USDA

United States Department of Agriculture

Five Year Report FY14 – FY18

National Feral Swine Damage Management Program

Manage the Damage
Stop Feral Swine

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Program Overview

OVERVIEW

The National Feral Swine Damage Management Program (NFSP) was initiated in fiscal year 2014 (FY14) as a way to implement control activities to reduce feral swine damage across the United States and afflicted territories. This report provides a five-year review of the program and its components, ongoing collaborative research, operational feral swine population reduction, and outreach and communication campaigns. This initial overview section provides the foundational information relative to the mission and strategy of NFSP, headquarters staffing structure and contact information, as well as publications, reports, and presentations that have been products of programmatic efforts.

EXECUTIVE SUMMARY

Feral swine are a harmful and destructive invasive species and their geographic range is rapidly expanding with populations increasing across the United States (Waithman *et al*., 1999; Barrios-Garcia *et al*., 2012). Feral swine inflict significant damage to property, agricultural crops, natural resources, and native ecosystems. They also represent a risk to domestic animals and human health. Approximations of the total aggregate cost of damage caused by feral swine in the United States are estimated to be $1.5 billion annually, with more than half of that attributed to direct damage to agriculture according to a 2007 study which is still applicable today (Pimentel, 2007). These costs would be expected to increase in the absence of control efforts as feral swine populations continue to expand across the country.

United States Department of Agriculture, Animal and Plant Health Inspection Service (USDA APHIS) proposed a national response to reduce, and in some areas eliminate, the risks and damages inflicted by feral swine to property, agriculture, natural resources, and human health. APHIS serves as the lead federal agency in a cooperative effort with other federal, state, tribal, and local entities that share a common interest in reducing or eliminating problems caused by feral swine. APHIS works cooperatively with bordering countries, Canada and Mexico, to support border activities and ensure collaborative efforts on feral swine disease monitoring and removal activities. Since environmental conditions and laws governing feral swine vary considerably among states, APHIS' strategy is to provide resources and expertise at a national level, while allowing flexibility to manage operational activities from a state and local perspective. The overall objective of the program is to minimize damage inflicted by feral swine. APHIS implements activities to reduce problems associated with feral swine in most states where they are present. In states where feral swine are emerging or populations are low, APHIS cooperates with local and state agencies to implement strategies to eliminate them. APHIS also targets feral swine emerging in urban areas where they pose a danger to humans and property.

OVERARCHING GOAL

APHIS' goal in establishing the NFSP is to reduce damage and risk to agriculture, natural resources, property, animal health, and human health and safety in the United States by reducing or eliminating feral swine populations in cooperation with states, tribes, other federal agencies, organizations, and others.

To achieve this goal, APHIS invests resources in this effort as it recognizes the significance of feral swine damage and acknowledges the need for federal leadership in addressing this national invasive species problem. APHIS proposed an integrated approach to feral swine damage management issues, using the latest scientific research findings, improvements in field tactics, and communication and outreach tools to accomplish its goal. More specifically, APHIS developed the following objectives with regard to feral swine damage management:

OBJECTIVES

1. Further develop cooperative partnerships with other pertinent federal, state, tribal, and local agencies, and private organizations working to reduce the impacts of feral swine to agriculture, natural resources, property, animal health, and human health.
2. Expand feral swine management programs nationwide to protect agriculture, natural resources, property, animal health, and human health.
3. Expand disease monitoring in feral swine to improve understanding of disease ecology, particularly at the feral swine, agriculture, and human interface.
4. Develop and improve tools and methods to manage feral swine populations, including field tests to assess efficacy for reducing risks to agriculture, natural resources, property, animal health, and human health.
5. Develop predictive models for population expansion and economic impacts of feral swine, along with risk analysis to agriculture, animal health, and human health.
6. Develop outreach materials and activities to educate the public about feral swine damage and related activities to prevent or reduce damage.
7. Coordinate with Canada and Mexico to ensure awareness of feral swine initiatives and mitigation techniques as appropriate.

BACKGROUND

The national feral swine population is estimated at more than six million, with their numbers having increased significantly over the past 30 years (Pimentel, 2007; Timmons *et al*., 2012). In 1982, feral swine were thought to inhabit only a small percentage of counties in 17 states (Timmons *et al*., 2012); now, they are present in approximately 43% of all counties in the United States with populations recognized in at least 38 states and three U.S. territories.

Growth of feral swine populations and the increased economic, environmental, and social damage they cause is due to their reproductive capacity, lack of natural predators, and ability to adapt to a variety of environmental conditions (Mayer and Brisbin, 1991). The distribution of feral swine has expanded primarily because humans have transported them to new areas to increase local hunting opportunities (Waithman *et al.*, 1999). Other sources of feral swine introductions have come from escaped or released domestic swine which have reverted back to feral status. Outlined below are specific types of damage that are caused by feral swine; much of this original research was done 20 to 30 years ago as feral swine populations were expanding rapidly across the continental U.S. and remains true today.

Damage to Crops: Feral swine cause tremendous crop losses as they consume significant amounts of field and high-value vegetable crops, including corn, soybeans, grain sorghum, wheat, oats, peanuts, rice, lettuce, spinach, melons, and pumpkins (Schley and Roper, 2003; Seward *et al.*, 2004). In addition, feral swine engage in other behaviors such as rooting, trampling, and wallowing that destroy fields or render them far less productive. Feral swine also damage tree seeds and seedlings, impacting forest regeneration, and can retard the growth of larger trees, as well as reduce nut crops such as pecans and almonds (Campbell and Long, 2009).

Impacts to Livestock: Feral swine are known to exist in at least 43% of swine producing counties, which account for 23% of the United States domestic swine herd. They also are present in 13% of dairy production counties, which accounts for 40% of the United States dairy herd. Feral swine damage pasture grasses and consume, contaminate, and destroy supplemental feed and mineral sources for livestock (Wigley, 1995; Bach and Conner, 1997). Feral swine predation on livestock is primarily on calves and lambs; however, they also occasionally kill adult animals that are vulnerable while giving birth (Pavlov and Hone, 1982; Choquenot *et al*., 1997). In Australia, where feral swine populations are estimated to be at least 20 million, predation on lambs is reported to be as high as 32% (Choquenot *et al*., 1997).

In Texas, which has the highest population of feral swine in the United States, livestock predation is a significant problem.

Disease Threats: Feral swine can carry at least 30 viral and bacterial diseases, and nearly 40 parasites, that may affect humans, domestic livestock, and wildlife species (Hutton *et al*., 2006). Specifically, feral swine can shed or harbor zoonotic bacteria or parasites (e.g., cryptosporidium, giardia, trichina, and salmonella) and possibly contribute to the contamination of watersheds, soil, and plants, including vegetable crops. For example, the presence of feral swine in Salinas Valley in California is thought to have contributed to bacterial contamination on fresh produce. Feral swine have been suspected as a possible source of an *E. coli* O157:H7 contamination in spinach (Jay *et al*., 2007). A recent pilot study in Texas demonstrated that removing feral swine from a watershed reduced total *E. coli* contamination by nearly 50%. Another pilot study revealed that 30% of feral swine samples tested for *Leptospira spp.* were positive. Feral swine also can carry *Brucella suis* which can be transmitted to hunters, causing severe flu-type symptoms, often for a prolonged period of time.

The animal agriculture industry is concerned with the potential for feral swine to spread disease to domestic livestock, which would result in losses through increased morbidity and mortality, decreased production and feed efficiency, increased costs associated with veterinary diagnostics and treatment, and impact international trade. Disease transmission between feral swine and domestic livestock occurs by direct contact, through contamination at fence lines, or when fences are breached (Corn *et al*., 2009; Wyckoff *et al*., 2009; Cooper *et al*., 2010). Preventive measures, such as increased biosecurity, are the best means to prevent a disease introduction and to reduce economic losses; however, if livestock herds were to become infected, it would be vital to reduce the duration of a disease event. Feral swine presence is cause for concern, because if they were to become infected it may be more difficult to end a disease event quickly (Meng *et al*., 2009).

Additionally, feral swine could contribute to undermining the industry's effort to maintain a healthy national swine herd. Pseudorabies (PRV) was eliminated in domestic commercial swine herds in 2004 after a 25-year effort (Hahn *et al*., 2010). The elimination of PRV and swine brucellosis (SB) from domestic commercial estimated value of $56.3 billion in 2012. However, feral swine continue to be infected with PRV and SB, presenting a risk of re-introduction to domestic swine herds in the United States. Feral swine also may carry bovine brucellosis and bovine tuberculosis (bTB) making those potential threats to the cattle industry (Meng *et al*., 2009); cattle also are susceptible to SB (Olsen and Hennegar, 2010).

Feral swine could also play a role in the spread of a foreign animal disease (FAD) which could cause substantial damage to the U.S. economy. A FAD outbreak would not only impact livestock producers, but also grain producers, particularly corn and soybean farmers, energy companies, and manufacturing jobs, among others.

Human Safety and Property Damage: Feral swine in urban and suburban areas become less wary of human presence over time, and have aggressively approached golfers, picnickers, and others in recreational areas (Colorado State University, 2012a). This behavior may be particularly problematic where feral swine have been fed or for other reasons associate humans with food. Large swine pose serious threats to adults and children and are capable of substantially damaging vehicles if struck in roadways. In 2012, the annual cost of property damage and personal injury associated with feral swine-vehicle collisions in the United States was estimated to be $36 million (Colorado State University, 2012b). Estimates do not exist for costs associated with feral swine damage to landscaping or recreational areas; however, homeowners' efforts to improve their properties are often ruined quickly if feral swine are in the vicinity.

Destroyed vegetation and wallows reduce the aesthetic value of private properties, public parks, and recreational areas. Feral swine also impact ranch operations by damaging fences, water supplies, irrigation ditches, guzzlers, and other facility infrastructure (Campbell and Long, 2009). Their behaviors cause soil erosion, weaken levees and earthen dams, and increase siltation of ponds and other water bodies (Ford and Grace, 1998; Hampton *et al*., 2006; Wirthner *et al*., 2012).

Harmful Effects on Wildlife and Habitats: The World Conservation Union has labeled feral swine as one of the "World's Worst Invasive Alien Species" (Lowe *et al*., 2002). Feral swine compete with, and prey on, native wildlife, including threatened and endangered species. In Florida, feral swine have contributed to the decline of at least 22 plant species and four species of amphibians listed as rare, threatened, endangered, or of special concern, including endangered sea turtles (Fordham *et al*., 2006; Engeman *et al*., 2010). Feral swine predation and competition for food can negatively affect bobwhite quail, wild turkey, and colonial nesting birds (Cuthbert, 2002). Feral swine consume large quantities of herbaceous vegetation (three to five percent of their body weight daily) and have been linked to 95% declines of understory vegetation (Cole *et al*., 2012); as such, species that depend on understory vegetation (from arthropods to mammals) decline (Singer *et al*., 1984).

APHIS STRATEGIC GOALS

APHIS' NFSP supports the USDA's strategic goals and objectives by improving the health and prosperity of rural America. APHIS has a longstanding commitment and strong record of accomplishment in helping people prevent or reduce wildlife-caused agricultural losses and ensure animal and human health. Government agencies, county and municipal governments, private homeowners, farmers, ranchers, and other property owners rely on APHIS' expertise to help prevent, minimize, and manage wildlife damage. This damage affects human health and public safety, and impacts agriculture, property, and natural resources. The economic value of APHIS' efforts can be significant for rural communities throughout the United States.

IMPLEMENTATION

The overarching goal of the APHIS NFSP is to reduce damage to agricultural and natural resources, property, animal health, and human health and safety by reducing feral swine populations in the United States. The program is delivered through a nationally coordinated APHIS effort, led by Wildlife Services (WS), and includes Veterinary Services (VS) and International Services (IS) in key program activities. Program partners will include other federal agencies, states, tribes, local governments, and individual property owners. The program is based on an integrated approach to controlling damage caused by feral swine and it includes six key components:

- Operations
- Disease and Population Monitoring
- Communication and Outreach
- Research
- Regulatory Actions
- Planning and Evaluation

ROLES AND RESPONSIBILITIES

APHIS Program Units: While the specific roles of external APHIS partner groups vary from project to project and evolve over time, within APHIS there are five units that are involved in implementing feral swine damage management activities.

1. Wildlife Services: WS is the lead unit within APHIS to manage the wide array of wildlife damage issues that impact agriculture (plant and animal), natural resources, property, and human health and safety. WS personnel have extensive experience working with feral swine, including control methods, research to develop damage mitigation measures, and monitoring techniques to assess disease risk.

2. Veterinary Services: VS is the lead unit within APHIS to manage the myriad of issues related to the health of domestic animals across the United States. VS personnel have extensive experience in mitigating animal health risks and documenting swine disease information for health protection and livestock trade.

3. International Services: IS is the international arm of APHIS. Their experience and capacity to address cross border issues related to foreign animal disease threats to domestic animals is essential in working with Canada and Mexico on the integration and education of feral swine damage mitigation management actions in each respective country.

- Mexico

The Wildlife Program in Mexico was established to serve as a liaison with the Mexican counterparts to develop binational collaboration activities for surveillance, monitoring, and management of wildlife diseases in accordance with the directives and guidelines established for the USDA/APHIS/WS National Programs, including the Feral Swine Damage Management Program. The main goal of the program is to monitor and identify diseases transmitted by feral swine and assess risks along the U.S.–Mexico border as feral swine are not bound by political boundaries and are known to move fluidly between the two countries. The main goals of the Mexico program are strategic planning, implementing training programs, and resolving technical, personnel, research and planning issues, as well as helping coordinate and implement cooperative programs with the Government of Mexico (GOM) agencies of Health (SALUD), Agriculture (SAGARPA), and Natural Resources (SEMARNAT). Additionally, partnerships with other institutions is facilitated, including universities (UNAM and IPN), the State Committees of Animal Health (SCAH), research centers, veterinary associations, hunting associations, NGO's, and other organizations involved in the Wildlife Services Management Programs.

The program was developed by two veterinarians and coordinated locally by the Veterinary Attaché and the Regional Director at the IS/NAR/Mexico office, with participation from the WS Deputy Administrator as well as the National Coordinator of the Feral Swine Damage Management Program. The two veterinarians in charge are Luis Lecuona, who is responsible of the Integrated Wildlife Program, and Meztli Mendez, who serves as the Wildlife Assistant. Ms. Marcela Loyo plans, administers, and tracks the annual budget and operating plan for the APHIS WS local staff. Each member acts individually as a full-time equivalent (FTE) full-time, with the temporary collaboration and support of the coordinated FTE's form SALUD, SAGARPA/SCAH, SEMARNAT, the UNAM, and veterinary and hunting associations.

- Canada

The incomplete understanding of feral swine ecology and demographics in the species' northern range in North America motivated the development of a collaborative effort between the NFSP and the University of Saskatchewan. This knowledge gap hampered APHIS' efforts to assess risks and manage populations of feral swine along the Canadian border with the United States. To address this need, APHIS worked with the University of Saskatchewan to collect data on populations of feral swine (aka feral wild boar in Canada) and describe and model their spatial distribution and movement patterns on the prairies and other natural areas in the Canadian provinces.

The NFSP provided funding to the University of Saskatchewan to map feral swine populations in Canada and to provide insight into the movement of animals along the border between Canada and the United States. Studies included estimates of feral swine spatial distribution, dispersal patterns, and economic damage information vital to estimating risks to agricultural and natural resources and the effective design of feral swine surveillance, population management, and mitigation strategies. The data suggests that wild pigs are widespread and their home range is rapidly expanding in Canada which has significant implications for both native ecosystems and agricultural and livestock production. For a more thorough review of this research, please see the resulting manuscript by Aschim and Brook, 2019 (full citation in References).

4. Legislative and Public Affairs: Legislative and Public Affairs (LPA) is the primary APHIS unit responsible for outreach and communication regarding feral swine damage management issues. They have extensive experience in developing effective communications and outreach products for a large number of partner and stakeholder groups, along with members of the general public.

5. Policy and Program Development: Policy and Program Development (PPD) is the lead unit in drafting the budget documents that accompany this plan as it moves out from APHIS to the department and beyond. PPD personnel also have expertise in strategic planning, National Environmental Policy Act (NEPA) analysis, regulatory policy, and general performance monitoring of the broad strategic goals and milestones for the NFSP.

Program Components/Roles of APHIS Units: This section provides an overview of each of the six program components that are vital to the successful implementation of the NFSP. These roles evolve over time, due to changes in various circumstances surrounding feral swine damage management.

Component 1. Field Operations: WS is the lead unit for this program component. Field operations primarily consist of efforts to decrease feral swine populations in specific areas to reduce damage and protect valuable resources. WS State Directors lead field operations and serve as the primary liaisons with state wildlife agencies and other cooperators. An integrated pest management approach to resolve damage issues is utilized by WS, and control techniques currently available for feral swine removal includes ground and aerial shooting, individual and corral traps, snares, and pursuit with trained dogs for detection and tracking. WS has considerable experience removing feral swine; during FY13 more than 30,000 feral swine were removed from targeted locations and exclusionary devices were used where appropriate. Operational WS programs also provides technical advice and recommendations to landowners when requested and assists in conducting disease monitoring, along with outreach and research activities.

Aerial operations have proven to be an effective means to control feral swine; however, aerial activities are expensive and require specific expertise to manage and assure compliance with safety policies and standards. WS incorporates two approaches to provide aerial support for field operational programs. One approach is to establish regional helicopter teams, consisting of helicopters, pilots, and support crew; these teams are based in Kentucky and Texas. WS programs in these states have existing infrastructure for feral swine aerial activities and are centrally located to current feral swine management activities. The other approach is to cover flight time costs for WS aircraft that have been previously used for predator management work or to contract additional aerial support through private companies. The WS Aviation Training and Operations Center provides oversight for aircraft operational safety and maintenance procedures.

Component 2. Disease and Population Monitoring: WS and VS have shared responsibilities to monitor diseases in feral swine via targeted surveillance and opportunistic control measures. Expanding feral swine populations and emerging threats amplify the need for increased vigilance. Historically, WS personnel have opportunistically collected biological samples from feral swine taken during operational control activities. WS then submits samples to diagnostic labs identified by VS to run diagnostic tests. More than 2,800 feral swine samples have been collected annually to monitor for classical swine fever (CSF), PRV, and SB in the United States.

In conducting the national program for feral swine, APHIS uses risk-based modeling to determine locations and populations that should be targeted for disease sampling. The national surveillance program includes CSF, SB, and PRV and historically has included other diseases such as porcine reproductive and respiratory syndrome (PRRS) and influenza A virus in swine (IAV-S). WS collaborates with VS to identify locations where disease transmission is of greatest concern due to the potential for livestock and feral swine interaction and then targets monitoring efforts at those locations. Ecological modelers at the Center for Epidemiology and Animal Health (CEAH, part of VS), have performed risk assessments to determine high, medium, and low priority counties for surveillance for the three current diseases of national concern. The presence of international borders, international air and seaports, domestic swine operations, and existing feral swine populations are all metrics included in the targeted surveillance plan. WS field personnel are asked to collect a targeted number of samples from each high, medium, and low priority counties in a manner that is distributed across both space and time.

VS also provides general guidance and support for diagnostic tests conducted through the National Veterinary Services Laboratories and collaborating laboratories. Beyond the three diseases included in the national monitoring program, WS collects additional biological samples from feral swine in collaboration with local state animal health officials to support research activities to assess new disease spread and transmission risks.

APHIS works with the United States Department of Health and Human Services (HHS) and the Centers for Disease Control and Prevention with regard to disease monitoring for pathogens of public health concern. These partnerships ensures that APHIS and human health institutions are well informed on zoonotic pathogens. A strong inter-departmental working relationship among agencies increases the emergency response capacities across all groups. These relationships directly support APHIS' efforts to address zoonotic diseases in animals and HHS' goal to advance the health, safety, and well-being of the American people by understanding and possibly reducing the occurrence of infectious diseases.

Component 3. Communication and Outreach: LPA works with WS to develop a strategic communication plan, key messages, and other related in-house materials in addition to professional quality communications and outreach materials in support of the NFSP. LPA works closely with WS, VS, and IS to identify appropriate audiences, messages, materials, and actions/events. Initial products included an overarching brand design, interactive website, customizable factsheets, and brochures. LPA also assists program spokespeople in responding to media inquiries and identifying and coordinating proactive media opportunities.

Component 4. Research: WS is the primary lead for the research component of the program. The WS National Wildlife Research Center (NWRC) currently conducts research projects on an extensive array of issues related to feral swine, including:

- Feasible toxicants and toxicant delivery systems to control feral swine
- Patterns of feral swine movement and potential disease transference between feral swine and domestic animals
- Methods to locate and control feral swine

- Effectiveness of various feral swine exclusion devices
- Population estimation techniques
- Baits for pharmaceutical delivery
- Attractants for feral swine
- Fertility control agents
- Feral swine behaviors in response to damage control activities
- Economic analysis of feral swine damage
- Economic considerations for implementing management strategies
- Ecological investigations addressing feral swine impacts on agriculture and the environment

NWRC regularly collaborates with other government agencies, universities, and private organizations to conduct research activities. Currently, the highest priority for feral swine research being conducted by NWRC is assessing the feasibility of using sodium nitrite, a feral swine toxicant developed in Australia, to safely reduce feral swine populations. Another related high-priority activity focuses on developing a delivery system to dispense baits to feral swine while limiting access to non-target species. NWRC continues to develop or modify other new capture or control devices and to evaluate efficacy and efficiency of existing and new methods, including sodium nitrite as a toxicant, and potential reproductive inhibiters. NWRC also investigates the potential for emerging technologies to be incorporated in feral swine control and monitoring activities. Another role of research is in developing and evaluating possible performance measurements for monitoring accomplishments of the NFSP.

VS also contributes to feral swine research. CEAH integrates existing knowledge to develop population and disease risk models to estimate potential impacts of feral swine on domestic livestock. Population and epidemiologic data gathered during field activities is of value in parameterizing risk models. These models are used in developing and evaluating future strategies for monitoring feral swine diseases, removal activities, and evaluating the effectiveness of the NFSP. CEAH collaborates with WS to refine existing maps of feral swine populations and create distribution models to predict where future feral swine establishment may occur. VS' Wildlife Livestock Disease Investigations Team develops technologies for remote detection of infectious diseases in feral swine (e.g., brucellosis, tuberculosis). They also develop and evaluate population and disease management methods for feral swine, such as vaccines and vaccine delivery methods.

