed to wild pigs are negatively correlated to intention to adopt practices; the more money spent on mitigating the impacts of wild pigs using current control methods, the less likely a landowner will be interested in implementing additional methods and further increasing their costs.

Research has shown that decreasing and managing populations of invasive species is an expensive endeavor (Olson, 2006). However, environmental losses and damages, including economic losses and negative impacts on other species, are high (Pimental et al., 2005). Landowners are already spending money on control methods, and the more they spend the less they are willing to adopt new practices [see Table 59]. Adopting additional control methods would increase landowners' costs, which may lead to a disinclination to adopt new control techniques. Researchers and practitioners should consider how to encourage landowners to retire methods that are ineffective or outdated in favor of spending resources on more efficient techniques and adopting research-based best management practices.

In this case, landowners' attitudes toward adopting additional control practices may be negative based on a belief that additional methods would cost more money. According to Ajzen (1991), beliefs form attitudes, which have an impact on the likelihood that an individual will perform a behavior. It may be challenging for practitioners to convince landowners that the benefits of implementing more effective control techniques outweigh the costs.

Summary

The areas that were reported as being the most negatively impacted by wild pigs were pastures (70.5-72%) and owner/employee time (36.2-38%). The areas that were reported the least by respondents as being negatively impacted were personal injuries (4.0-17%) and stored commodities (2.1-4%).

The control method used by most respondents was trapping and destroying (49.9-51%). Other (snares, aerial gunning) (8-8.8%) and lease hunting (7.4-8%) were reported as being used by the smallest percentage of landowners.

At the regional level, losses in the year prior to attending a program for the duration of the study (2006-2014) were estimated by 63% of respondents to be $39,465,953. Losses of $2,999 to $1,000 were estimated by the highest percentage (33.1%) of landowners at the individual level (2008-2014). Landowners that estimated having no losses in the year prior made up the smallest percentage of landowners (8.8%). The average amount of loss reported by landowners was $4,861. 36.4% of participants did not respond to this item.

Losses predicted to occur in the year following a program at the regional level (2006-2014) were estimated by 54% of respondents to be $24, 730,885. The most commonly reported range at the individual level (2008-2014) was between $999-$1. The average amount of loss landowners predicted to occur in the year following the program was $3,863. 48.3% of participants did not respond to this item.

Based on losses estimated in the year prior to attending a program and those estimated to occur after attending a program, 42.8% of participants at the regional level expected an overall reduction in losses of $14,735,068. 35.8% of participants did not respond to this question.

The majority of landowners (84.6%) reported making no income from trapping and selling and/or leasing wild pig hunting rights. Those landowners who did report income fell mainly in the range of under $1,000 (10.5%). A small number of respondents (4.9%) estimated income of $1,000 or more. 58.0% of participants did not respond to this item.

The vast majority of participants (98.8%) perceived they gained knowledge as a result of attending a program conducted by the Wild Pig Damage Abatement Project. Nonresponse was low for this item (1.2%).

Knowledge level in four specific areas (wild pig biology; efficient trap/bait techniques; legal control options; and types/extent of pig damage) was increased as a result of attending a program. Knowledge of wild pig biology was reported by the highest percentage of participants as increasing (89.7%), followed by knowledge of efficient trap/bait techniques (88.6%). Awareness of legal control options was reported

as having the third highest increase in knowledge gain (84.5%). Knowledge of types/extent of pig damage had a slightly lower increase in knowledge (76.1%).

The method that most landowners indicated they planned to adopt was to use larger traps (51%), followed by intent to pre-bait traps (47.3%). The lowest percentage of landowners planned to adopt wearing eyewear and gloves during field dressing (16.7%). The average number of practices respondents planned to adopt was 2-3.

Most participants ranked Texas A&M AgriLife Extension as a 10 (likely to recommend) on a scale from 0-10 (58.7%). The average anchor indicated was an 8.96. This item had low nonresponse rate. The NPS at the regional level for all years of the program (2006-2014) was 60.4. The NPS at the individual level (2008-2014) was 63.6.

Although Texas A&M AgriLife Extension is successful in transferring knowledge to landowners, this knowledge gain appears to have little relationship with the likelihood of landowners to adopt wild pig management practices (r=.15, p=.00*). These relationships were weak. Knowledge of efficient trap/bait techniques appeared to have the greatest influence on planned adoption (*b*=.41, SE *b*=.05, *p*=.00).

The items that were the most strongly related to planned adoption were the total number of negative impacts on the property in the last year (r=.39, *p*=.00*) and the total number of control methods used on landowners' property in the previous year (r=.39, *p*=.00*). However, these relationships were moderate at most. Knowledge of efficient trap/bait techniques appeared to have the greatest influence on planned adoption (*b*=.41, SE *b*=.05, *p*=.00). it is important to note that this was an inverse relationship; as

knowledge of efficient trap/bait techniques increased, likelihood to adopt control practices decreased.

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APPENDIX A

FERAL HOG DAMAGE AND CONTROL SURVEY

63180

TEXAS A&M AGRILIFE EXTENSION

MARKING INSTRUCTIONS
CORRECT: ● INCORRECT: ✓ ✗ ✓ ✗

FERAL HOG DAMAGE AND CONTROL SURVEY

You have recently participated in a program on feral hog life history, behavior and control information hosted by Texas A&M AgriLife Extension Service. Please complete the following on the economic impact of feral hogs and the value of information you received. Your survey will assist us in planning future programs.