Component 5. Regulatory Actions: VS and WS collaborate to assess the effectiveness of existing regulations (9 CFR 78.30(c)) that restrict the movement of feral swine. VS and WS also evaluate issues associated with the illegal state-to-state translocation of feral swine. While APHIS has no immediate plans to seek a regulatory solution, it will focus on outreach with stakeholders to clearly explain the existing movement restrictions for feral swine and the risks associated with feral swine and their transplantation.

Component 6. Planning and Evaluation: WS is the primary lead for environmental planning and performance evaluation. PPD and the USDA Office of the General Council provide support to WS to ensure requirements of NEPA and other applicable environmental compliance statues are met. APHIS also ensures federal decision making regarding the NFSP is conducted in a manner that is transparent and accountable to the public. The program reflects information gathered during NEPA analysis prior to implementing feral swine damage management activities.

PPD works closely with WS to develop performance measurements that are consistent with long-term strategic goals and objectives of the NFSP. Performance measures are incorporated into adaptive management decision making and are used to communicate with agency decision makers and budget officials within USDA and APHIS. PPD incorporates technical efficacy metrics developed by WS and VS within the overall performance metrics.

IMPLEMENTATION STRATEGY

General Strategy

APHIS Strategy: APHIS' strategy is to provide resources and guidance from a national level, while allowing flexibility to manage operational activities from a local or state perspective. The capacity of APHIS to manage all aspects of feral swine is greatly enhanced through cooperation with federal, state, tribal, and local entities with a common interest in eliminating problems caused by feral swine.

Baseline Capacity (Infrastructure): The expansion of feral swine populations over the last decade created a need for WS to establish a baseline capacity to address feral swine issues. WS provided personnel, funding, and other resources through WS state programs where there was a demonstrated feral swine presence. In states with few feral swine, WS confirmed reports of feral swine activity and removed them from local areas as appropriate in collaboration with state officials. By establishing some baseline capacity, WS was better positioned to remove swine from targeted areas while their populations were still relatively small. Most of WS' prior feral swine damage management actions had been conducted at the request of individual cooperators (private entities). Therefore, it had not been possible to affect overall populations as cooperators typically did not request WS assistance until after feral swine populations were large or damage had become extensive. By establishing baseline capacity with appropriated funds, WS was able to proactively address damage issues before they became significant. The level of baseline capacity established in each state primarily depended on current feral swine populations and current damage to resources, but also reflected the presence of potential resources likely to be damaged, and state or local regulations that impacted management efforts. WS established two helicopter teams in central locations to provide aerial support for operational programs.

Cooperative Support: APHIS seeks partners in all aspects of feral swine damage management. As appropriate, APHIS develops projects with cooperators to combine efforts and resources towards meeting national objectives. Generally, the APHIS lead for these projects is the WS State Directors, who collaborate with state authorities. These activities usually focus on eliminating or suppressing feral swine populations in targeted agricultural areas, protecting threatened or endangered species, or removing swine from urban/suburban areas to reduce property damage.

Leadership and Coordination: The WS Associate Deputy Administrator provides oversight, with guidance from the Deputy Administrator, for the NFSP. The WS Feral Swine Program Manager reports to the WS Associate Deputy Administrator and coordinates activities across organizations. The Program Manager serves as the dedicated point of contact for all aspects of the NFSP. The Feral Swine Program Manager also will serve as lead for three groups: 1) a National Multi-Agency Feral Swine Committee; 2) an APHIS Feral Swine Coordinating Committee; and 3) a WS Feral Swine Steering Committee.

1. A National Multi-Agency Feral Swine Committee for exchanging information and developing cooperation across federal and state government agencies (e.g., Forest Service, Bureau of Land Management, National Park Service, United States Fish and Wildlife Service) and other organizations (e.g., Association of Fish and Wildlife Agencies (AFWA)) interested in feral swine issues is co-chaired by the WS Feral Swine Program Manager, along with a representative from another federal agency, such as the Department of Interior's National Invasive Species Council.

2. An APHIS Feral Swine Coordinating Committee consists of WS, VS, IS, PPD, and LPA representatives that report to the WS Associate Deputy Administrator through the WS Feral Swine Program Manager. The APHIS Feral Swine Coordinating Committee ensures that management structures are in place within each of the agency's represented programs to meet national objectives and evaluate project status and performance. The APHIS Feral Swine Coordinating Committee provides input into prioritizing national projects and resources.

3. A WS Feral Swine Steering Committee provides technical support and develops recommendations for the WS Management Team regarding WS feral swine activities. The committee is chaired by the WS Feral Swine Program Manager and other members consist of the WS Feral Swine Assistant Program Manager, one State Director from each the Eastern and Western Region (representatives are selected by respective Directors from each region), one member from the National Wildlife Research Center, and two representatives from the AFWA (chosen by the AFWA Director).

In addition to work conducted with other APHIS entities, the NFSP collaborates closely with a number of university partners and other stakeholder groups. **Table 1** provides an overview of the cooperative agreements that have been funded between FY14 and FY18 and a brief description of each project conducted. Generally, these projects align closely with the mission of the NFSP and primarily seek to address gaps in knowledge and facilitate information dissemination (e.g., workshops, conferences).

Table 1: Cooperative agreements funded by the NFSP between FY14 and FY18.

Cooperator	Agreement Number(s)	Time Period Funded	Amount(s)	Description
Arizona State University	VS Agreement	09/15/2017 - 09/14/2018	$118,250	VS Agreement funded by Feral Swine Program. The purpose of this agreement is to: 1) collect data that contributes to efforts to estimate the size and geographic distribution of U.S. feral swine populations; and 2) develop methods that calculate damage caused by feral swine which can be used to monitor changes in feral swine populations and agricultural impacts over time.
Auburn University	14-7100-0359-CA	09/18/2014 - 09/17/2016	$22,949	The purpose of this agreement is to provide funding to develop a National Wild Pig Task Force composed of natural resource professionals to provide national level leadership, as well as a collective voice for science-based management of wild pigs.
Auburn University	17-7100-0393-CA	09/01/2017 - 08/31/2018	$16,500	The purpose of this agreement is to provide funding to support the university's outreach activities to provide information on and encourage participation in efforts to reduce damages inflicted by feral swine. The funding will help the university host a feral swine management clinic for landowners and congressional staffers, as well as establish a National Wild Pig Task Force.
Auburn University	17-7100-0397-CA 18-7100-0397-CA	09/15/2017 - 06/08/2018 06/09/2018 - 06/08/2019	$205,095 $265,586	The purpose of this agreement is to provide funding to perform experimental studies for examining the impacts of wild pigs on floral and faunal communities, as well as the environment. The main research objectives are: 1) to investigate the impacts of feral swine to white-tailed deer and wild turkey populations; 2) to investigate the impacts of feral swine to surface water quality and hydrology; 3) to quantify spatial and temporal patterns of physical damage caused by feral swine rooting; and 4) to quantify the potential for feral swine to impede oak regeneration in the southeast United States.

Colorado State University	15-7408-1042-CA	05/16/2015 - 05/15/2017	$20,000	The purpose of this agreement is to support a post-doctoral researcher in the field of genomic bioinformatics to support collaborative research on DNA concentration (pathogens and hosts, including feral swine) from water and development of a biting midge species database.
Colorado State University	17-7100-0396-CA 18-7100-0396-CA	07/03/2017 - 07/01/2019 07/03/2018 - 07/02/2019	$158,400 $120,000	The purpose of this agreement is to provide funding for Colorado State University to conduct an external review of the NFSP approach for reporting disease risk posed by feral swine to livestock, humans, and wildlife; and documentation to support future directions for minimizing risk. This review would address two things: 1) what diseases in feral swine should be targeted along with which monitoring approach to utilize, including frequency and magnitude of a sampling regime; and 2) if there should be response preparedness in case a foreign animal disease is detected in feral swine.
Colorado State University	17-7100-0402-CA	08/21/2017 - 08/20/2019	$66,124	The purpose of this agreement is to provide funding to support graduate research in the area of human dimensions of wildlife. The objective of this agreement is to enhance opportunities for collaborative research and education in the disciplinary area of human dimensions of wildlife by combining the opportunities for educational training in human dimensions provided at CSU with the research expertise and facilities for conducting studies on wildlife economics available at the NWRC.
Colorado State University	18-7100-0409-CA	04/15/2018 - 04/14/2019	$196,504	The purpose of this agreement is to provide funding to support graduate research in the area of economics. The objective of this agreement is to enhance opportunities for collaborative research and education in the disciplinary area of wildlife economics and human dimensions of natural resources by combining the opportunities for educational training in economics provided at Colorado State University with the research expertise and facilities for conducting studies on wildlife economics available at the NWRC and the NFSP.
Colorado State University	17-7488-1265-CA	06/15/2017 - 06/14/2018	$30,000	NWRC agreement partially funded by the Feral Swine Program. The purpose of this agreement is to continue collaborative research on developing statistical models for assessing disease risk in wildlife populations and resource use patterns in feral swine.

Colorado State University	18-7100-0415-CA	07/01/2018 - 06/30/2019	$89,978	The purpose of this agreement is to continue collaborative research on developing statistical models for assessing disease risk and resource use patterns in feral swine. The work will help to minimize and prevent damage to the U.S. food supply caused by animal pests and diseases by developing novel approaches for assessing wildlife disease risk and land use by feral swine.
Hawaii Department of Agriculture	18-7100-0413-CA	07/01/2018 - 06/30/2019	$15,050	The purpose of this agreement is to provide funding to determine the prevalence of bTB and SB in feral swine at the east end of Molokai.
Mississippi State University	14-7100-0360-CA 15-7100-0373-CA	09/12/2014 - 09/11/2016 09/03/2015 - 09/02/2017	$148,851 $219,963	The purpose of this agreement is to provide funding for the university, in partnership with the Center for Resolving Human-Wildlife Conflicts (CRHWC), to administer and implement educational forums specific to feral swine management for current and future wildlife professionals, the general public, and research scientists.
Mississippi State University	16-7100-0375-GR	02/04/2016 - 02/03/2017	$5,000	The purpose of this agreement is to provide assistance for the 2016 Wild Pig Conference which was held April 17-21, 2016 in Myrtle Beach, South Carolina.
Mississippi State University	16-7100-0389-CA 17-7100-0389-CA 18-7100-0389-CA	09/22/2016 - 09/21/2017 09/22/2017 - 05/15/2018 05/16/2018 - 05/15/2019	$31,000 $14,960 $13,297	The purpose of this agreement is to continue to provide funding to Mississippi State University's CRHWC to work to determine the impact of feral swine to crops through diet analysis and training students for potential careers in wildlife damage management. Student interns would create both a visual guide for vegetative material commonly found in feral swine as well as a reference for biologists and managers who continue diet research, which would be the first of its kind for feral swine diet research.
Mississippi State University	17-7100-0404-CA 18-7100-0404-CA	09/26/2017 - 09/25/2018 09/26/2018 - 09/25/2019	$102,000 $136,000	The purpose of this agreement is to provide funding to MSU to support a graduate student and to collaborate with MSU to conduct research toward the development of a strategic trapping system to optimize feral swine eradication efforts. Graduate students will use island biogeography to decrease agricultural damage and systematically eradicate feral swine from agricultural landscapes.

Mississippi State University	18-7100-0407-GR	03/30/2018 - 06/30/2018	$18,000	The purpose of this agreement is to provide funding to the Wild Pig Conference which was held in Oklahoma City, from April 15-19, 2018. The conference is the largest gathering of wild pig researchers and managers in North America and provides unparalleled opportunities in information sharing, discussion, professional development, and networking.
New Mexico State University	14-7400-0934-CA	09/28/2014 - 09/27/2015	$15,000	The purpose of this agreement is to provide educational support for four students at New Mexico State University and summer employment with WS for one student.
Texas A&M University – Kingsville	14-7100-0363-CA 15-7100-0363-CA 16-7100-0363-CA	09/18/2014 - 09/17/2015 08/07/2015 - 08/06/2017 09/01/2016 - 08/31/2018	$25,000 $248,050 $200,000	The purpose of this agreement is to provide funding to the university so they can provide minority students with educational support through financial scholarships. The university coordinates the selection of students to receive financial support, monitor student course study, and assign a mentor to each student. These students will serve as future leaders/specialists on projects addressing feral swine concerns. They will also conduct research to assess the potential impacts of feral swine on artificial wild turkey nests in Texas.
Texas A&M University – Kingsville	17-7100-0398-CA	09/25/2017 - 09/17/2019	$146,000	The purpose of this agreement is to provide financial assistance in the form of financial scholarships for students at this university. The scholarship funds may be used for course tuition, university fees, textbooks, lab supplies, school supplies, and other miscellaneous related expenses.
Texas A&M University - Veterinary Medical Diagnostic Laboratory (TVMDL)	14-7100-0362-CA	09/01/2014 - 08/31/2016	$19,388	The purpose of this agreement is to provide funding in order to test 375 feral swine collected from slaughter facilities in Texas for exposure to various zoonotic pathogens such as toxoplasmosis, influenza A virus, trichinellosis, and leptospirosis.
Texas Parks & Wildlife	18-7100-0417-CA	09/01/2018 - 08/31/2019	$120,000	The purpose of this agreement is to provide funding to develop a toxicant and delivery strategies, as well as management strategies, to optimize population reduction of feral swine. Analysis of current data, writing of reports, and pen and field studies will be conducted in support of these objectives. Feral swine and non-target species ecology and behavior will

				be studied to optimize the effectiveness and safety of strategies for management of feral swine.
The University of Georgia - Board of Regents of the University System of Georgia (SCWDS)	14-7100-0361-CA 15-7100-0361-CA 16-7100-0361-CA 17-7100-0361-CA 18-7100-0361-CA	09/04/2014 - 09/03/2015 09/11/2015 - 09/10/2016 09/11/2016 - 09/10/2017 09/11/2017 - 09/10/2018 09/11/2018 - 09/10/2019	$100,000 $100,000 $100,000 $50,000 $50,000	The purpose of this agreement is to provide funding in order to develop and supply an informational training/seminar on disease issues in feral swine for WS personnel. A brochure on feral swine disease was developed and printed (in English and Spanish) by SCWDS. This agreement will also develop and enhance training opportunities for WS personnel relative to disease issues in feral swine.
The Wildlife Society	14-7100-0263-GR	09/12/2014 - 09/11/2015	$10,000	The purpose of this agreement is to provide funding to publish *The Wildlife Professional* magazine. This quarterly print and online magazine is designed to be the leading information resource for wildlife students, scientists, managers, and conservationists in North America and beyond.
The Wildlife Society	14-7100-0358-CA	09/18/2014 - 09/17/2015	$30,000	The purpose of this agreement is to provide funding for maintenance of the Wildlife Society's News & Info Network. This network will use various communication channels to improve the sharing of wildlife science, management, and conservation information with wildlife professionals, and the general public.
The Wildlife Society	14-7100-0145-GR	09/18/2014 - 09/17/2015	$10,000	The purpose of this agreement is to provide funding for the Wildlife Society Annual Conference from October 25-30, 2014 in Pittsburgh, PA.
Tuskegee University	14-7100-0357-CA	09/04/2014 - 09/03/2015	$100,000	The purpose of this agreement is to provide funding to identify, coordinate, and implement survey outreach activities among the 1890 Universities, in which limited resource farmers are targeted.

	15-7100-0357-CA 16-7100-0357-CA 17-7100-0357-CA	04/08/2015 - 04/07/2017 09/19/2016 – 09/18/2017 09/19/2017 - 09/18/2019	$225,000 $204,600 $204,600	
Tuskegee University	16-7100-0378-GR	04/12/2016 - 04/11/2017	$5,000	The purpose of this agreement is to provide funding for the fees associated with registration and travel support for two-three students to attend the Wild Pig Conference in Myrtle Beach, South Carolina.
Tuskegee University	14-7400-0930-CA	09/01/2014 - 08/31/2016	$15,000	The purpose of this agreement is to provide funding for educational support for four students at Tuskegee University and summer work experience with WS for one student.
Universidad Nacional Autonoma de Mexico (UNAM)	18-5000-2116-CA	05/30/2018 - 05/29/2019	$20,000	The purpose of this agreement is to provide funding in order for the university to identify the distribution of feral swine in Mexico and to develop a better understanding of the distribution, impacts, and presence of the main pathogens in feral swine populations in captive conditions in central and southeastern Mexico. The results of this study will inform operational plans to reduce the threats of feral swine to environmental health in North America.
University of Colorado	15-7408-1050-CA	06/27/2015 - 06/26/2016	$20,000	The purpose of this agreement is to provide collaborative research on diet analysis of feral swine and rodents using a high-throughput DNA sequencing approach.
University of Florida	VS Agreement	09/15/2017 - 09/14/2018	$155,102	VS agreement funded by the Feral Swine Program. The purpose of this agreement is to provide the methods and data to support modeling activities to estimate feral swine contact structure, disease transmission risks, population distribution, and invasibility in North America.
University of Georgia	17-7488-1119-CA	02/20/2017 - 02/19/2019	$36,000	NWRC agreement partially funded by the Feral Swine Program. The purpose of this agreement is to provide funding to quantify movement behavior of translocated sounders. Understanding how translocation affects pig movement behavior and social structure will help managers understand the impact of human behavior on pig populations. Sounders

				will be captured, translocated, and monitored for a period of time after translocation. The data will also be used to inform predictive models of feral swine invasion dynamics.
University of Georgia, Savannah River Ecology Lab (SREL)	18-7100-0414-CA	09/05/2018 - 09/04/2019	$338,960	The purpose of this agreement is to quantify movement behavior of translocated sounders. Sounders will be captured, translocated, and monitored for a period of time after translocation, to understand how translocation may affect movement behavior and resource location. Another objective of this agreement is to measure crop damage from feral swine. A third objective is to conduct pen studies evaluating warfarin toxicant on feral swine. And a fourth objective is to conduct field studies evaluating warfarin toxicant on feral swine.
University of Saskatchewan	17-7100-0403-CA 18-7100-0403-CA	09/25/2017 - 09/24/2018 09/25/2018 - 09/24/2019	$198,000 $59,000	The purpose of this agreement is to provide funding to assist the university in mapping feral swine populations in Canada and to provide insight in movement of animals along the border between Canada and the United States. Studies include estimates of feral swine spatial distribution, dispersal patterns, and economic damage information vital to estimating risks to agricultural and natural resources and the effective design of feral swine surveillance, population management, and mitigation strategies. Results will inform operational plans to reduce the threats of feral swine to environmental health in North America, contributing to the APHIS strategic goal of helping prevent or reduce wildlife-caused agricultural losses.
University of Saskatchewan	15-9200-0396-CA 16-9200-0396-CA	09/25/2015 - 09/27/2016 09/25/2016 - 09/24/2017	$104,000 $140,000	VS agreement funded by the Feral Swine Program. The purpose of this agreement is to provide funding to develop methods and data to estimate feral swine continental distribution.
University of Wyoming	18-7100-0405-CA	01/01/2018 - 12/31/2018	$15,987	The purpose of this agreement is to provide funding for the development of an automate camera-trap photo classification procedure for wildlife species detection, identification, and enumeration. Wildlife camera traps are a common and effective tool for studying the ecology of feral swine.

USDA – Agricultural Research Service (ARS)	15-7100-0366-IA	01/01/2015 - 09/30/2015	$50,000	The purpose of this agreement is to provide funding for ARS to conduct diagnostic analysis on various tissues from approximately 375 feral swine submitted by WS, primarily testing for *Brucella spp*.
USDA – National Agricultural Statistics Service (NASS)	18-7100-0382-IA	07/20/2018 - 09/30/2019	$300,000	The purpose of this agreement is to provide funding to evaluate alternatives for reducing damage and risks to human health and safety. The most effective means of obtaining the desired data on the impact of and attitudes toward feral swine within agricultural operations is to obtain a random sample of the population and survey them. NASS has the unique ability to cost-effectively sample the population (e.g., recent hay/haylage, tree nut, melon, sugar cane, sweet potato, and cotton producers), conduct screenings, and administer the survey. NASS will conduct a survey and provide NFSP with access to an electronic dataset without Personally Identifiable Information (PII) through NASS's Data Lab process and procedures. NFSP will analyze the data and disseminate and publish the findings with NASS' concurrence on the statistical defensibility of the studies and assurance of confidentiality.
USDA – NASS	16-7100-0382-IA	07/01/2016 - 09/30/2016	$280,000	The purpose of this agreement is to provide funding in order to consult and implement the 2016 Feral Swine Livestock Damage Survey to eligible farmers in identified states. This is in support of the Feral Swine Damage Management Initiative's goal of evaluating the impacts of alternatives for reducing feral swine damage in the U.S.
emUSDA – NASS	14-7483-1062-IA	02/18/2014 - 05/31/2015	$190,200	The purpose of this agreement is to evaluate the impact of alternatives for reducing feral swine damage in the U.S.
USDA – Office of Communications	18-7100-0406-IA	02/15/2018 - 09/30/2018	$29,000	The purpose of this agreement is to provide funding to work with the NFSP to help create short, educational films on feral swine damage and management.

Program Office: National Feral Swine Program

The NFSP is headquartered out of the National Wildlife Research Center in Fort Collins, CO. The program consists of eight full-time office staff that manage all components of the national program and interface closely with the respective states and territories. Provided below are brief biographies and job descriptions for each staff member, followed by an organizational chart. A list of publications, presentations, and trainings completed by headquarter personnel and close collaborators can be found in Appendix A, in addition to meetings attended.

Dale Nolte – Program Manager:

Dale Nolte is the Program Manager for the APHIS WS NFSP. As the Program Manager he provides oversight for the program and has direct responsibility for the planning and monitoring the program component, along with the research component. Currently he also works in conjunction with the Assistant Manager on developing Program Projects with State Directors and providing oversight to the Regional Helicopter Teams.

Contact: dale.l.nolte@usda.gov; 970-266-6049

Michael Marlow – Assistant Program Manager:

Michael Marlow is a Wildlife Biologist and serves as the Assistant Program Manager for the NFSP. Michael manages the operational component of the Program, working closely with state programs on their state plans, state quarterly reports, and elimination and local projects. Additionally, Michael oversees the regulation component, NEPA, GIS, UAS, and population monitoring aspects of the Program.

Contact: michael.c.marlow@usda.gov; 970-266-6067

Vienna Brown – Biologist:

Vienna Brown serves as a Biologist for the NFSP, and started with the Program in July 2018. Vienna serves as the Program's lead for disease monitoring and the primary liaison on feral swine disease issues with the National Wildlife Disease Program and WS field operations, along with serving as the lead for other emerging projects. Additionally, she serves as the Program's interface between universities, diagnostic laboratories, and other disease related collaborators.

Contact: vienna.r.brown@usda.gov; 970-266-6071

Mark Lutman – Wildlife Biologist:

Mark Lutman serves as a Wildlife Biologist for the NFSP. Mark's duties include maintenance and oversight of feral swine disease data, maintaining the National Feral Swine Population Map (formally operated by SCWDS), geographic information systems (GIS) projects using the Collector app, the use of unmanned aircraft systems (drones) to collect crop damage data, as well as the detection of feral swine using thermal sensors. He also serves on several WS committees.

Contact: mark.w.lutman@usda.gov; 970-266-6077

Rachel Maison – Biological Science Technician:

Rachel Maison has served as the NFSP's biological science technician since March 2016. Her primary responsibilities include sample receipt, data entry and management, and general support of field staff; however, she also assists the program biologists with ongoing and emerging project needs as they arise. She also works closely with the National Wildlife Disease Program as a laboratory technician, assisting with sample diagnostics as well as sample receiving and data management.

Contact: rachel.m.maison@usda.gov; 970-266-6086

Allie Mitchell – Program Specialist:

Allie Mitchell serves as the Program Specialist for the NFSP. Allie provides administrative support for the program and helps to maintain the SharePoint website.

Contact: alexandra.a.mitchell@usda.gov; 970-266-6314

Jeanine Neskey – Biologist Extension:

Jeanine Neskey is a Biologist and has been with the NFSP since November of 2015. Jeanine serves as the program lead for the outreach component and is the communications specialist for the program, developing outreach materials, communication campaigns, and working closely with APHIS Public Affairs.

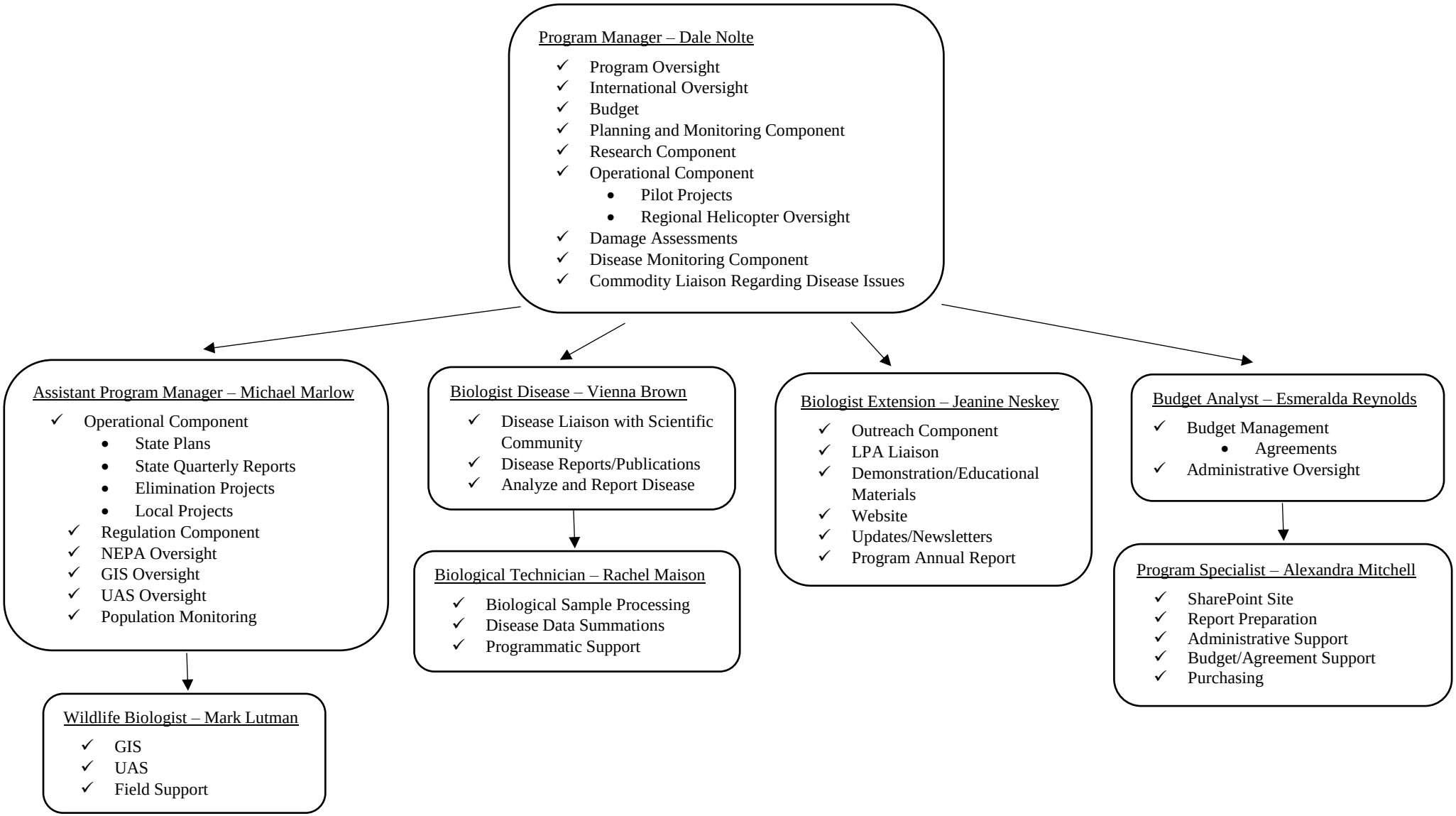
Contact: jeanine.t.neskey@usda.gov; 970-266-6316

Esmeralda Reynolds – Budget Analyst:

Esmeralda Reynolds serves as the NFSP Budget Analyst. Esmeralda started with the program in April 2015. Her responsibilities include: budget planning, managing, monitoring, analysis, procurement processing, cooperative agreements, human resources, and supervision. Esmeralda provides budget guidance to 40 WS State Offices/Territories and communicates across a wide variety of agency and private sector personnel, including representatives from Headquarters, Regional Offices, PPD, and FMD. Additionally, she serves as the Wildlife Services Hispanic Special Emphasis Program Manager and a Work/Life Wellness Committee member.

Contact: esmeralda.reynolds@usda.gov; 970-266-6311

National Feral Swine Damage Management Program Headquarters Personnel



Operational Component

Since environmental conditions and laws governing feral swine vary considerably among states, APHIS' strategy is to provide resources and expertise at a national level, while allowing flexibility to manage operational activities from a local or state perspective. Each state is classified by level depending on the number of feral swine estimated to be there. This is a tiered system with level 5 being the highest, these states receive the highest baseline funds.

Level 0 = No feral swine
Eliminated = States that have successfully removed feral swine following population elimination efforts.
Detection level = States that have removed feral swine but receive funding to continue monitoring for two additional years.
Level 1 = < than 1,000 feral swine in state
Level 2 = > 1,000 and < 10,000 feral swine in state
Level 3 = > 10,000 and < 100,000 feral swine in state
Level 4 = > 100,000 and < 750,000 feral swine in state
Level 5 = > 750,000 feral swine in state
Territory = Puerto Rico, Guam, and the Virgin Islands

Baseline funds are operational funds to maintain a feral swine damage management program in the state. Additionally, project funds may be allocated based on demonstrated need and state level. Elimination project funds are supplemental funds requested by Level 1 and 2 states to support feral swine eradication. Local funds are competitive funds with levels 3, 4, and 5 and territories being eligible to apply; these funds are directed towards special projects within the state or territory. **Table 2** depicts level movement by individual states over the course of FY14-FY18.

Table 2: State transitions from FY14 and FY18.

Year	State	Movement
2014	N/A	Program begins
2015	N/A	None
2016	HI	Level 4 to Level 3
	ID	Level 1 to Detection
	MD	Level 1 to Detection
	MI	Level 3 to Level 2
	NY	Level 1 to Detection
	WA	Level 1 to Detection
2017	NJ	Level 1 to Detection
	NM	Level 2 to Level 1
	WI	Level 1 to Detection
2018	ID	Detection to Elimination
	NY	Detection to Elimination
	MN	Level 1 to Detection

Below is an overview of each state or territory. Budgetary resources are outlined, representing both baseline levels and supplementary project funds. The task force organizational members listed are those that were participatory in FY18. There may be instances in which there are resources protected listed or references to feral swine being removed but no graphic depicting removal methods. This is a result of one of several scenarios, including 1) the swine detected on the landscape were escaped domestics and they

were captured alive and returned to their owner or 2) an agency at the state or local level was responsible for removing the feral swine but worked collaboratively with WS to do so.

Alabama

- FY18 funding level: 4
- Point of contact: State Director
    - Address: School of Forestry and Wildlife, 602 Duncan Drive
    - City/State/Zip: Auburn University, AL 36849
    - Phone: 334-844-5670

- State task force: Alabama Feral Hog Control Council
    - Member organizations:
        - Alabama Department of Conservation and Natural Resources
        - Alabama Department of Agriculture and Industries
        - Alabama Forestry Commission
        - Alabama Soil and Water Conservation Committee
        - Auburn University, School of Forestry and Wildlife Sciences
        - Alabama Cooperative Extension System
        - USDA Natural Resources Conservation Service
        - USDA APHIS Wildlife Services
        - USDA Forest Service
        - Alabama Wildlife Federation
        - Local farm association
        - Local livestock association

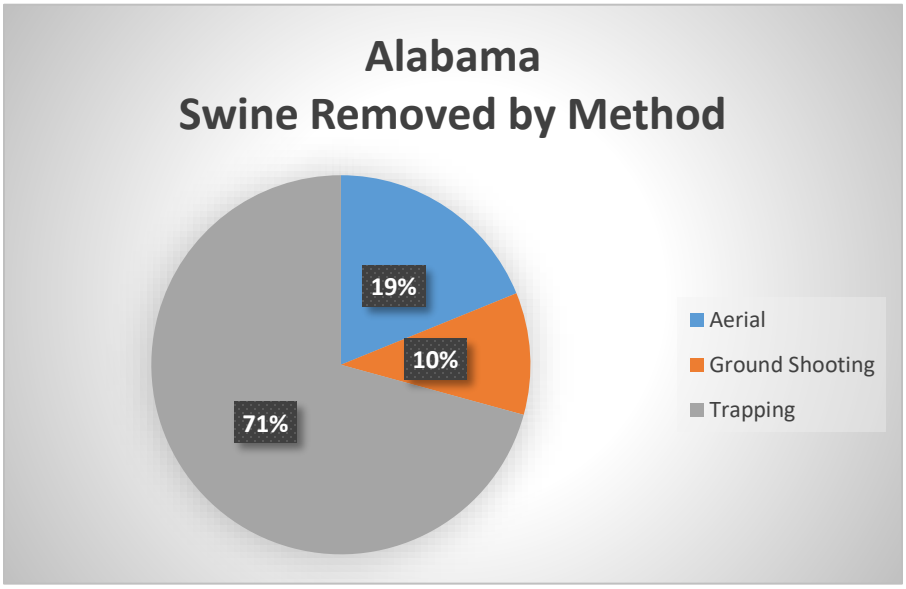
- Objectives:
    - Established goals: development, study, and implementation of techniques and strategies that can have long-term control effects across the landscape.
    - Develop, study, and implement techniques and strategies that can be applied at present to provide landowners with shorter-term control options.
    - Develop clear and documented depictions of known geographic distribution of feral hogs in Alabama.
    - Develop an information portal to provide the best available information regarding potential control options/assistance programs for eliminating damage caused by feral swine.
    - Develop, improve, and affect implementation of laws and regulations to stem the transportation of live feral hogs.
    - Support research in Alabama regarding the use of toxicants and immune-contraceptives as a future control method.
    - Address toxicant (warfarin) concerns and questions regarding the potential impact to non-target wildlife species, edible meat consumption, and federal/state registrations of the product.
    - Expand research and identify resources to document negative impacts of feral swine damage in Alabama and effective short and long-term control strategies to mitigate them.
    - Prevent the implementation of counter-productive practices to control feral swine, including bounty systems and economic meat markets.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Conducted nine outreach presentation/field days for landowners and professionals
        - Met with the Alabama Feral Pig Control Council and participated in two primary committees and WS personnel co-chaired one committee.
        - Held preliminary meetings with various state and federal partners concerning potential cooperative projects and funding.
        - Conducted operational control projects on U.S. Forest Service lands, U.S. Army Corps of Engineers lands, Fort Rucker, and private properties.
        - Worked directly with Alabama Division of Wildlife and Freshwater Fisheries, Alabama Farmers Federation, and Alabama Wildlife Federation on exploring regulatory options for illegal transportation of live feral swine. Alabama now does not allow pig hunting on state management areas.
        - Worked with multiple landowners to conduct field trials to improve feral swine trapping techniques.
        - Conducted feral swine surveys and trapping on Sand Mountain in northern Alabama where the majority of commercial swine production is located; attempting to identify any feral swine populations that may come into contact with commercial production.
        - Conducted special projects that involved eliminating feral swine damage in a continuous hardwood habitat.
    - 2015
        - Developed a partnership with Alabama State Lands and State Wildlife Agency.
        - Developed a partnership with U.S. Forest Service (three National Forests).
        - Implemented control options and supported Auburn Research regarding door sizes and door types on feral swine traps.
    - 2016
        - Developed partnership with Alabama state lands, Alabama Department of Conservation and Natural Resources (ADCNR), and National Wildlife Refuge (NWR).
        - Developed a partnership with the military installation at Fort Rucker.
        - Possible elimination of feral swine from Tuskegee National Forest and Bon Secour NWR.
        - Initiated aerial removal activities on private and public lands.
    - 2017
        - Five properties identified by the Alabama Farmer's Federation in excess of 1,000 acres per property implemented different management strategies to determine the most cost efficient ways to control damage.
        - Each farmer completed a NWRC questionnaire to capture historic damage loss from feral swine.
        - Conducted NWRC peanut damage assessments for producers participating with the Dothan Pilot Project Area.
        - Assisted Alabama Farmer's Federation with a feral swine damage response to producers requesting assistance and subsequent training programs.
        - Conducted intensive feral swine control in hardwood bottomland habitat.
        - Implemented cost-share programs to control feral swine.
        - Conducted aerial operations on private lands located in Autauga and Macon Counties to determine the effectiveness of aerial management support in subsequent habitat; a total of 390 feral swine removed in four days.
        - Developed an Aerial Emergency Action Plan for State Operations.

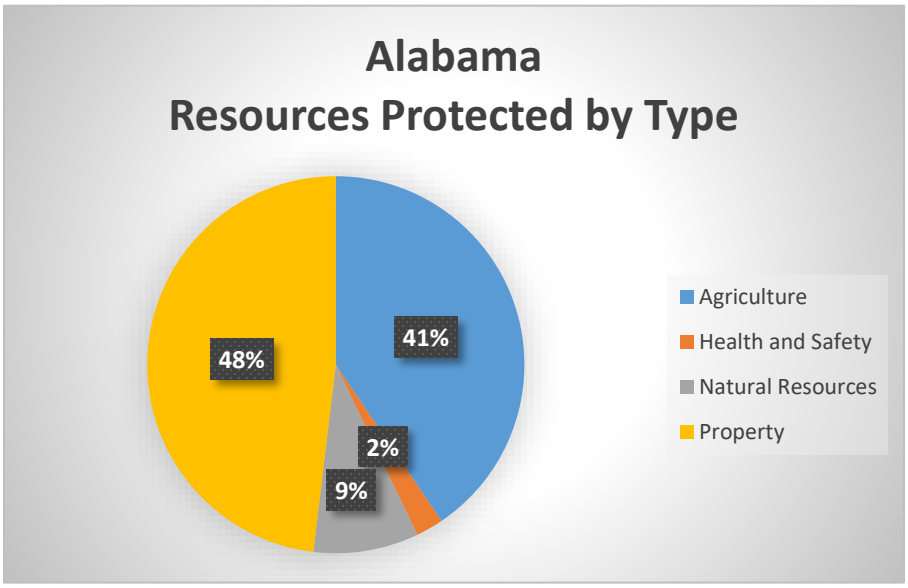
        - Conducted multiple field days in regards to feral swine management for the Alabama Farmers Federation, Tuskegee University, Auburn University, political staffers, etc.
    - 2018
        - Conducted operational feral swine work for cooperatively funded projects (Army Corps of Engineers, ADCNR, USDA Forest Service, private lands, Fort Rucker, cities, etc.-$180,000).
        - Conducted aerial operations in Clarke, Macon, Dale, Henry, Coffee, Hale, Perry, Dallas, Pickens, Sumter, and Autauga counties. Properties included privately owned recreational properties, agricultural lands, state managed wildlife sanctuaries, and national forests. Removed a total of 519 individuals from associated properties.
        - Coordinated implementaiton of hangar security and supplies for new agency helicopter in Anadalusia.
        - Hired and currently in the process of hiring six additional personnel to assist with feral swine control efforts in the state and the Carribean.
        - Coordinating NWRC Sodium Nitrate study with Alabama Department of Conservation and Natural Resources and Alabama Department of Agriculture to test toxicant on private lands in Alabama.
        - Program is on course to remove a projected 2,000 feral swine using all methods available.
        - Held meetings with various private landowners and agricultural producers in multiple counties regarding feral swine management and aerial gunning activities.
        - Met with Fort Rucker Command (Garrison Commander and subsequent chain of command) in regards to aerial operations and feral swine management activities on the installation.
        - Conducted multiple field days and presentations in regards to feral swine management for the Alabama Farmers Federation, Auburn University, County Extension, etc.

- Future directions and goals related to feral swine management over the next five years:
    - Increase program and personnel to more effectively control damage and provide assistance to farmers and landowners who request assistance.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$295,000	$72,000	$30,000	$397,000
2015	$295,000	$37,000	$45,000	$377,000
2016	$295,000	$100,000	$150,000	$545,000
2017	$303,850	$350,000	$165,000	$818,850
2018	$303,850	$400,000	$180,000	$883,850
Total	**$1,492,700**	**$959,000**	**$570,000**	**$3,021,700**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	54	253
Fixed-wing	0	0	0	0	64

- Major cooperators:
  - Alabama Department of Conservation and Natural Resources
  - Alabama Department of Agriculture
  - U.S. Forest Service
  - U.S. Army Corps of Engineers
  - U.S. Army
  - Alabama Wildlife Federation
  - Auburn University
  - U.S. Fish and Wildlife Service
  - County Extensions
  - USDA Natural Resources Conservation Services
  - Local farm association

Arizona

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 8836 North 23rd Avenue, Suite 2
    - City/State/Zip: Phoenix, AZ 85021
    - Phone: 602-870-2081

- State task force: Arizona Feral Swine Working Group
    - Member organizations:
        - Arizona Department of Agriculture
        - Arizona Game and Fish Department
        - U.S. Fish and Wildlife Service
        - U.S. Forest Service
        - U.S. Bureau of Land Management
        - USDA APHIS Veterinary Services
        - USDA APHIS Wildlife Services

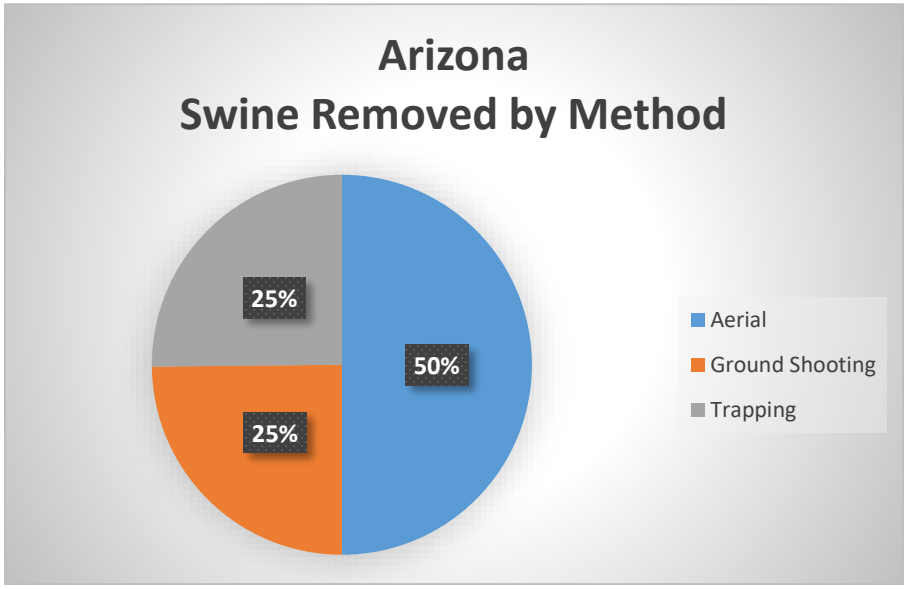
- Objectives:
    - Eradicate feral swine in Arizona.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Eliminated feral swine on the Virgin River and in Cochise County.
        - Addressed various landowner complaints regarding feral swine.
    - 2015
        - Cleared Cordes Junction Game Management Unit 21, Alamo Lake area, Cochise County, and Virgin River – no feral swine were found.
    - 2016
        - Reduced the number of feral swine in the Havasu NWR.
    - 2017
        - Conducted the first helicopter removal of 65 feral swine in the Havasu NWR.
        - Increased partnership with the U.S. Fish and Wildlife Service (USFWS).
        - Confirmed the presence of feral swine on the San Pedro River via fixed-wing aircraft.
        - Removed a new population of feral swine on the Salt River in the Phoenix metro area.
        - Conducted outreach at tribal meetings with the Fort Mojave Indian Tribe, Arizona and New Mexico Chapters of the Wildlife Society, and Colorado River meetings.
        - Reported and removed a new population of feral swine along the Gila River.
    - 2018
        - Conducted two helicopter operations at Havasu NWR (removing 61 in February and 35 in September.
        - Hired a Feral Swine Specialist that will be stationed at Havasu NWR year-round to eliminate the population.
        - Used dogs for the first time to assist with feral swine removal (six individuals) at Havasu NWR.
        - Protected the following threatened and endangered species: Yuma Ridgeway Rail, Southwestern Willow Flycatcher, Razorback Sucker, Lowland Leopard Frog, Northern Mexican Gartersnake, and Yellow-billed Cuckoo at Havasu NWR.