1. Please mark all of the areas in which feral hogs had negative impacts on your property in the past year.
   - O Growing or planting commodity crop losses
   - O Growing or planting specialty crop losses
   - O Stored Commodities
   - O Pastures
   - O Wetlands
   - O Livestock (injury, deaths, diseases)
   - O Fences, water troughs, or other improvements
   - O Equipment or vehicles
   - O Personal injuries
   - O Loss of land value
   - O Loss of lease value, damage to food plots/feeders
   - O Owner or employee time

2. Please mark all of the control methods you use on your property(s).
   - O Trapped & destroyed
   - O Trapped & moved from premise
   - O Other (snares, aerial gunning)
   - O Trapped & Sold
   - O Owner/Employee hunting
   - O Lease hunting
   - O Use of dogs

3. *Please estimate your total economic losses due to feral hogs during the **previous year** on all your property(s). This includes all items marked above in Question 1. $ [ ][ ][ ][ ][ ] .00 (dollars only)

4. What do you expect your losses due to feral hogs to be during the **upcoming year** AFTER implementing what you learned at Texas A&M AgriLife Extension Service workshop(s)? $ [ ][ ][ ][ ][ ] .00 (dollars only)

5. How much income did you make by trapping and selling hogs and/or leasing hog hunting rights last year? $ [ ][ ][ ][ ][ ] .00 (dollars only)

6. Did you increase your knowledge of feral hogs and their control by attending this program? O Yes O No

7. Rate your knowledge **before and after** the program on these subjects. Mark only one number for each answer choice with 1 = no little knowledge, 3 = some knowledge, 5 = high level of knowledge.

TOPICS	Before the Meeting	After the Meeting
a. Feral hog biology	O 1 O 2 O 3 O 4 O 5	O 1 O 2 O 3 O 4 O 5
b. Legal control options	O 1 O 2 O 3 O 4 O 5	O 1 O 2 O 3 O 4 O 5
c. Efficient trap/bait techniques	O 1 O 2 O 3 O 4 O 5	O 1 O 2 O 3 O 4 O 5
d. Types/extent of hog damage	O 1 O 2 O 3 O 4 O 5	O 1 O 2 O 3 O 4 O 5

8. Please mark all practices that you plan to adopt in order to better manage feral hogs on your property:
   - O Use larger traps
   - O Use baits with scent appeal
   - O Vary/change baits at different locations
   - O Set traps whenever fresh sign appears.
   - O Pre-bait traps to encourage consistent hog visits
   - O Scout for hog sign (tracks, wallows, rubs, hair)
   - O Wear eyewear and gloves during field dressing
   - O Market trapped hogs to processors to recoup losses

9. Based on the information provided at the program, what is the likelihood that you would recommend Texas A&M AgriLife Extension Service (includes Wildlife Services) to your family and friends as a contact for information on feral hogs and their control? Mark one number below with 0 = not likely and 10 = likely.

   O 0 O 1 O 2 O 3 O 4 O 5 O 6 O 7 O 8 O 9 O 10

   Not Likely **Likely**

APPENDIX B

TEXAS COOPERATIVE EXTENSION FERAL HOG DAMAGE AND CONTROL SURVEY

TEXAS COOPERATIVE EXTENSION
FERAL HOG DAMAGE AND CONTROL SURVEY

Dear Landowner:

You recently heard discussions about feral hog life history, behavior and control information at a program hosted by Texas Cooperative Extension. Please take a minute to complete the following so we can gauge the economic impact feral hogs in Texas and the value of information you received. Please return the completed survey as soon as possible. Your response will assist us in planning future educational programs and possibly to obtain resources for programs to control feral hog populations in Texas.

Sincerely, Billy Higginbotham, TCE, TAMU-OVERTON, POB 38, Overton, TX 75684 (903-834-6191)

1. **Place a check mark next to all the areas in which feral hogs had a negative impact on your property(s) *in the past year.***

Possible Area of Loss	Please check all areas that apply
Growing or planting commodity crop losses	
Growing or planting specialty crop losses	
Stored commodities	
Pastures	
Wetlands	
Livestock (deaths, diseases, etc.)	
Fences, water troughs, or other improvements	
Equipment or vehicles	
Personal injuries	
Loss of land value	
Loss of lease value, damage to food plots, or wildlife feeders.	
Owner and/or employee time	

2. **Place a check mark next to all the control methods you use on your property(s).**

Control measure	Please check all areas that apply
Trapped & destroyed	
Trapped & moved from premise	
Trapped & sold	
Owner & employee hunting	
Lease hunting	
Use of dogs	
Other:	

3. "I estimate my total economic losses due to feral hogs during the ***previous year*** to be about $_____on all my property(s). This includes all items checked above.

4. As a result of implementing what I learned at Texas Cooperative Extension workshop(s), I expect my losses due to feral hogs to be approximately $_____ during the ***upcoming year***.

5. Based on the information provided at the program, what is the likelihood that you would recommend Texas Cooperative Extension (includes Wildlife Services) to your family and friends as a contact for information on feral hogs and their control? Circle one number below with 1 = not likely and 10 = likely

1 2 3 4 5 6 7 8 9 10

Not Likely **Likely**