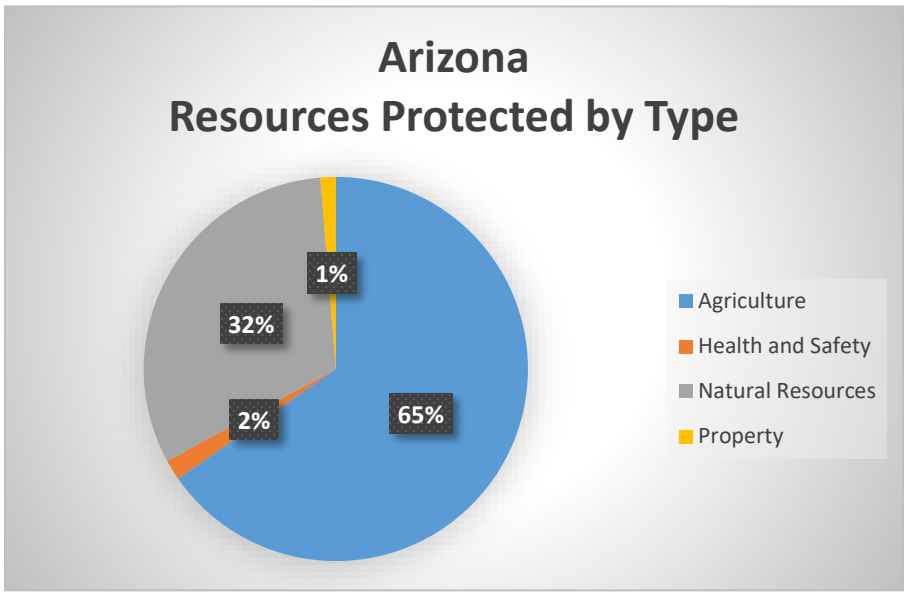
- Confirmed the presence of feral swine on the San Pedro River via fixed-wing aircraft, and set-up trail cameras to monitor the feral swine and a bait station to concentrate the feral swine for capture.
- Expanded our ability to manage feral swine on the San Pedro River through increased cooperation with the Nature Conservancy and the U.S. Bureau of Reclamation.
- Continued to monitor trail cameras throughout the state.
- Confirmed that feral swine were escaping from a high fenced hunting facility in Navajo County.
- Conducted outreach at the Arizona Farm Bureau Trade Show, Arizona Outdoor Expo, the Southwest Indian Agriculture Association, Arizona Animal Control Association, Arizona Cattle Grower's Association, Dine College – Navajo Nation, Navajo Technical University – Navajo Nation, and Fort Mojave Indian Tribe.
- Assisted the Arizona Department of Agriculture and the Texas Animal Health Commission in an investigation of the illegal import of 60 feral swine.
- Discussed feral swine management at annual work plan meetings with the Arizona Department of Agriculture, Arizona State Land Department, Arizona Game and Fish Department, Bureau of Land Management, USFWS, and U.S. Forest Service.

- Future directions and goals related to feral swine management over the next five years:
  - Continue to move towards eradication at Havasu NWR with the addition of year-round staff.
  - Add two additional personnel to address feral swine on the San Pedro River and centered near Camp Verde.
  - Remove the newly identified population east of Mesa.
  - Remove escapees around the high fenced hunting facility.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$0	$68,000
2015	$68,000	$23,000	$5,500	$96,500
2016	$68,000	$48,000	$5,800	$121,800
2017	$68,000	$42,000	$5,800	$115,800
2018	$68,000	$60,500	$20,000	$148,500
Total	**$340,000**	**$173,500**	**$37,100**	**$550,600**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	31.7	24.7
Fixed-wing	22.5	105.1	66.9	83.5	103.3

- Major cooperators:
  - Arizona Department of Agriculture
  - Arizona Game and Fish Department
  - Local commodity association
  - Arizona State Land Department
  - U.S. Bureau of Land Management
  - U.S. Bureau of Reclamation
  - U.S. Fish and Wildlife Service
  - U.S. Forest Service

Arkansas

- FY18 funding level: 4
- Point of Contact: State Director
    - Address: 2967 Highway 130 East
    - City/State/Zip: Almyra, AR 72003
    - Phone: 870-673-1121

- State task force: Arkansas Feral Hog Eradication Task Force
    - Member organizations:
        - Arkansas Agriculture Department
        - Arkansas Game and Fish Commission
        - Arkansas Natural Resource Commission
        - Arkansas Livestock and Poultry Commission
        - Arkansas Association of Conservation Districts
        - University of Arkansas, Division of Agriculture
        - Local commodity association
        - Arkansas Economic Development Commission
        - Arkansas Forestry Commission
        - Arkansas State Parks
        - Local farm association
        - Department of Arkansas Heritage
        - The Nature Conservancy

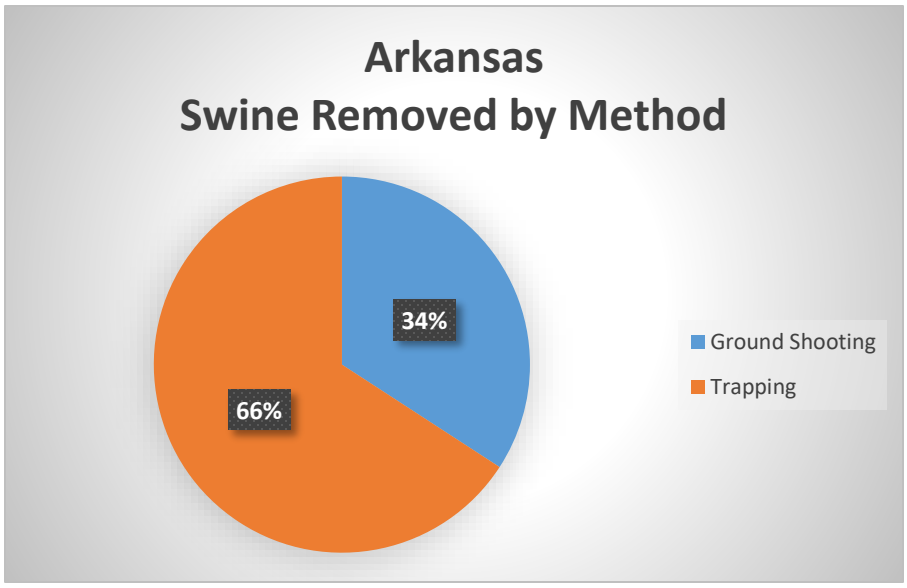
- Objectives:
    - Develop a multi-partner alliance.
    - Increase public understanding of the damage and harm feral swine cause.
    - Increase awareness of controlling illegal transport and release of feral swine.
    - Increase resources to assist landowners and land managers in effort to control feral swine damage.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Initiated private land feral swine program, 32 cooperators assisted.
        - Coordinated with Arkansas Game and Fish Commission to establish control efforts on wildlife management areas and identify potential elimination sites with ongoing efforts to suppress current populations.
        - Established feral swine control in-service training with University of Arkansas Cooperative Extension Service to provide training for county agents on proper feral swine control techniques for dissemination to the public.
        - Established feral swine control presentations with Arkansas Association of Conversation Districts as an outreach message to public.
    - 2015
        - Reduced the feral swine population at Pine Tree Wildlife Demonstration Area.
        - Implemented private land feral swine program. Ninety-five cooperators assisted.
        - Implemented feral swine initiative pilot project on private lands with Natural Resources Conservation Service (NRCS), the Arkansas Association of Conservation Districts (AACD), and the Arkansas Game and Fish Commission (AGFC).
        - Isolated reduction of feral swine populations on private land.

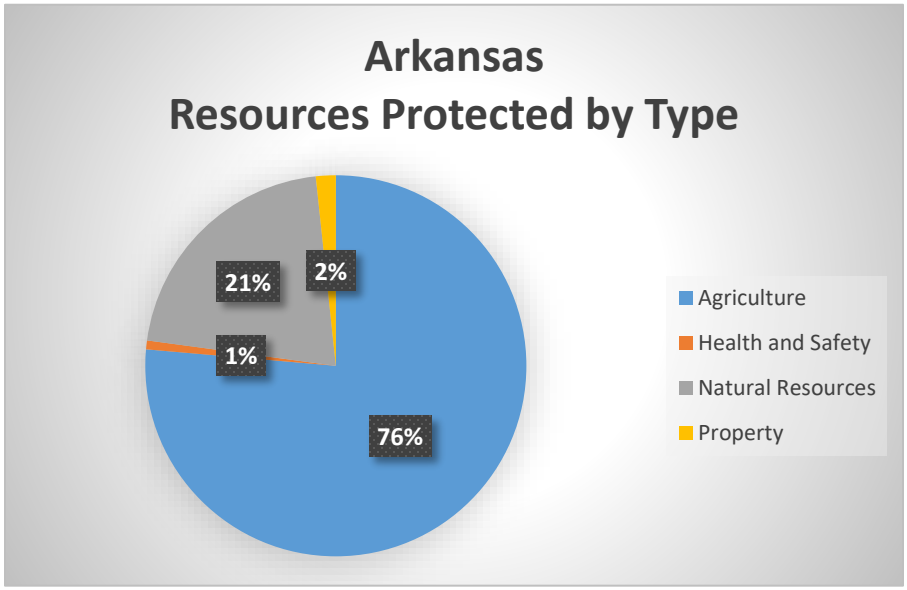
        - Collaborated with NRCS, AACD, AGFC, and Cooperation Extension Service on feral swine control workshops.
    - 2016
        - Implemented private land feral swine program. One hundred twenty-one cooperators assisted.
        - Implemented regional reduction of feral swine damage on agricultural lands where control conducted.
        - Continued work with NRCS, AACD and AGFC to implement feral swine initiative pilot project.
        - Continued collaboration with NRCS, AACD, AGFC, and Cooperation Extension Service on feral swine control workshops. Fifteen feral swine control workshops were conducted.
    - 2017
        - Implemented private land feral swine program. One hundred one cooperators assisted.
        - AR-WS asked to serve on NRCS Wildlife Subcommittee as feral swine advisor.
        - Conducted aerial operations to control feral swine at Big Lake Wildlife Management Area in conjunction with Missouri WS.
        - Continued work with NRCS, AACD and AGFC to implement feral swine initiative pilot project.
    - 2018
        - Implemented private land feral swine program. Two hundred+ cooperators assisted.
        - Hired four additional technicians to conduct feral swine control in northern and southwest Arkansas.
        - Conducted aerial operation on AGFC owned property and private land in southeast Arkansas.
        - Entered into tentative cooperative agreement to conduct feral swine control on wetland reserve easements controlled by USDA NRCS.
        - Conducted aerial operations to control feral swine at Big Lake Wildlife Management Area in conjunction with Missouri WS.

- Future directions and goals related to feral swine management over the next five years:
    - Anticipate continuation of private lands initiative with AGFC, NRCS, and AACD.
    - Further involvement with Arkansas Feral Hog Eradication Task Force to create statewide multi-agency trapping program.
    - Development of statewide cooperative agreement for feral swine control on Wetland Reserve Program easements with NRCS.
    - Continued goal for statewide reduction of feral swine population to reduce damage.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$295,000	$0	$130.000	$425,000
2015	$295,000	$45,000	$130,000	$470,000
2016	$295,000	$32,000	$130,000	$457,000
2017	$303,850	$125,000	$130,000	$558,850
2018	$303,850	$150,000	$130,000	$583,850
Total	**$1,492,700**	**$352,000**	**$650,000**	**$2,494,700**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Arkansas Game and Fish Commission
    - USDA Natural Resource Conservation Service
    - Arkansas Association of Conservation Districts
    - Arkansas Cooperative Extension Service
    - Arkansas Agriculture Department
    - Arkansas Livestock & Poultry Commission
    - Arkansas Natural Resources Commission
    - Local farm association

California

- FY18 funding level: 5
- Point of Contact: State Director
    - Address: 3419-A Arden Way
    - City/State/Zip: Sacramento, CA 95825
    - Phone: 916-979-2675

- State task force: Feral Swine Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - California Department of Food and Agriculture
        - California Department of Fish and Wildlife
        - USDA APHIS Veterinary Services
        - California Agricultural Commission and Sealers
        - Barona Band of Mission Indians
        - USDA Natural Resources Conservation Service
        - U.S. Bureau of Indian Affairs
        - U.S. Bureau of Land Management
        - U.S. Fish and Wildlife Service

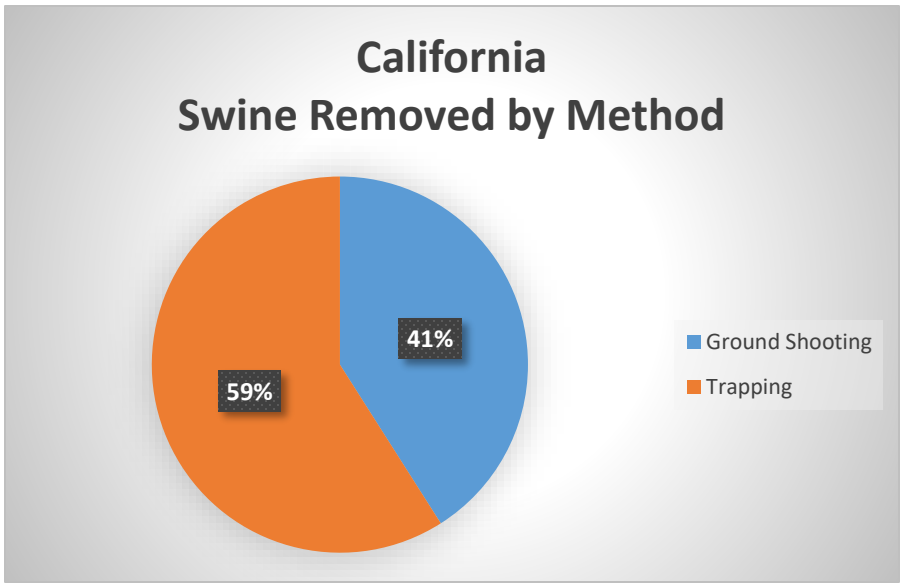
- Objectives:
    - Develop partnerships with organizations working to reduce impacts of feral swine to agriculture, natural resources, property, animal health, and human health.
    - Increase research and disease monitoring throughout the state.
    - Provide feral swine management programs to protect agriculture, natural resources, property, animal health, and human health.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Resolved feral swine damage in 35 counties.
        - Contacted 120 Native American tribes concerning feral swine management.
        - Signed a Memorandum of Understanding (MOU) with Barona Band of Mission Indians, provided draft MOUs to six additional Native American tribes for signature, and contacted an additional 120 Native American tribes concerning feral swine management.
        - Increased inventory of equipment to increase number of trap nights for feral swine.
    - 2015
        - Continued eradication program in San Diego County.
        - Continued discussions with federal partners, California Department of Fish and Wildlife, California Department of Food and Agriculture, and California Agricultural Commissioner and Sealers on impact of feral swine and increased efforts for removal.
        - Continued work on removal of feral swine through depredation permits.
        - Increased inventory of night optic equipment to increase number of feral swine removed.
    - 2016
        - Initiated feral swine research program on Tejon Ranch.
        - Met and provided all feral swine sampling goals.

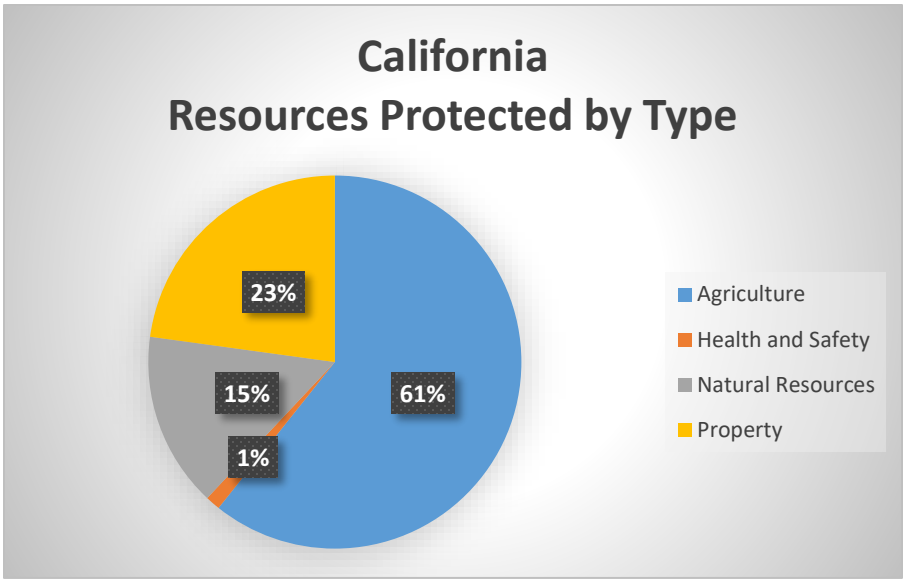
        - Continued eradication program in San Diego County.
        - Continued discussions with federal partners, California Department of Fish and Wildlife, California Department of Food and Agriculture, and California Agricultural Commissioner and Sealers on impact of feral swine and increased efforts to remove.
        - Continued work on removal of feral swine through depredation permits.
    - 2017
        - Met with cooperating agencies regarding feral swine status and need to increase ability to remove feral swine on federal property.
        - Finished feral swine research program on Tejon Ranch.
        - Continued eradication program in San Diego County.
        - Cooperated with feral swine research on Vandenberg Air Force Base.
        - Gave multiple presentations and provided handouts to Assistant Agriculture Commissioners, California pesticide applicators, integrated pest management workshops, and California Department of Fish and Game (CDFG) Commission on feral swine damage and depredation.
        - Met with CDFG Commission in regard to status change and worked in a small group on regulation wording changes.
    - 2018
        - Conducted outreach meetings with cooperating agencies regarding feral swine status and the need to increase feral swine removal across the state.
        - Continued NWRC research project on feral swine research on Vandenberg Air Force Base.
        - Gave multiple presentations concerning feral swine damage, disease notification, and provided handouts to Agriculture Commissioners, Farm Bureau, California Cattlemen, Ca Wool Growers, California pesticide applicators, integrated pest management workshops, and CDFG Commission on feral swine damage, disease, and depredation.
        - Continued meeting with CDFG Commission and NGO's in regard to status change of game mammal status and continued to work in a small group on wording changes in regulations.

- Future directions and goals related to feral swine management over the next five years:
    - Continue to work with California Fish and Game Commission and the State legislature to remove feral swine listing as a game mammal in state.
    - Continue to expand feral swine removal and disease sampling across the state.
    - Increase efforts along state borders and the U.S. border to stop feral swine movements between states and Mexico.
    - Increase feral swine research involvement with NWRC, University of California Extension.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$325,000	$245,000	$200,000	$570,000
2015	$325,000	$220,000	$225,000	$770,000
2016	$325,000	$402,000	$238,000	$965,000
2017	$334,750	$355,000	$258,900	$948,650
2018	$334,750	$140,000	$241,000	$715,750
Total	**$1,644,500**	**$1,362,000**	**$962,900**	**$3,969,400**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	17	21	12.2	3

- Major cooperators:
  - California Agricultural Commissioner and Sealers
  - California Department of Food and Agriculture
  - California Department of Fish and Wildlife
  - California Fish and Game Commission
  - The San Diego Association of Governments
  - Barona Band of Mission Indians

Colorado

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 12345 W. Alameda Parkway, Suite 204
    - City/State/Zip: Lakewood, CO 80228
    - Phone: 303-328-9041

- State task force: Colorado Feral Swine Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Colorado Parks and Wildlife
        - Colorado Department of Agriculture

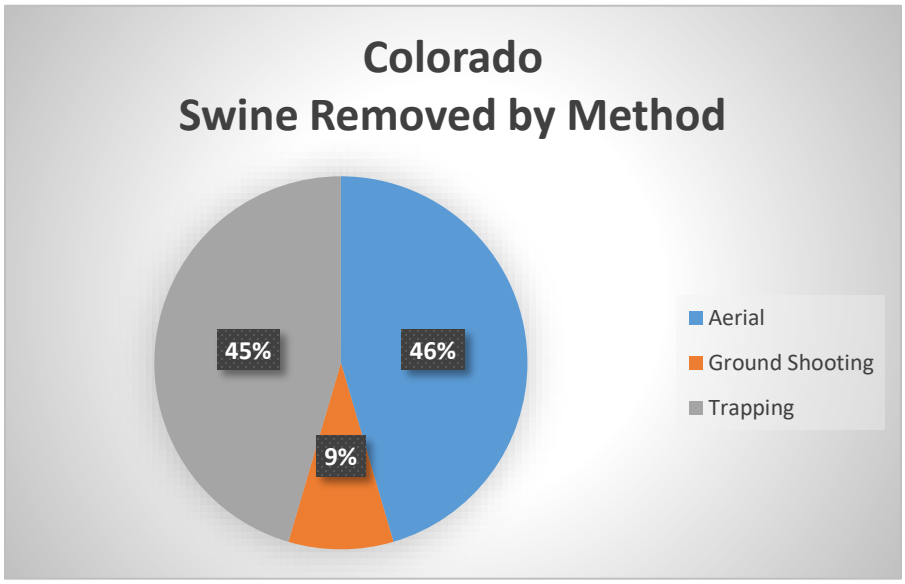
- Objectives:
    - Eliminate feral swine from Colorado by 2020.
    - Eliminate feral swine from surrounding areas of Kansas, Oklahoma, and New Mexico by 2020 to prevent re-infiltration into Colorado.
    - Surveillance for detection of feral swine after elimination.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Surveyed areas where WS has previously conducted feral swine control projects, no feral swine were detected this year.
    - 2015
        - Removed all released feral swine from Baca County and collected disease and genetics samples.
        - Baca County with the Colorado Department of Agriculture and Colorado Cattlemen's Association regarding goals and plans for FY16.
    - 2016
        - GPS-tracked feral swine in Baca County for six months.
        - Conducted outreach to landowners and land managers in southeastern Colorado.
    - 2017
        - Gained access to key private lands in the Arkansas River and Dry Cimarron River Valleys in southeastern Colorado for the surveillance and removal of feral swine.
        - Conducted feral swine surveillance in southeastern Colorado via rotary-wing and fixed-wing aircraft, ATV, horses, trail cameras over bait stations, and outreach efforts. Areas included Baca, Bent, Crowley, Kiowa, Otero, Prowers, and Pueblo counties.
        - Conducted feral swine surveillance via rotary-wing and fixed-wing aircraft in the Oklahoma panhandle (Cimarron County) and southwestern Kansas (Morton County).
        - Worked with Colorado Parks and Wildlife and Colorado Department of Agriculture to investigate reports of feral swine.
        - Formed and met with the Colorado Feral Swine Task force and agreed on goals, roles, and strategy.
        - Conducted outreach on feral swine in southeastern Colorado, including: a booth at the Montezuma County Agriculture Exposition; discussion and distribution of brochures, stickers, and magnets in the Denver area; and personal contact with landowners in Ouray County.

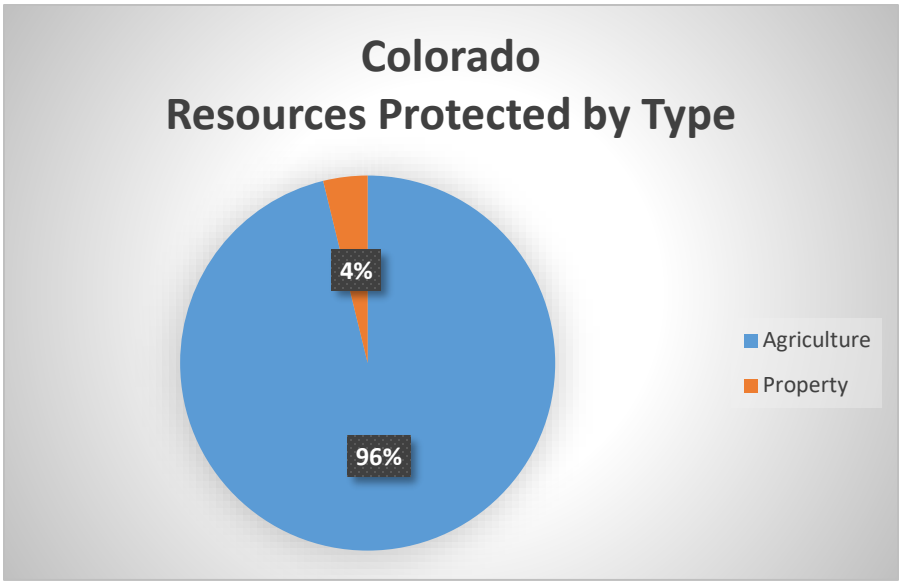
        - Trained and certified a WS employee to use unmanned aerial systems (UAS) as an additional surveillance tool.
    - 2018
        - Conducted surveillance for feral swine in Colorado via rotary-wing and fixed-wing aircraft, ATV, horses, trail cameras over bait stations, and outreach efforts in Baca, Bent, Crowley, Delta, Kiowa, Mesa, Otero, Prowers, and Pueblo Counties.
        - Provided outreach information on feral swine, and the feral swine elimination project in Alamosa, El Paso, Huerfano, and Pueblo Counties.
        - Meetings: On February 2, 2018, met with United States Forest Service personnel regarding feral swine surveillance on the Comanche and Cimarron National Grasslands in southeastern Colorado and southwestern Kansas.
        - Worked with Colorado Parks and Wildlife and Colorado Department of Agriculture to investigate reports of feral swine.
        - Investigated a credible report of feral swine in Delta County, Colorado. No feral swine have ever been documented in Delta County. The investigation included outreach and surveillance by foot and trail cameras. The investigation resulted in independent corroboration of the feral swine sightings, but no future sightings. No feral swine or signs of feral swine activity were documented during surveillance efforts by CPW and WS-Colorado.
        - Investigated a credible report of feral swine in Mesa County, Colorado. Feral swine had previously been documented in this area of Mesa County, which is near a former captive feral swine hunting facility. Feral swine reportedly escaped this facility. The facility has since been closed to feral swine hunting, and all feral swine were removed. No reports or sightings have been documented in several years. The 2018 investigation included outreach and surveillance, and is ongoing as of September 2018. Results are pending.

- Future directions and goals related to feral swine management over the next five years:
    - As of September 2018, intend to remove all known feral swine populations within the State of Colorado, and to investigate all credible reports of feral swine, as funding allows.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$33,000	$85,000	$186,000
2015	$68,000	$0	$85,000	$153,000
2016	$68,000	$0	$85,000	$153,000
2017	$68,000	$198,000	$85,000	$351,000
2018	$68,000	$141,243	$85,000	$294,243
Total	**$340,000**	**$339,243**	**$425,000**	**$1,137,243**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	11	2	0	0
Fixed-wing	3.3	0	0	36.2	82.4

- Major cooperators:
  - Colorado Department of Agriculture
  - Colorado Parks and Wildlife

Florida

- FY18 funding level: 5
- Point of Contact: State Director
    - Address: 2820 East University Avenue
    - City/State/Zip: Gainesville, Florida 32641
    - Phone: 352-377-5556

- State task force: Florida Hog Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Florida Department of Agriculture
        - Florida Fish and Wildlife Conservation Commission
        - Florida Department of Environmental Protection, Division of State Parks
        - USDA APHIS Veterinary Services
        - University of Florida

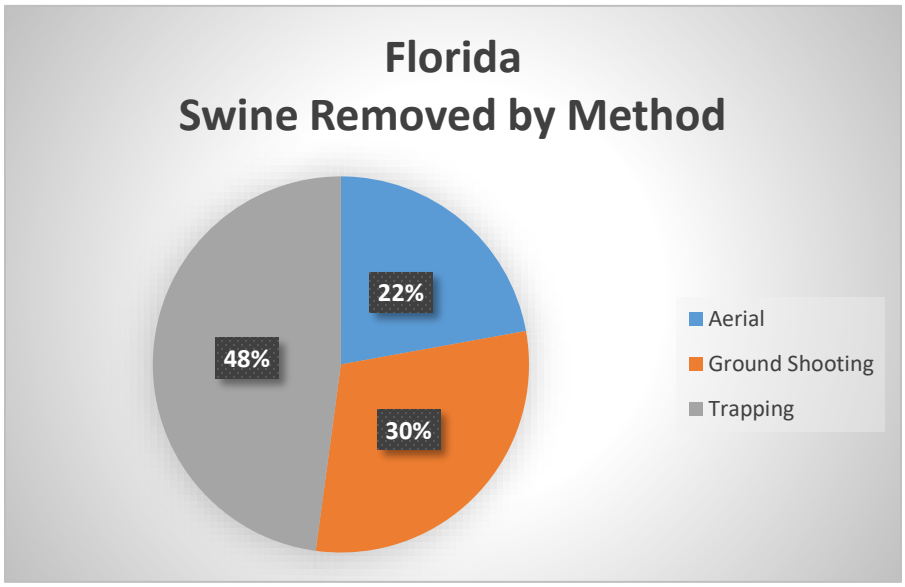
- Objectives:
    - Develop unified strategy on feral swine management activities between agencies.
    - Improve communication and working relationships between agencies involved.
    - Reduce feral swine damage as much as possible in key areas of the state.
    - Continue feral swine disease surveillance and report results.
    - Educate the public about feral swine damage methods, and diseases.
    - Continue to pursue program growth opportunities to expand areas of operation within the state.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Met with interested agencies and groups to discuss feral swine management with an attempt to develop a unified statewide management strategy.
        - Conducted pilot control projects and developed control strategies for the future.
    - 2015
        - Conducted aerial operations for the first time in Florida and removed feral swine from Avon Park Air Force Base and St. Vincent National NWR.
        - Secured special project funding to continue the elimination of feral swine from St. Vincent NWR and to begin operations on Cayo Costa State Park.
        - Cooperated with Florida Agricultural and Mechanical University (FAMU), as part of the 1890 Institutions partnership, to host multiple feral swine workshops for outreach to limited resource farmers, ranchers, and general property owners.
    - 2016
        - Secured special project funding and continued to aggressively implement the feral swine elimination projects on St. Vincent NWR and Cayo Costa State Park.
        - Expanded aerial feral swine operations in the state of Florida from federal lands to include some state owned lands.

- 2017
  - Continued to make progress and edge closer to our goal of complete elimination of feral swine from St. Vincent NWR and Cayo Costa State Park.
  - Expanded aerial feral swine removal opportunities with the addition of 127,712 acres throughout the state which includes two Florida Department of Environmental Protection (FLDEP) properties, one DOD installation, one private property, and one county property.
  - Signed three new feral swine damage management agreements, including Paynes Prairie Preserve State Park, Bexley Community Development District, and Royal Highlands Property Owner's Association.
  - Completed and signed the Florida Mammal Environmental Assessment which includes the aerial feral swine removal supplement.
  - Support of the National Feral Swine's initiative of reaching out to limited resource producers by participating in FAMU's feral swine workshops. Participated in three FAMU workshops and presented to approximately 60 participants.
- 2018
  - Successful completion and elimination of feral swine from our special project Cayo Costa State Park.
  - Continue to aggressively pursue the last few remaining feral swine on St. Vincent NWR to achieve our goal of complete elimination.
  - Successfully removed 558 feral swine during 55.6 operational flight hours from four state parks, two private ranches, one county property, one Nature Conservancy Property, one wildlife refuge, and one DOD installation.
  - Scheduled an additional aerial operation for September 2018 at multiple properties throughout the state.
  - Signed numerous new feral swine related agreements including Dunns Creek State Park, Lake Louisa State Park, Torreya State Park, Faver-Dykes State Park, Rookery Bay National Estuarine Research Reserve, and the Bexley Community.
  - Approval of an additional 80,000 acres opened to conduct feral swine removal operations at Avon Park AFB.
  - Hired of three additional FTE wildlife specialists to meet the demand of increasing feral swine opportunities arising throughout the state.
  - Continued to support the National Feral Swine's initiative of reaching out to limited resource producers by participating in FAMU's feral swine workshops. Presented to 40 participants at these workshops.
  - On track to reach our state's goal of collecting over 320 feral swine disease samples.

- Future directions and goals related to feral swine management over the next five years:
  - Continue to exchange information through the Florida Hog Working Group (FHWG) and enhance relationships with Florida agencies and non-governmental organizations (NGOs) throughout the state to help identify feral swine issues and potential collaborative projects.
  - Expand the aerial gunning program to include more private properties.
  - Hire multiple dedicated feral swine technicians stationed throughout the state to meet the increasing demand for our services.
  - Have all dedicated feral swine technicians equipped with the latest technologies in gear advancement to maximize efficiency and cooperator satisfaction.
  - Increase statewide feral swine take.

- Feral swine removed by method:



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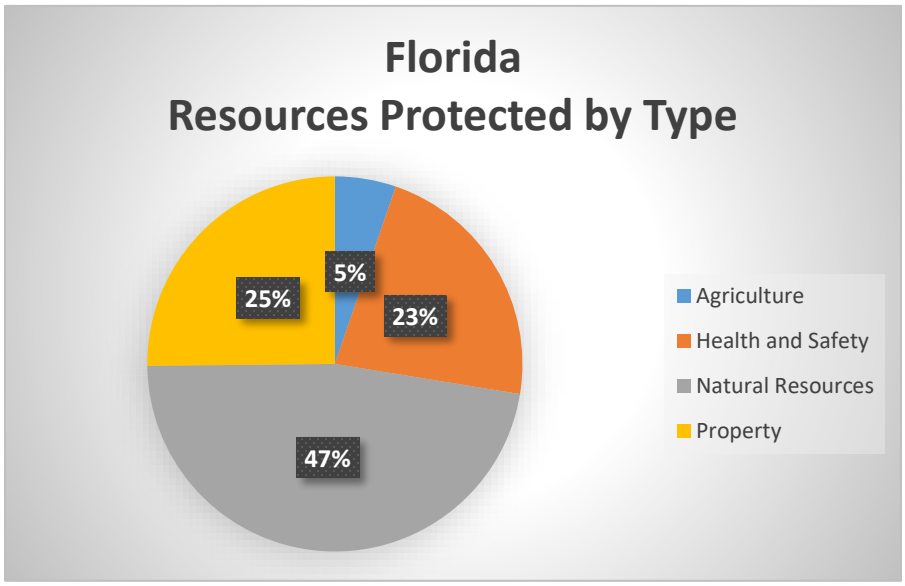


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$325,000	$75,000	$408,753	$808,753
2015	$325,000	$0	$615,000	$940,000
2016	$325,000	$75,000	$786,029	$1,186,029
2017	$334,750	$75,000	$837,483	$1,247,233
2018	$334,750	$172,000	$837,068	$1,343,818
Total	**$1,644,500**	**$397,000**	**$3,484,333**	**$5,525,833**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	21.6	68.9	109.2
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Florida Fish and Wildlife Conservation Commission
  - Florida Department of Agriculture and Consumer Services
  - Florida Department of Environmental Protection
  - U.S. Fish and Wildlife Service
  - Avon Park Air Force Base
  - Eglin Air Force Base
  - Cape Canaveral Air Force Station
  - Charlotte County
  - University of Florida
  - Florida Agricultural & Mechanical University

Georgia

- FY18 funding level: 4
- Point of Contact: State Director
    - Address: 200 Phoenix Road
    - City/State/Zip: Athens, GA 30605
    - Phone: 706-546-5637

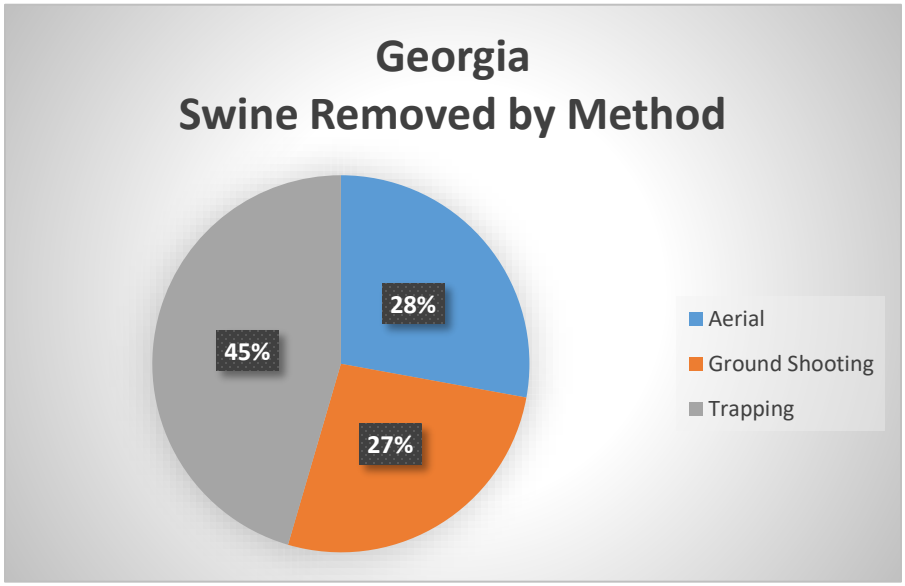
- State task force: Georgia Feral Swine Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - USDA APHIS Veterinary Services
        - Georgia Department of Agriculture
        - Georgia Department of Natural Resources (DNR), Wildlife Resources Division
        - Georgia DNR Law Enforcement Division
        - Southeastern Cooperative Wildlife Disease Study
        - Georgia Forestry Commission
        - National Park Service
        - University of Georgia
        - Local farm association
        - Joseph W. Jones Ecological Research Center
        - Private sector
        - Georgia Chapter of The Wildlife Society
        - Local game associations
        - Georgia Wildlife Federation
        - U.S. Forest Service
        - U.S. Fish and Wildlife Service
        - U.S. Army, Fort Benning
        - University of Georgia, Cooperative Extension Service
        - Georgia Soil and Water Commission
        - The Nature Conservancy, Georgia
        - Georgia College and State University

- Objectives:
    - To reduce feral swine populations through legislation, education, research, and control.
    - Working group parties agree to work cooperatively toward the goal of limiting the distribution and reducing the density of feral swine in Georgia and to eradicate localized populations wherever feasible.
    - The working group parties will come together to create and implement outreach tools to effectively disseminate information to the public, defining the problems associated with feral swine in Georgia and how the parties are working cooperatively to help landowners and other stakeholders combat the problems associated with feral swine.
    - The working group parties will work together to identify and pursue alternative funding

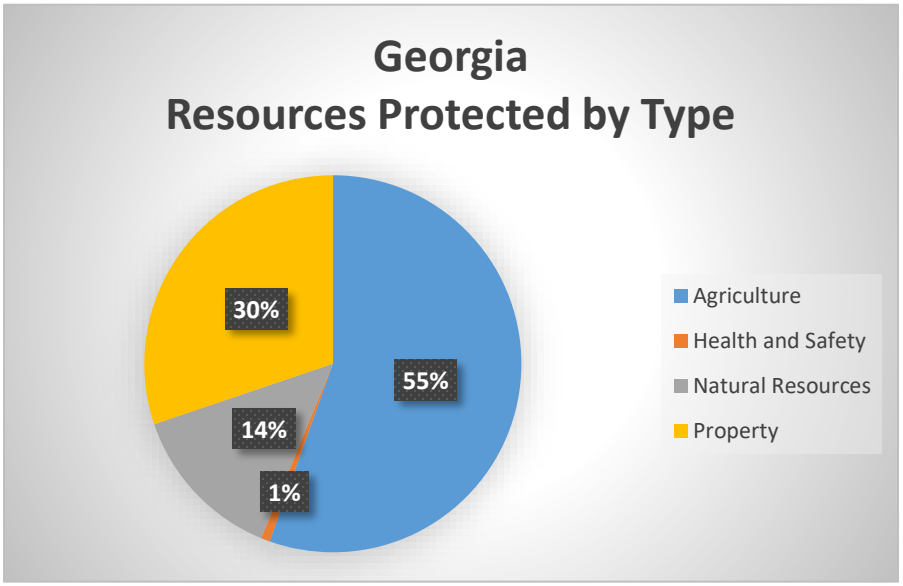
- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Purchased traps, drop nets, firearms, vehicles, and other equipment necessary for feral swine management.
        - Started a feral swine reduction/elimination project on Blackbeard Island NWR.
        - Conducted aerial feral swine removal operations for the first time in Georgia. Began coordinating with APHIS VS on a feral swine/dairy cattle *Brucella spp* project to monitor for *Brucella suis* in feral swine around dairy operations in the state.
    - 2015
        - Started a local project in Dooly County to intensely manage feral swine in a heavily agricultural county.
        - Conducted aerial feral swine removal operations for the first time in southern plantation habitat.
        - Established feral swine cost share program.
        - Continued an active role with the Feral Swine Working Group which contributed to new feral swine regulations being passed in FY15.
    - 2016
        - Expanded special project in Dooly County, very positive initial response.
        - Expanded cost share program and started working with a substantial private plantation in southern Georgia.
    - 2017
        - Advanced stakeholder collaboration and outreach: met with the Georgia Commissioner of Agriculture, the Georgia Department of Natural Resources Commissioner, the President of Georgia Farm Bureau, the Executive Director of the Georgia Association of Conservation Districts, and the USDA NRCS which led to five public outreach events with all stakeholders involved to share information on feral swine biology, diseases, and control to landowners, agriculture producers, and the public.
        - Established a relationship with a private barrier island and implemented a cost share cooperative service agreement as well as feral swine control measures to protect sea turtle nesting sites.
        - Conducted first aerial operations in agricultural habitat as part of the Dooly County Local Project.
        - Met with two Department of Defense (DOD) Army installations to discuss feral swine control assistance.
    - 2018
        - Signed CSAs to fund two, full-time feral swine technicians. Both positions were filled late in the fiscal year.
        - Conducted aerial operations for the first time on a state managed game area.
        - Conducted 11 outreach workshops/events on feral swine management and regulations.
        - Collaborated with several cooperators on the development and implementation of a special project in Webster County. The goal is to develop a cost share program with landowners and resource managers impacted by feral swine.
        - In our local project on St. Catherine's Island, we reduced sea turtle nest loss from feral swine from 60% to 0.
        - Expanded the Dooly County Local Project and now have approximately 80,000 acres signed up for aerial operations.

- Future directions and goals related to feral swine management over the next five years:
    - Continue to conduct outreach and educate Georgia residents on feral swine management and the services we can provide.
    - Continue our efforts to reduce, and possibly eliminate, feral swine on St. Catherine's Island for the protection of T&E species and historic archeological sites.
    - Assess our progress with our Dooly County Local Project and determine our best course of action moving forward.
    - Continue our leadership with the Georgia Feral Swine Working Group while encouraging our state partners to be proactive with feral swine management.
    - Seek areas/projects in the state where we can have a localized impact on damage and swine populations.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$295,000	$26,000	$4,000	$325,000
2015	$295,000	$26,000	$170,000	$491,000
2016	$295,000	$31,500	$50,000	$376,500
2017	$303,850	$135,500	$120,000	$559,350
2018	$303,850	$290,000	$186,000	$779,850
Total	**$1,492,700**	**$509,000**	**$530,000**	**$2,531,700**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	10.8	27.4	0	71.9	96.5
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Georgia Department of Agriculture
    - Georgia Department of Natural Resources, Wildlife Resources Division
    - University of Georgia
    - U.S. Army, Fort Benning
    - Local farm association

Guam

- FY18 funding level: Territory funding
- Point of Contact: State Director
    - Address: 233 Pangelinan Way
    - City/State/Zip: Barrigada, Guam 96913
    - Phone: 671-635-4440

- State task force: WS Guam Feral Swine Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Guam Invasive Species Council/Northern Soil District Representative
        - Guam Division of Aquatic Wildlife Resources
        - U.S. Fish and Wildlife Service
        - Guam Southern Soil and Water District
        - Guam Agriculture Development Service
        - Department of Defense, 36th Civil Engineer Squadron

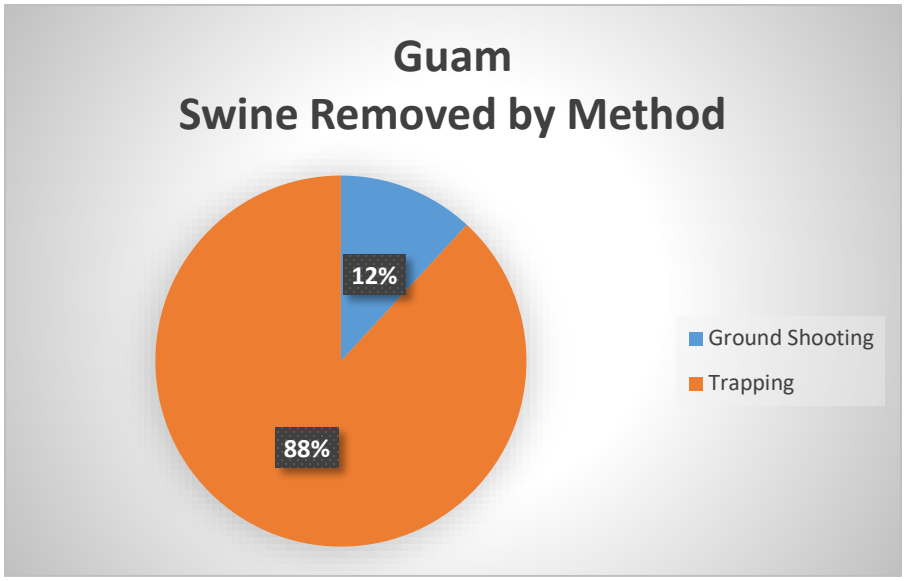
- Objectives:
    - Identify cooperators willing to partner in feral swine control efforts (public and private).
    - Reduce impacts of feral swine to agriculture and native ecosystems in Guam.
    - Manage/suppress/eradicate feral swine on Guam.
    - Spread awareness of the threats feral swine pose to human health and agriculture.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Continued feral swine control Interagency Agreements on Andersen Air Force Base and Naval Base Guam.
    - 2015
        - Initiated public awareness campaign.
        - Purchased improved equipment to support control efforts, including firearms and vehicles.
        - Developed network for future control efforts.
        - Implemented active control to compliment passive control.
        - Continued feral swine control Interagency Agreements on Andersen Air Force Base and Naval Base Guam.
    - 2016
        - Attendance of the Regional Feral Swine Training and the International Feral Swine Conference.
        - Met with local politicians to garner support for feral swine control efforts.
        - Continued feral swine control Interagency Agreements on Andersen Air Force Base and Naval Base Guam.
        - Started Outside the Fence Program in Cooperation with Guam University and Northern and Southern Soil and Water Districts.
    - 2017
        - Conducted five feral swine related outreach events with 1,430 attendees.
        - Partnered with the Andersen Air Force Base Feral Ungulate Program.

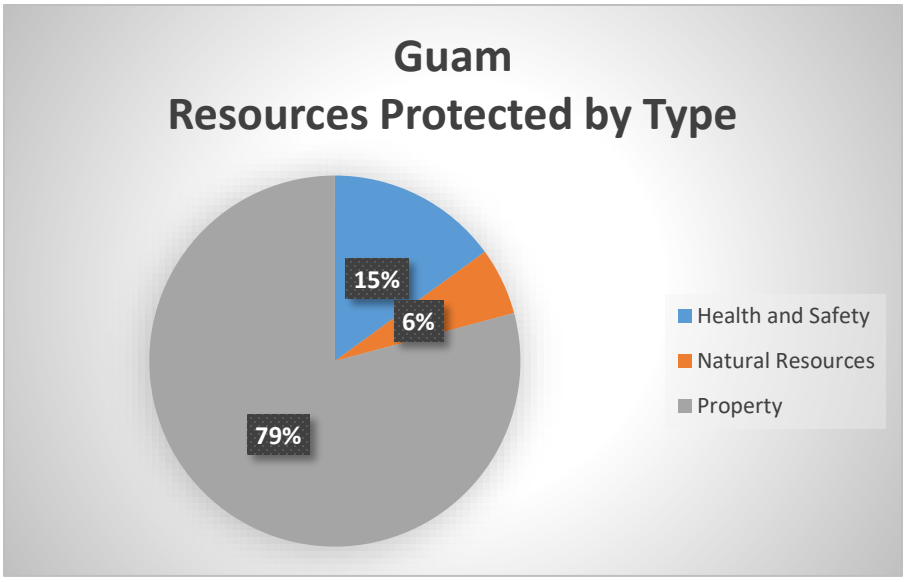
        - Signed new cooperative service agreements for feral swine control on private lands, including Northern Guam Soil and Water Conservation District, Southern Soil and Water Conversation District, Onward Golf Club.
        - Signed new agreement with the Air Force on Japanese encephalitis virus (JEV) surveillance.
        - Detected the presence of the virus that causes JEV in humans in the feral swine population on Guam (1st detection ever recorded on Guam in feral swine).
        - Continued feral swine control Interagency Agreements on Andersen Air Force Base.
        - Increased public outreach events by presenting at the Guam Invasive Species Council and other venues open to the public (fairs, schools, etc.).
    - 2018
        - Ordered state-of-the-art remotely activated feral swine traps from Jager Pro to increase efficiencies.
        - Continued feral swine control Interagency Agreements on Andersen Air Force Base.
        - Increased Cooperative Service Agreements two-fold for feral swine control on private lands, including Northern Guam Soil and Water Conservation District, Southern Soil and Water Conversation District, and Onward Golf Club.
        - Protected over 11,000 acres of government and private lands from feral swine damage on Guam.
        - Held initial meeting of Guam Feral Swine Task Force.
        - Met with NRCS to create MOU for partnership on swine surveys and WS removal efforts with appropriated funding and Soil districts in-kind contributions.

- Future directions and goals related to feral swine management over the next five years:
    - The immediate goal is to find more cooperators willing to partner with suppressing the feral swine population on Guam and other islands in the Commonwealth of the Northern Marianas (CNMI). Strategy is to educate the public about the threats feral swine pose to the population of Guam, especially in terms of zoonotic disease, which occur at rates much higher than on the U.S. mainland. As the public realizes the threat feral swine pose to the human population and the ecosystem we hope to create a public awareness and instill that the problem needs to be addressed. In addition, plans are cooperate with NRCS in feral swine removal activities. Preliminary meeting was held with NRCS to discuss possible collaboration in FY19 and beyond, not only on Guam but across the CNMI.
    - The Guam Invasive Species Council (GISC) was approached about future feral swine suppression projects. The GISC has expressed interest in funding our activities.

- Feral swine removed by method:



- Resources protected:



- Funding representation related to feral swine activities – both Wildlife Services and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$100,000	$0	$481,977	$581,977
2015	$100,000	$0	$547,824	$647,824
2016	$100,000	$0	$510,317	$610,317
2017	$125,000	$0	$298,165	$423,165
2018	$125,000	$0	$232,549	$357,549
Total	**$550,000**	**$0**	**$2,070,832**	**$2,620,832**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Department of Defense, United States Air Force
    - Northern Guam Soil and Water Conservation District
    - Southern Soil and Water Conversation District
    - Local golf club
    - USDA Natural Resources Conservation Service
    - U.S. Fish and Wildlife Service
    - University of Guam

Hawaii

- FY18 funding level: 3
- Point of Contact: State Director
    - Address: 3375 Koapaka Street, Suite H-420
    - City/State/Zip: Honolulu, HI 96819
    - Phone: 808-838-2841

- State task force: Hawaii Feral Swine Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - U.S. Fish and Wildlife Service
        - Hawaii Division of Land and Natural Resources, Division of Forestry and Wildlife
        - Waianae Mountains Watershed Partnership
        - Mauna Kea Watershed Alliance
        - USDA Natural Resource Conservation Service
        - The Nature Conservancy
        - National Park Service – Kalaupapa
        - Local farm association
        - East Maui Watershed Partnership

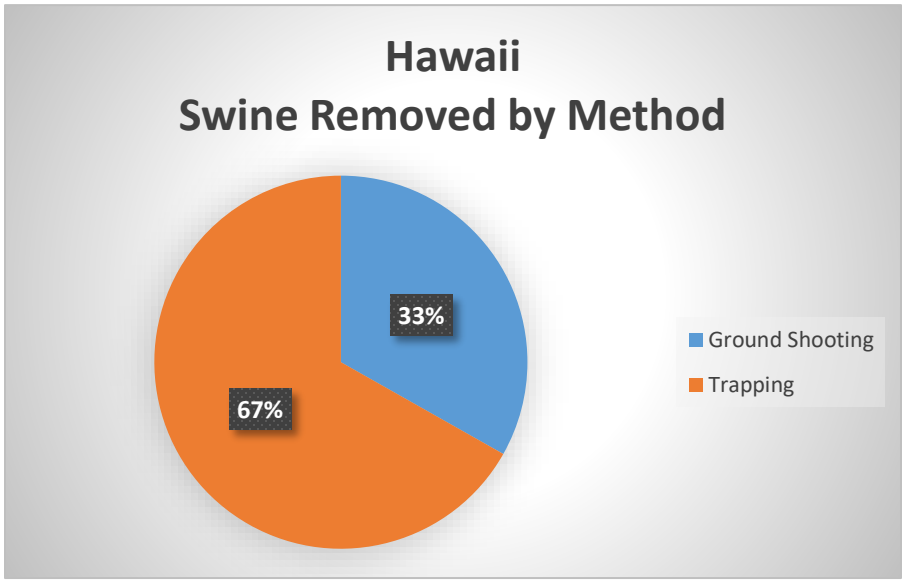
- Objectives:
    - Reduce feral swine damage and disease threat to the public.
    - Manage feral swine damage to natural resources for conservation concerns.
    - Reduce feral swine damage to agricultural resources.
    - Hire and appoint a Feral Swine Coordinator.
    - Measure and minimize feral swine impacts to resources and the public.
    - Conduct research on the efficacy of toxicants in Hawaii.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Reduced costs to agricultural cooperators and provided supervisory and management oversight to all agriculture protection cooperative service agreements where feral swine were the depredating species.
        - Purchased remote activated trap closures, built box traps, and replaced firearms to improve control efforts.
    - 2015
        - Purchased trail cameras for Na Pali Natural Area Reserve System on Kauai.
        - Purchased trapping equipment for Kanaio Natural Area Reserve System.
        - Provided feral swine control on numerous properties, including both state and private lands.
    - 2016
        - Increased feral swine work on the Island of Hawaii.
        - Entered into cost share with Grove Farm on the Island of Kauai.
        - Provided feral swine control at city and county of Honolulu Botanical Gardens.
        - Increased cooperator activities to include feral swine disease monitoring.
    - 2017
        - Expanded program by reaching out to small local farmers and providing them with removal activities.

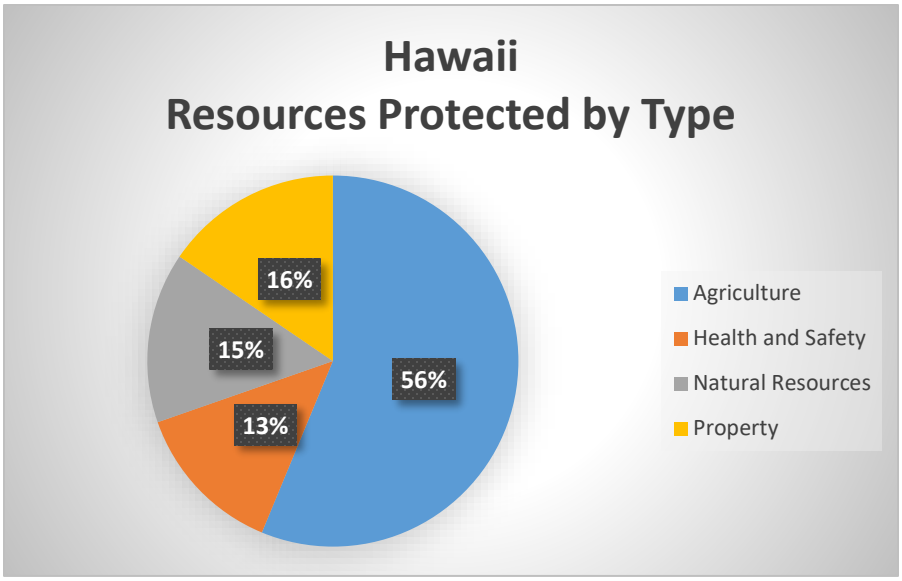
        - Continued feral swine management to reduce damage to current cooperators, and T&E species protection.
        - Continued sample collection for WS disease surveillance program on properties throughout the Island of Oahu and Hawaii.
    - 2018
        - Continued to expand services to small local farmers and received positive feedback.
        - Coordinated the purchase of multiple remote traps to be used or loaned out to other working group members for the removal of feral swine.
        - Expanded the use of FLIR which has proven to be a great monitoring device for feral swine night activities.
        - Expanded collaborative efforts with members of the Feral Swine Working Group.
        - Continued feral swine control for T&E species protection and agriculture.
        - Established a cost share agreement with the City and County of Honolulu for feral swine removal.

- Future directions and goals related to feral swine management over the next five years:
    - Conduct research on the efficacy of toxicants in Hawaii.
    - Increase outreach of the National Feral Swine Program.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$195,000	$0	$762,193	$957,193
2015	$195,000	$0	$513,702	$708,702
2016	$235,000	$0	$477,579	$712,579
2017	$242,050	$0	$666,799	$908,849
2018	$242,050	$0	$500,097	$742,147
Total	**$1,109,100**	**$0**	**$2,920,370**	**$4,029,470**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Hawaii Natural Areas Reserve System
  - U.S. Fish and Wildlife Service
  - National Park Service
  - Various Watershed Agencies
  - National Resource and Conservation Service
  - Local livestock association
  - Army Environmental

Idaho

- FY18 funding level: Eliminated
- Point of Contact: State Director
    - Address: 9134 W. Blackeagle Drive
    - City/State/Zip: Boise, ID 83709
    - Phone: 208-373-1630

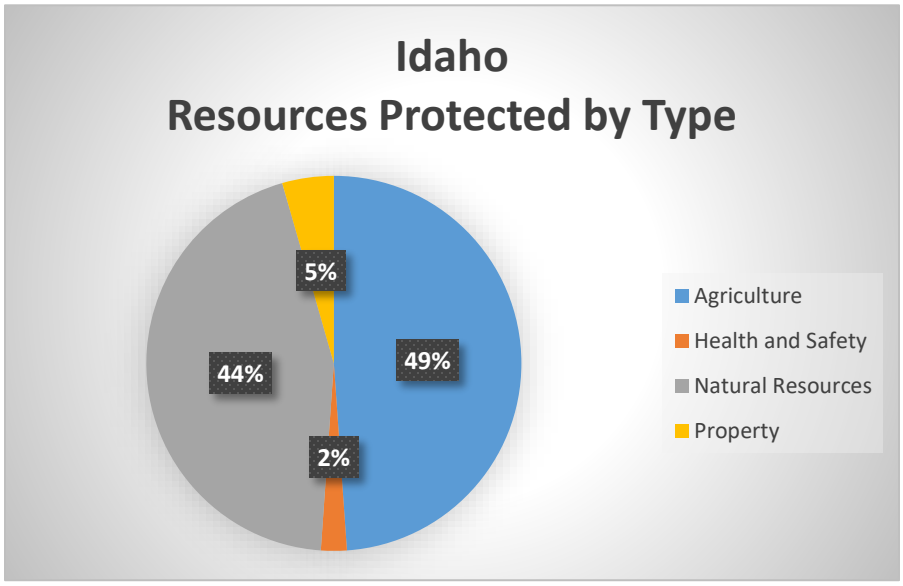
- State task force: Idaho Feral Swine Task Force
    - Member organizations:
        - Idaho State Department of Agriculture
        - Idaho State Department of Fish and Game
        - Local commodity association
        - Local farm association
        - USDA APHIS Wildlife Services
        - USDA APHIS Veterinary Services
        - Private livestock producer

- Objectives:
    - Eliminate feral swine in Idaho.
    - Provide timely response and investigation to all Idaho feral swine sightings reported to the Tri-State Swine Line (Washington, Oregon, Idaho).
    - Conduct ongoing site surveillance/monitoring in previously known locations of feral swine in Idaho.
    - Work with the Idaho State Department of Agriculture and Idaho State Department of Fish and Game concerning ongoing feral swine management in Idaho; reinitiate the Feral Swine Task Force for Idaho.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Utilized Idaho aviation resources to conduct surveillance for feral swine in previously known feral swine locations as well as a new location after the discovery of a feral swine carcass in eastern Idaho.
        - Incorporated Idaho feral swine activities/reporting into program information booths at state fairs and cooperator displays.
        - Investigated two new reports of feral swine in Idaho – no credible evidence observed of a free-ranging population.
        - Acquired equipment and new technologies to better conduct feral swine surveillance activities (thermal imaging equipment and remote sensing cameras).
    - 2015
        - No reports of feral swine in Idaho in 2015.
    - 2016
        - No feral swine sightings reported in years.
    - 2017
        - No feral swine sightings reported in years.
    - 2018
        - No feral swine sightings reported in years.

- Future directions and goals related to feral swine management over the next five years:
    - No return of feral swine populations to Idaho.

- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$0	$68,000
2015	$68,000	$0	$0	$68,000
2016	$42,000	$0	$0	$42,000
2017	$42,000	$0	$0	$42,000
2018	$0	$0	$0	$0
Total	**$220,000**	**$0**	**$0**	**$220,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	2	3.5	0	11	2.2
Fixed-wing	0	0	43.1	49	43.6

- Major cooperators:
    - Idaho Department of Agriculture
    - Idaho Department of Fish and Game
    - Local commodity association
    - U.S. Forest Service
    - U.S. Bureau of Land Management
    - Idaho Conservation League
    - Private landowners

Illinois

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: USDA WS, 3430 Constitution Dr., Suite 121
    - City/State/Zip: Springfield, IL 62711
    - Phone: 217-241-5726

- State task force: Illinois Collaborative Feral Swine Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Illinois Department of Natural Resources (IL DNR) and Law Enforcement
        - Illinois Department of Agriculture

- Objectives:
    - Elimination of self-sustaining and reproducing populations of feral swine from Illinois.
    - Protect wildlife and wildlife habitat from damage caused by feral swine.
    - Quickly detect and eliminate emerging populations of feral swine throughout Illinois.
    - Utilize new technology and research to aid in feral swine elimination efforts.
    - Establish baseline capacity to respond to conflicts with feral swine throughout the state.

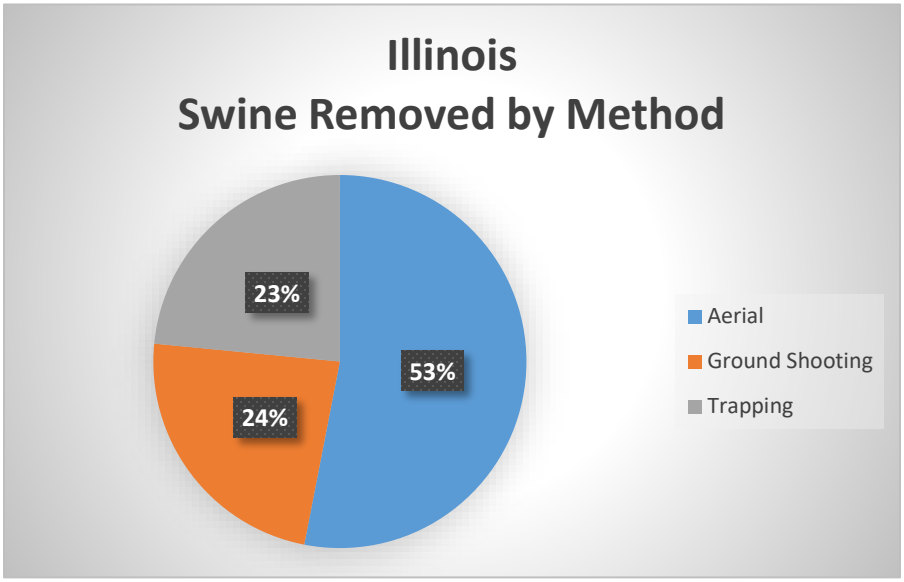
- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Successfully removed 90-95% of feral swine known to occur among the southern population which includes the adjoining counties of Fayette, Marion, Effingham, and Clay.
        - Successfully removed 95% of feral swine known to occur among the central population of Fulton County.
        - Initiated investigations of feral swine presence among secondary management areas/remainder of the state.
    - 2015
        - Initiated the Great Lakes Restoration Initiative (GLRI) Feral Swine Project and surveillance was conducted over thousands of acres of land bordering or near Lake Michigan which was searched for presence or absence of feral swine. A total of 36 preserves were searched across four counties, including 10,677 acres; no sign of feral swine was detected.
        - Conducted outreach activities throughout the state – 14 events were held totaling 416 participants and 1,422 leaflets and brochures were distributed.
    - 2016
        - Conducted 49 feral swine outreach activities throughout the state with 156 participants.
        - Successfully eliminated the last known feral swine from the primary management areas (Fayette, Marion, Effingham, Clay, and Fulton counties).
        - Assisted NWRC with feral swine research, including the use of aerial crop damage surveys to detect and assess feral swine damage and evaluating trail camera photos to detect a reduction in feral swine densities.

- 2017
  - Interviewed by a freelance writer from the Chicago Sun Times regarding the Feral Swine Damage Management Program and feral swine at Springbrook Prairie Forest Preserve.
  - Developed a newsletter article for the Illinois Farm Bureau concerning the IL Feral Swine Damage Management Program.
  - Collaborated with NWRC and the Michigan DNR to create a book chapter on the regional feral swine management efforts in IL.
  - Received IL hunter harvest and feral swine sighting data from the IL DNR in order to assist with locating potential feral swine in the state. A total of 43 reports of feral swine or suspected feral swine were received and investigated and technical assistance was provided for each report along with surveys and active searches conducted for some reports to verify damage or sightings. One new feral swine population was discovered in Pike County.
- 2018
  - Working cooperatively with the IL DNR since 2011 in efforts to eliminate feral swine from over 31,000 acres in Illinois in order to protect wildlife, wildlife habitat, agriculture, livestock and human health and safety. With the recent successful elimination of all known self-sustaining and reproducing populations within the state, surveillance and investigations have expanded throughout the remainder of IL. Completed feral swine surveillance of more than 2,000 acres of forest preserve properties near Lake Michigan during FY18. The detection and elimination of any new/emerging populations has become a top priority in order to prevent any future feral swine establishment. A total of 34 reports of feral swine throughout IL have been investigated thus far in FY18. Feral swine outreach efforts have also been conducted statewide including the IL State Fair, Agriculture Discovery, and University of Illinois Veterinary Medical students as part of their medical rotation.
  - Reports from the public and stakeholders led to the discovery of a potential emergent feral swine population in Pike County, located in the west central portion of the state in 2016. Since November 2016, working with numerous stakeholders in this area to coordinate a response once all stakeholders were in agreement. This potential new population is the result of a landowner/livestock producer, who has as many as 200 free ranging pigs on his 500-acre property with poor to non-existent fencing. Multiple neighboring landowners to this farm have sustained damage to agricultural crops and property in recent years in excess of $64,000 as a result to these loose swine. Multiple sightings of these swine by the public/hunters have been reported as far away as five miles from the source. Technical assistance has been provided to numerous landowners in the area, execution of Form 12As for feral swine elimination on nearly 3,000 acres of private land, conducting surveillance for feral swine near the source population, and actively baiting and monitoring feral swine movements near the source population with trail cameras at several properties.
  - Upon request by the state, a significant amount of time and effort has been invested assisting the Pike County State Attorney with developing language for a plea deal with the offending domestic swine producer. The State Attorney requested attendance at an arraignment where the producer plead guilty to chronic neglect of a fence that could lead to the establishment of a feral swine population. While the domestic swine producer has been released on probation, numerous meetings were coordinated with the IL DNR, County Sheriff, Probation Office, and State's attorney.

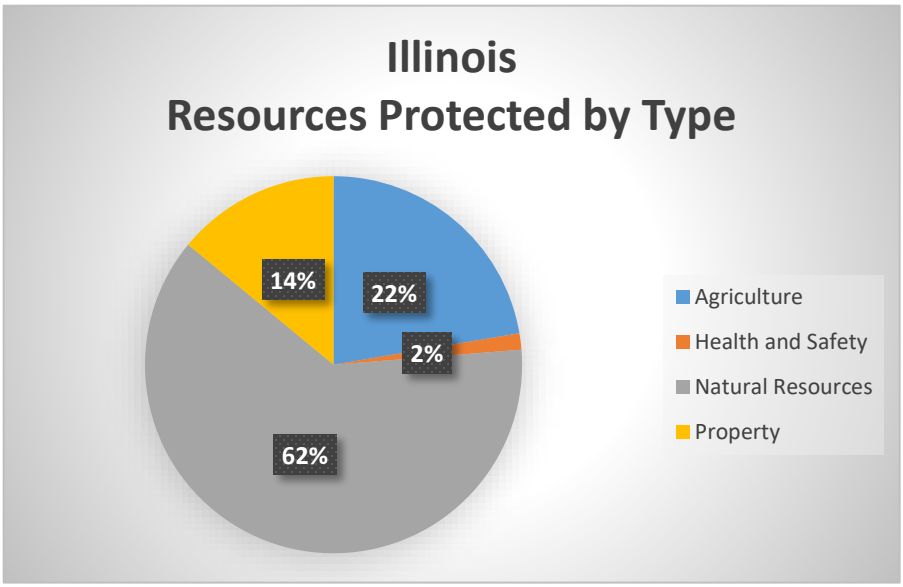
At the request of the Probation Officer, four probation inspection visits were made to document compliance with the producer's terms of probation (and violation thereof) and the population of feral swine. The State Attorney recently issued a Petition to revoke the swine producer's probation and the livestock producer was subsequently arrested; a new court date is set for July 2018. The lengthy legal process which has been implemented to eliminate the source of the feral swine population in Pike County has delayed some of our anticipated efforts to eliminate the population of feral swine. Significant time and fiscal resources have been invested supporting the legal efforts of our partners. Significant information on the distribution of feral swine in the region around the domestic swine producers and signed 12A agreements have been acquired in order to begin region-wide elimination efforts once the judicial system has addressed the source population.

- Future directions and goals related to feral swine management over the next five years:
    - Short Term/FY19 Goals:
        - Continue to garner landowner support and signed WS Work Identification Documentation Form 12As to allow elimination of feral swine from private and public land in Pike County.
        - Gain additional information on the distribution and density of feral swine within Pike County.
        - Continue to support legal efforts of the Pike County State Attorney & the IL DNR in eliminating the source of free-roaming 'domestic' swine in Pike County. IL Assistance will only be provided at the request of the Pike County State's Attorney & the IL DNR.
        - Eliminate over half of the known feral swine population from private and publically owned land in Pike County.
    - Long Term Goals:
        - Eliminate all feral swine from private and publically owned land in Pike County, IL.
        - Monitor private and publically owned land in Pike County after feral swine elimination to document if elimination efforts were successful.
        - Move the feral swine classification of Illinois to a 'Detection Status' once elimination efforts are demonstrated to have been successful.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$165,000	$100,000	$312,703	$577,703
2015	$68,000	$190,000	$79,000	$337,000
2016	$68,000	$0	$9,800	$77,800
2017	$68,000	$0	$9,800	$77,800
2018	$68,000	$50,000	$9,800	$127,800
Total	**$437,000**	**$340,000**	**$421,103**	**$1,198,103**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	44.7	28.9	27.6	23.7	22.3
Fixed-wing	29.9	28.9	0	0	0

- Major cooperators:
  - Illinois Department of Natural Resources
  - EPA-Great Lakes Restoration Initiative
  - Illinois Department of Agriculture
  - Local farm association
  - Pike County Soil and Water Conservation District
  - USDA Farm Service Agency
  - Pike County State Attorney

Indiana

- FY18 funding level: 2
- Point of Contact: State Director
    - Address: 901 W. State Street
    - City/State/Zip: West Lafayette, IN 47907
    - Phone: 765-494-6229

- State task force: Indiana Wild Pig Task Force
    - Member organizations:
        - Indiana State Board of Animal Health
        - USDA Natural Resources Conservation Service
        - USDA APHIS Veterinary Services
        - USDA APHIS Wildlife Services
        - Indiana Department of Natural Resources, Law Enforcement Division
        - Indiana Department of Natural Resources, Division of Fish and Wildlife
        - Purdue University
        - Local commodity association

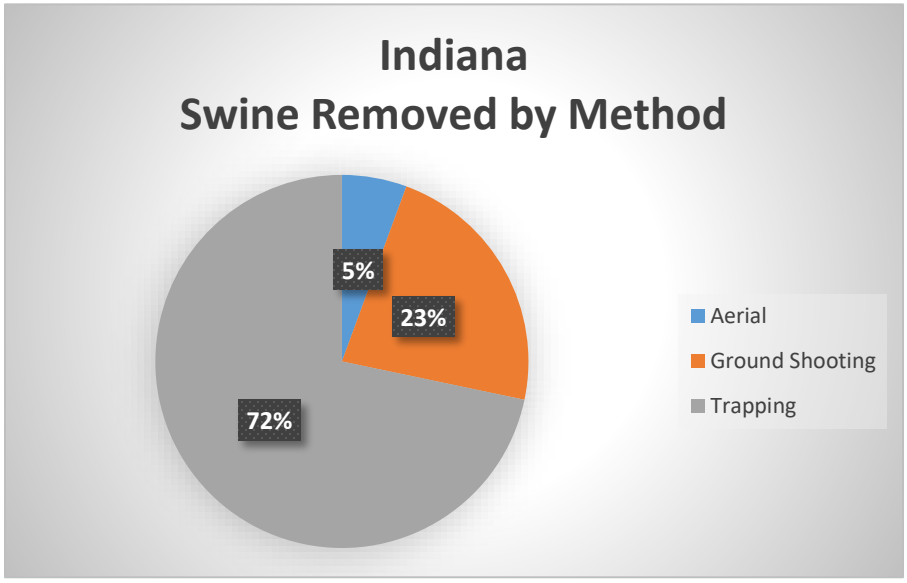
- Objectives:
    - Create cooperative partnerships in an effort to reach Wild Pig Elimination Project goals and objectives.
    - Continue to explore new avenues for delivering outreach materials and activities to educate the public about and their associated damage and disease threats.
    - Develop coordinated feral swine reporting systems between agencies.
    - Identify the best uses of resources to tackle identified goals.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Established a website and toll-free hotline for reporting feral swine sightings.
        - Continued to gain work initiation agreements and perform monitoring and removal.
    - 2015
        - Conducted first year of aerial operations.
        - Signed-up significant landowners for control activities.
        - Developed publication materials.
        - Developed statewide Wild Pig Management Plan.
    - 2016
        - Judas pig project initiated (nine GPS collars and one ear tag).
        - Completed and verified surveillance flight for late summer crop damage.
        - Experimented with the use of wireless cameras and wireless trap devices.
    - 2017
        - Completed 2nd feral swine crop damage surveillance flight and 3rd aerial removal flight.
        - Collared three Judas pigs to aid in determining location of other sounders.
        - Distributed educational material to Agriculture Extension offices throughout Indiana to increase awareness of feral swine damages and the importance of reporting sightings.
        - Attended and distributed educational material at county fairs, and various conservation meetings to increase the awareness, identify landowners experiencing

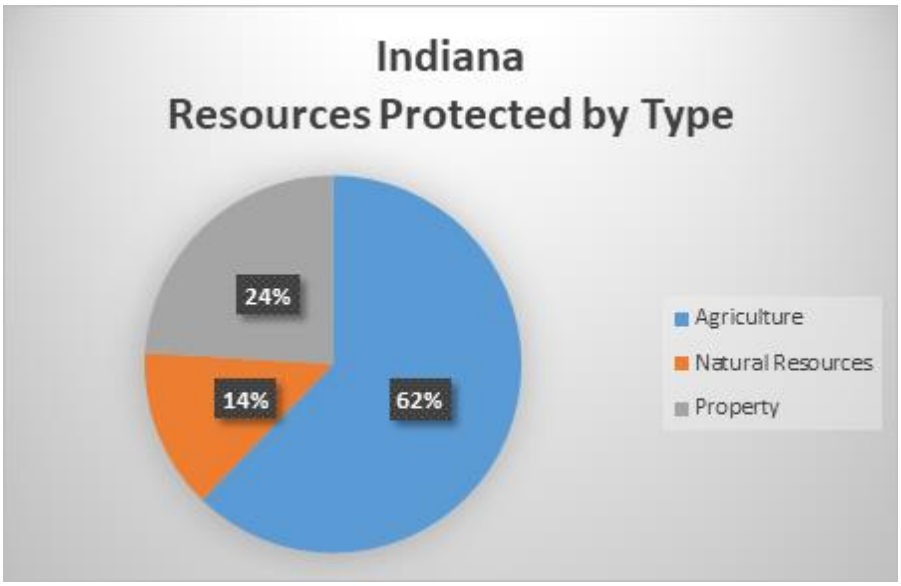
damage, and enhance communication of feral swine damage to natural resources and identify locations with damage, respectively.
        - Developed a new cooperator tracking system to manage contacting efforts.
    - 2018
        - Signed up an additional 4,700 acres for monitoring and control activities.
        - Developed an Elimination Plan and secured Elimination Funds for FY19.
        - Continued research efforts with NWRC to develop new methods for detecting feral swine in Indiana landscapes.
        - Conducted annual damage surveillance and aerial shooting flights.
        - Broadened grassroots efforts by continuing to educate general public at county fairs, conservation events, new employee orientation (partner agencies), and guest lecturing to colleges and extension workshops.
        - Continued to refine and tweak trapping techniques for trap-shy pigs.
        - Investigated reports of feral swine in historic ranges that were believed to have died out. No conclusive findings.

- Future directions and goals related to feral swine management over the next five years:
    - Implement newly developed elimination plan with target of removing all accessible feral swine within three to five years.
    - Work with partners to gain access into pig refuges where currently lacking permission to access.
    - Continue to strengthen relationships with partner agencies to broaden the education of feral swine threats to landowners.
    - Continue to work with researchers to develop and fine-tune tools and methods that aid in monitoring and removing feral swine.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$165,000	$50,000	$1,200	$216,200
2015	$165,000	$0	$1,200	$166,200
2016	$165,000	$32,000	$1,200	$198,000
2017	$165,000	$98,000	$1,200	$264,200
2018	$165,000	$100,000	$1,200	$266,200
Total	**$825,000**	**$280,000**	**$6,000**	**$1,111,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	22.9	0	6	23.8
Fixed-wing	0	19.6	0	0	0

- Major cooperators:
  - Indiana Department of Natural Resources
  - Indiana Board of Animal Health
  - Indiana State Department of Health
  - Purdue University
  - Local farm association
  - USDA APHIS Veterinary Services
  - USDA Natural Resources Conservation Service
  - Local commodity association
  - Indiana Invasive Species Council

Iowa

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 1714 Commerce Court, Suite C
    - City/State/Zip: Columbia, MO 65202
    - Phone: 573-449-3033

- State task force: Iowa Feral Swine Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Iowa Department of Natural Resources
        - Iowa Department of Agriculture and Land Stewardship
        - USDA APHIS Veterinary Services
        - USDA Investigative and Enforcement Services
        - Iowa State Forestry Extension
        - Iowa State University
        - Iowa Department of Public Health

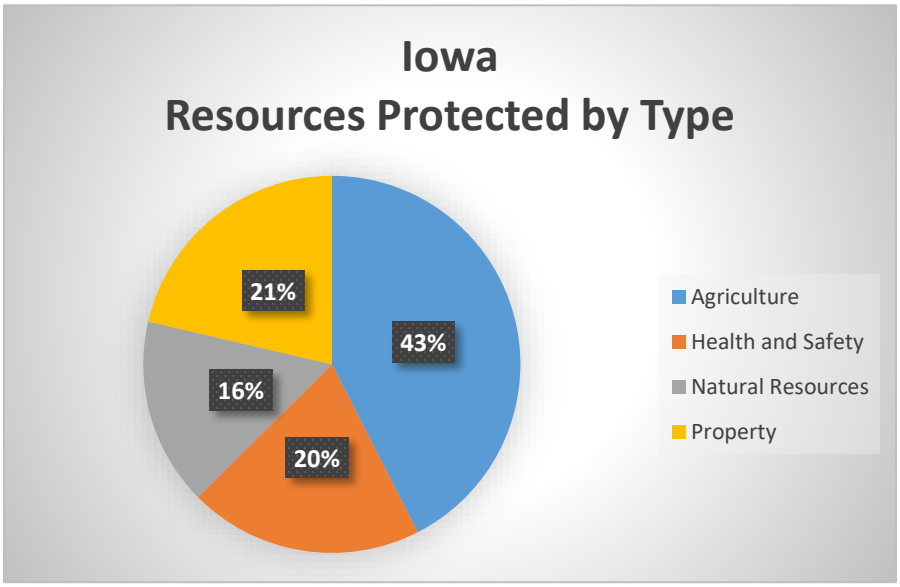
- Objectives:
    - Statewide eradication: maintain and increase a system that quickly and efficiently identifies feral swine and responds quickly (e.g., early detection, rapid response).
    - Disease surveillance: protection of Iowa's multi-billion dollar domestic swine industries from diseases associated with feral swine by testing all feral swine removed within the state.
    - Declare areas free of feral swine: investigate past locations with feral swine activity to determine if there may be remnant feral swine populations or if they have truly been eradicated.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Identified populations of free-ranging swine and assisted the DNR with released feral swine on DNR managed property in eastern Iowa.
        - Participated in outreach and education events.
    - 2015
        - Conducted outreach via public radio broadcast, newspaper and trade magazines, a civic conservation group, and Bass Pro's fall hunting classic.
        - Maintained steady monitoring of an area that has historically been a "hotspot" for feral swine coming into the state from Missouri – a combination of the use of trail cameras and cooperation between the Missouri Department of Conservation and Iowa Department of Natural Resources yielded no reports in the problem area.
    - 2016
        - Conducted outreach to a variety of different audiences, including the World Pork Expo, Iowa Deer Classic, and Iowa Pork Congress as well as many landowners.
        - Investigated all reports of feral swine in the state within 24 hours of being notified.
    - 2017
        - Investigated all feral swine reports (25) in the state within 24 hours of being notified.
        - Took over as leader of the Iowa Feral Swine Task Force and hosted a meeting to discuss agency roles, disease surveillance, and declaring areas free of feral swine.

- 2018
  - Responded to a report of seven feral swine. Collected disease surveillance samples and genetic samples. First brucellosis positive feral swine sample in the state. Assisted in investigation by IES – determined that these were escaped heritage breed hogs. Assisted Iowa Department of Agriculture and Land Stewardship (IDALS) and National Veterinary Services Laboratories (NVSL) in testing archived samples for confirmation – further testing concluded negative for brucellosis.
  - Coordinated with IDOT in developing a notification system for when domestic swine are released along Iowa roadways. WS now receives notifications as releases occur, and follow-up to ensure no swine remain at large.
  - One WS Iowa employee completed a one-week feral swine job detail in Missouri. The Missouri WS state program had a project that required an increased effort, and this opportunity was used to train personnel and gain experience in feral swine eradication methods.
  - Continued outreach and investigations of all reports of feral swine in the state within 24 hours.
  - Conducted site visits to areas of past feral swine sightings/management to verify no current activity.

- Future directions and goals related to feral swine management over the next five years:
  - Provide outreach to educate the public of the damages caused by feral swine and ways to identify feral swine activity.
  - Prevent new populations of feral swine by investigating all reports of swine (either escaped domestic or feral), and removing swine as quickly as possible.
  - Monitor areas of past swine activity to ensure no swine remain on the landscape (ensure elimination).
  - Disease surveillance: protection of Iowa's multi-billion dollar domestic swine industries from diseases associated with feral swine by testing all feral swine removed within the state.

- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$32,000	$0	$100,000
2015	$68,000	$28,000	$0	$96,000
2016	$68,000	$15,000	$0	$83,000
2017	$68,000	$15,000	$0	$83,000
2018	$68,000	$0	$0	$68,000
Total	**$340,000**	**$90,000**	**$0**	**$430,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Iowa Department of Natural Resources
    - Iowa Department of Agriculture and Land Stewardship
    - Local commodity association
    - USDA APHIS Veterinary Services
    - Iowa State Forestry Extension
    - USDA APHIS Investigative and Enforcement Services
    - Iowa State University
    - Iowa Department of Transportation – Enforcement
    - Iowa Department of Public Health

Kansas

- FY18 funding level: 2
- Point of Contact: State Director
    - Address: 4070 Stagg Hill Road
    - City/State/Zip: Manhattan, KS 66502
    - Phone: 785-537-6855

- State task force: Kansas Feral Swine Working Group
    - Member organizations:
        - Kansas Department of Agriculture
        - Local commodity association
        - Kansas Department of Wildlife Parks and Tourism
        - USDA APHIS Wildlife Services

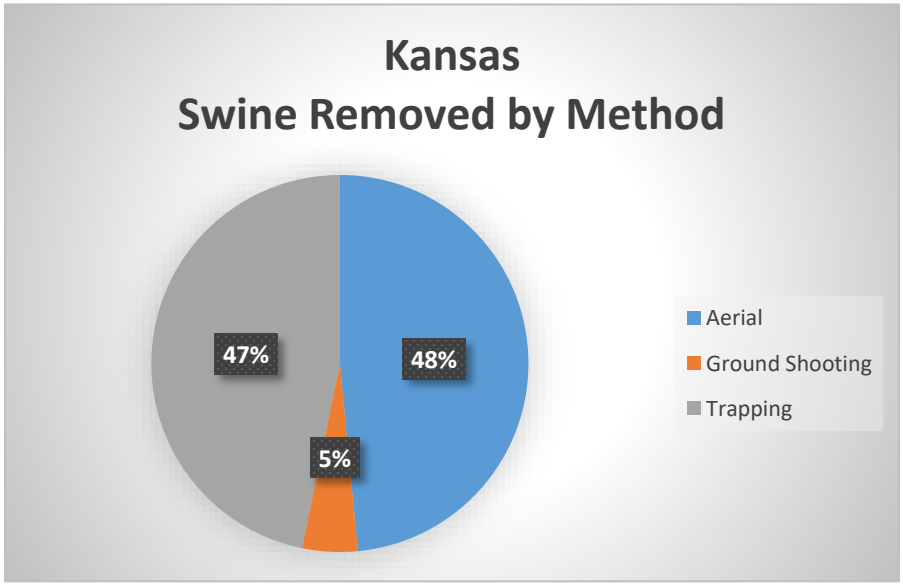
- Objectives:
    - Elimination of feral swine from Kansas.
    - Continue to develop and adopt new management strategies and techniques to assist with the elimination of Kansas' only endemic feral swine population in Bourbon and Linn counties.
    - Expand state border feral swine cooperation and control efforts, proactively preventing expansion and establishment of any new feral swine populations in Kansas.
    - Reduce damage caused by feral swine until extirpation has been achieved.
    - Work closely with bordering states (Colorado, Missouri, and Oklahoma) to ensure early detection of feral swine movement across/near state borders is occurring.
    - Continue to monitor feral swine for disease threats to livestock, humans, and wildlife.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Expanded the area jointly worked with the WS Oklahoma program.
        - Expanded aerial removal hours as well as the cooperating area.
    - 2015
        - Expanded border efforts with WS Oklahoma and Missouri.
        - Increased the number of cooperators in Kansas along the Oklahoma state line.
        - Worked with the Noble Foundation to develop the "Boar Buster" trap.
    - 2016
        - Continued to expand state border feral swine control efforts with cooperation from Missouri and Oklahoma WS programs.
        - Expanded control efforts in Chautauqua, Cowley, and Montgomery counties by increasing the number of cooperators along the Oklahoma border.
        - Reduced feral swine numbers in Chautauqua County to state border maintenance levels.
    - 2017
        - Increased landowner cooperation in Bourbon and Linn counties and established a better rapport in the area to gain access to additional acreage for management.
        - Reduced feral swine populations in south-central Kansas to maintenance levels and expanded cooperation and control efforts.
        - Investigated three reports of possible new feral swine populations.
        - No additional/new feral swine populations were allowed to establish in the state.

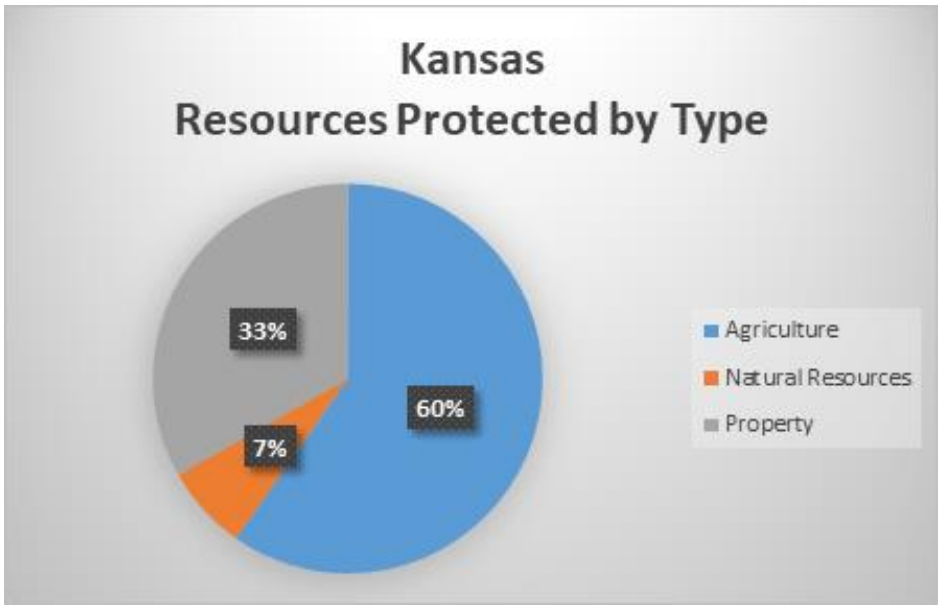
        - Created a Feral Swine Management Zone (FSMZ) in Chautauqua, Cowley, and Montgomery counties.
    - 2018
        - Expanded the FSMZ from 100 miles to 140 miles.
        - Enforced a population management buffer along the KS/OK border for 60 miles (this was an expansion from 30 miles at the inception of project 2016).
        - Detected and removed a new feral swine population in Labette County due to surveillance in the FSMZ.
        - Deployed two GPS collars in Chautauqua County to observe home ranges of FS in Southern Kansas.
        - Went over 125,000 cooperative acres in the FSMZ since its inception.
        - Added approximately 5,000 cooperator acres in Bourbon and Linn counties.
        - Conducted multiple public outreach events with in the FSMZ to increase landowner awareness and educated the public about feral swine management in Kansas.
        - Utilized new wireless technology to increase trapping success.
        - Allowed no additional/new feral swine populations to establish in the state.
        - Significantly reduced the feral swine population in the southern portion of the endemic area Bourbon County.

- Future directions and goals related to feral swine management over the next five years:
    - Continue to develop and adopt new management strategies and techniques to assist with the elimination of feral swine in Kansas.
    - Continue to expand state border feral swine cooperation and control efforts, proactively preventing expansion and establishment of any new feral swine populations in Kansas.
    - Work closely with bordering states (Colorado, Missouri, and Oklahoma) to ensure early detection of feral swine movement across/near state borders is occurring.
    - Continue to reduce the geographic footprint of the Bourbon/Linn County feral swine population.
    - Monitor feral swine for disease threats to livestock, humans, and wildlife.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$165,000	$80,000	$175,000	$420,000
2015	$165,000	$78,000	$175,000	$418,000
2016	$165,000	$81,000	$175,000	$421,000
2017	$165,000	$81,000	$175,000	$421,000
2018	$165,000	$80,000	$175,000	$420,000
Total	**$825,000**	**$400,000**	**$875,000**	**$2,100,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	21.3	70.2	58.1	27.1	56.3
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Kansas Department of Agriculture
  - Local commodity association
  - Kansas Wildlife and Parks
  - U.S. Army Corps of Engineers
  - Private land cooperators

Kentucky

- FY18 funding level: 3
- Point of Contact: State Director
    - Address: 537 Myatt Drive
    - City/State/Zip: Madison, TN 37115
    - Phone: 615-736-5506

- State task force: Kentucky Wild Pig Task Force
    - Member organizations:
        - University of Kentucky, Cooperative Wildlife Extension Service
        - U.S. Forest Service
        - Kentucky Department of Fish and Wildlife Resources
        - USDA APHIS Wildlife Services
        - Kentucky State Nature Preserves
        - Local farm association
        - Kentucky Department of Agriculture
        - USDA APHIS Veterinary Services

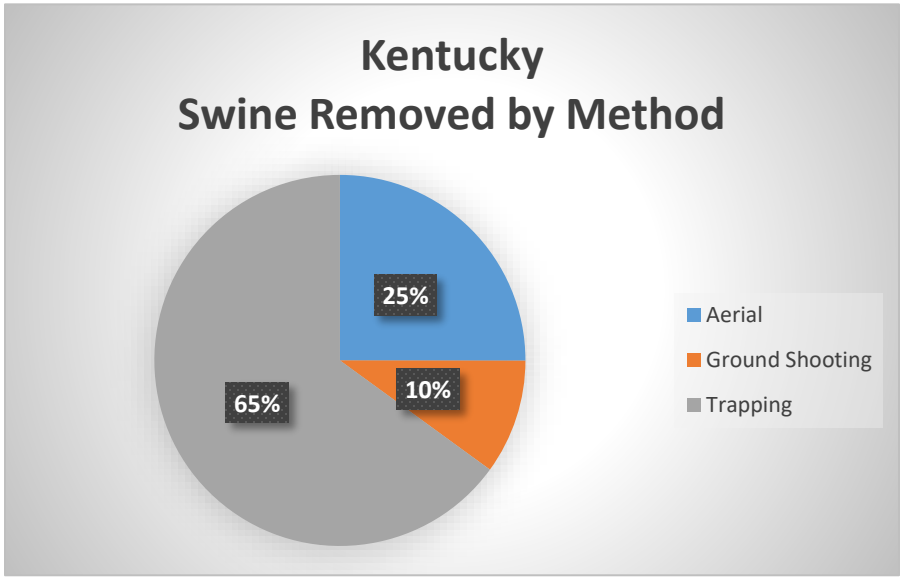
- Objectives:
    - To proactively address feral swine populations by creating and implementing a statewide management plan, which includes coalition building, education efforts, regulation and legislation, population monitoring and reduction, and disease surveillance to reduce or eliminate current populations and to promote appropriate enforceable legislation and regulation in order to prevent future introduction of feral swine.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Initiated coalition building and outreach efforts.
        - Initiated disease surveillance, population reduction, and distribution/frequency mapping efforts.
    - 2015
        - Nearly eliminated the Hickman County and Obion Creek Corridor feral swine populations.
        - Initiated and completed several surveillance operations that yielded new population data on several new populations of feral swine throughout the state.
    - 2016
        - Collaborated with Kentucky Department Fish and Wildlife Resources (KDFWR) and population reduction in Henry County.
        - Completed outreach efforts on the Tennessee/Kentucky/Virginia border including postcard mailings to 63,068 residents along the Tennessee border.
        - Completed aerial damage surveys and population estimates on approximately 1.9 million acres along the Tennessee/Kentucky/Virginia border.
    - 2017
        - Made major progress in elimination efforts in Henry County with regards to identifying additional populations and population reduction efforts. Tremendous progress made in securing additional private landowner support made possible from extended continued outreach efforts, population reduction success, and collaboration with KDFWR.

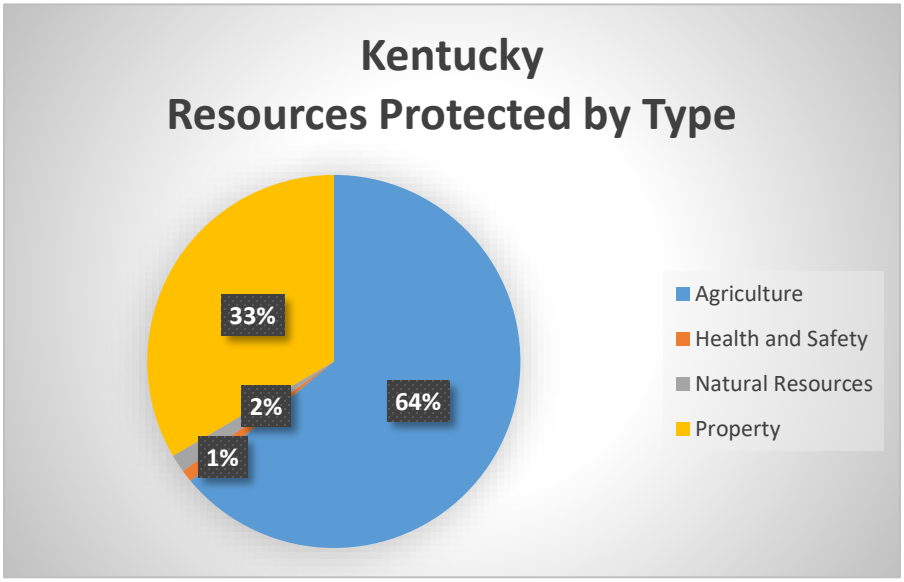
        - Successfully cleared and maintained approximately 20,000 acres of Obion Creek Corridor, and Hickman County elimination areas.
        - Completed numerous aerial surveys of the Tri-State Elimination area confirming reduced damages and reduced feral swine numbers.
        - Hosted six feral swine damage management workshops in collaboration with KDFWR focusing on landowner trapping efforts and feral swine sign identification; also conducted 255 outreach projects that provided technical assistance to 894 participants.
        - Made major progress in elimination efforts in Henry County with regards to identifying additional populations and population reduction efforts.
    - 2018
        - Captured and affixed a tracking collar on a mature male feral swine.
        - Assisted KDFWR with the testing and implementing of a new mobile app for tracking feral swine sightings and control activities.
        - Reduced the population of feral swine in Henry and Owen counties by an estimated 70%.
        - Re-initiated the Kentucky Wild Pig Task Force.
        - Re-engaged Fort Campbell Army Base.

- Future directions and goals related to feral swine management over the next five years:
    - Eradicate feral swine on land between the national recreational areas.
    - Eradicate feral swine on Fort Campbell Army Base.
    - Eradicate feral swine from Lyon, Trigg, Henry, and Owens counties.
    - Complete countywide aerial surveys for the entire state.
    - Continue to implement the Kentucky County feral swine protocol, in an effort to eradicate feral swine from all counties within the state.
    - Increase aerial operations in support of the Kentucky County feral swine protocol.

- Feral swine removed by method:



- Resources protected:



- Funding representation related to feral swine activities – both Wildlife Services and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$235,000	$40,000	$32,938	$307,938
2015	$235,000	$24,000	$20,000	$279,000
2016	$235,000	$119,997	$17,000	$371,997
2017	$242,050	$90,000	$19,500	$351,550
2018	$242,050	$114,837	$17,000	$373,887
Total	**$1,189,100**	**$388,834**	**$106,438**	**$1,684,372**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	11.3	21.1	28	13.6	23.3
Fixed-wing	5.7	6.8	2.6	10.1	0

- Major cooperators:
  - Kentucky Department of Fish and Wildlife Resources
  - Kentucky State Nature Preserves
  - Local farm association
  - University of Kentucky Cooperative Extension
  - U.S. Forest Service
  - U.S. Fish and Wildlife Service

Louisiana

- FY18 funding level: 4
- Point of Contact: State Director
    - Address: PO Box 589
    - City/State/Zip: Port Allen, LA 70767
    - Phone: 225-389-0229

- State task force: Feral Hog Management Advisory Task Force
    - Member organizations:
        - Louisiana Department of Wildlife and Fisheries
        - Louisiana Department of Agriculture and Forestry
        - Local landowner association
        - Local game associations
        - Louisiana State University Agricultural Center
        - Louisiana Association of Professional Biologists/Louisiana Chapter of The Wildlife Society
        - Local farm association
        - Association of Levee Boards of Louisiana
        - Wildlife Research Institute

- Objectives:
    - HLS 16RS-618: The task force is hereby charged with the responsibility to make recommendations with respect to issues pertaining to feral hog management efforts, including public awareness programs, to the various state agencies charged with responsibility for managing the feral hogs in this state, including the Department of Wildlife and Fisheries, the Department of Agriculture and Forestry, and the legislature. The task force shall consider hunter-based solutions and shall gather input from various stakeholder groups.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Conducted follow-up surveys and discussions with stakeholders to determine success of projects in terms of pre and post-operation estimates of feral swine numbers.
        - Provided no-cost helicopter assistance to coastal landowners to begin to establish the long-term framework for feral swine management across the coastal zone; entered into several cooperative agreements with others for helicopter and ground work.
        - Participated in workshops for stakeholders, and attended interagency feral swine meetings and conferences dealing with feral swine issues. Delivered talks to stakeholders about issues, damage, methods, and proposals.
        - Provided technical assistance to citizens reporting feral swine issues, including private, corporate, and public land managers, as well as the levee board in Orleans and Jefferson Parishes.
        - Worked with several corporate coastal land managers who have interests in feral swine projects in south Louisiana, including Continental Land and Fur Company and Apache Minerals.

- Participated in NWRC feral swine development projects that will be conducted in Louisiana (e.g., alligator nest predation study). Provided funding for two state projects, which began and have provided useful information. The feral swine survey for Terrebonne was extended into 2015.

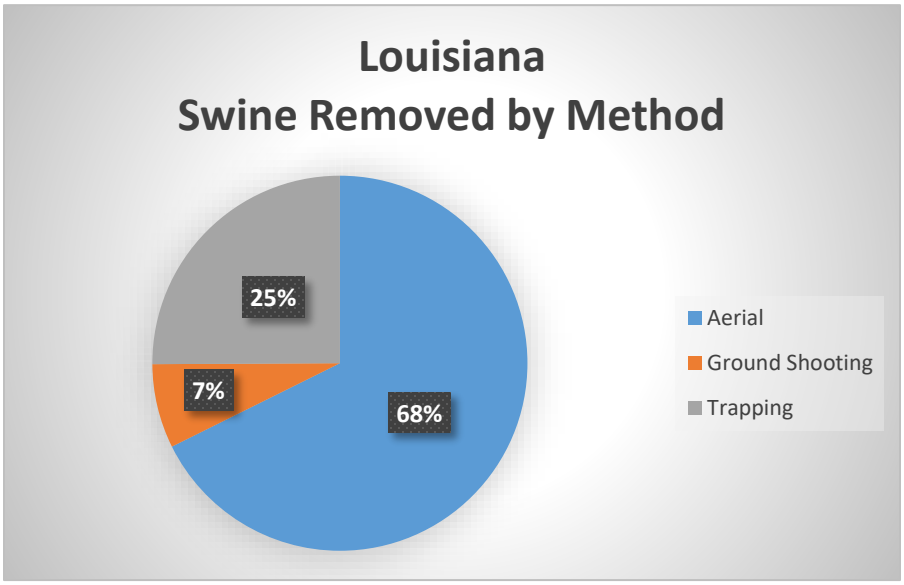
- 2015
  - Continued to educate landowners and other stakeholders about feral swine issues, resulting in an increase in acres available for feral swine control activities, including aerial removal.
  - Participated in over 20 meetings and workshops to provide information and recommendations to private individuals and public entities about feral swine control.
  - Participated in feral swine field projects (range and habitat mapping, GPS collaring, alligator nest predation, food habits and stomach contents) with Louisiana Department of Wildlife and Fisheries (LDWF) and University of Louisiana Monroe.
  - Expanded cooperative partnerships with LDWF, Louisiana Department of Agriculture and Forestry, SWCA Environmental Consultants, Air Force bases, and others to increase control efforts statewide.
- 2016
  - Increased property acreage worked on in Louisiana by approximately 60%; this represents a total of nearly 25% land available for access to feral swine work within the state.
  - Expanded cooperative partnerships with Soil and Water Conservation Districts, other Federal Agencies, and numerous state and local government entities.
- 2017
  - Increased acreage of properties available for feral swine control, including pilot projects in Cameron Parish and the Red River Valley; renewed old agreements and established new agreements with stakeholders.
  - Reported decreases in damage to coastal marsh and alligator nests in southwest Louisiana for the Cameron Parish pilot project. Reported decreases in damage to other agricultural resources in central Louisiana pilot project properties. Significantly reduced feral swine numbers in several locations.
  - Conducted/participated in ten feral swine workshops and gave presentations at four professional meetings. Attended numerous meetings with stakeholders. Met with several new landowners in pilot project work areas in order to increase employee work area.
  - Assisted researchers at NWRC, LDWF, and University of Louisiana Monroe to collect samples, monitor telemetry collars, as well as discuss research needs and new information.
  - Worked with the Louisiana Coastal Wetland Planning and Protection Act program to develop logistic and funding strategies for a coast-wide feral swine control program.
  - Expanded and intensified pilot control programs in Cameron and Natchitoches/Red River Parishes.
- 2018
  - Continued to increase acreage of property where feral swine control activities can be conducted. In 2018, this acreage increased to 728,045, from the 2017 total of 639,417.
  - A cooperating corporate landowner in Cameron Parish, reported no losses of alligator nests on their properties for the first time in four years. Four years ago, 10% of examined nests sustained feral swine damage. This decline is the result of intensified feral swine management using trapping, ground shooting and aerial gunning on a large contiguous block of federal, Parish, and private property. Similar trends are

being seen on work areas in the Red River Valley, between Shreveport and Natchitoches.

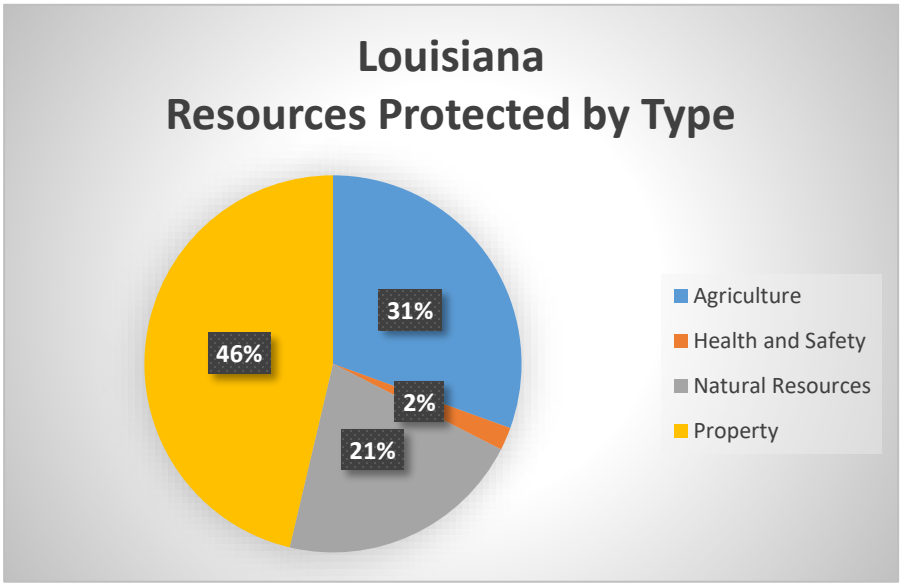
- Continued to provide workshops as needed and distributed educational materials to stakeholders.
- Continued to support work related to using drones in damage assessments. Worked with investigators at the NWRC and the LDWF to collect data in support of feral swine investigations. Have made commitment to assist ULM researches with a follow-up study of coastal marsh damage by feral swine in southern coastal Louisiana.
- Hired a new feral swine technician to provide support to farmers and citizens in south Central Louisiana. Have requested permission to hire two more individuals for a similar project in Northeast Louisiana.
- Continued to forge new relationships with stakeholders, and maintained existing working relationships.

- Future directions and goals related to feral swine management over the next five years:
  - Explore new operational projects with other federal and state agencies and try to increase number of cooperative agreements with other federal and state agencies, such as the Park Service and various state parks.
  - Maintain existing large-scale projects in order to maintain gains realized since the program began and use successes as examples for possible future endeavors with stakeholders.
  - In light of possible new direction if the Farm Bill is passed, reinforce relationships with our federal and state partners to make activities as efficient as possible. Increase hiring and equipping new employees for new project areas.
  - Pursue increased use of UAS's to assess damage and support damage control operations.
  - Continue participating in stakeholder meetings.
  - Expand availability of traps to stakeholders.
  - Continue to reduce damage in pilot areas.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$295,000	$52,500	$223,218	$570,718
2015	$295,000	$168,000	$193,116	$656,116
2016	$295,000	$135,567	$200,780	$631,347
2017	$303,850	$145,267	$288,613	$737,730
2018	$303,850	$252,291	$301,002	$857,143
Total	**$1,492,700**	**$753,625**	**$1,206,729**	**$3,453,054**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	107.1	116.2	200.6	141.6	580
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Louisiana Department of Wildlife and Fisheries
  - U.S. Fish and Wildlife Service
  - U.S. Forest Service – Kisatchie National Forest
  - USDA National Resource Conservation Service
  - Louisiana Department of Agriculture and Forestry
  - Louisiana Office of State Parks
  - Natchitoches Parish Soil and Water Conservation District
  - Red River Soil and Water Conservation District
  - Boeuf River Soil and Water Conservation District
  - Private and corporate landowners
  - University of Louisiana at Monroe
  - Ouachita Parish Government
  - National Park Service

- U.S. Geological Survey
- U.S. Coast Guard
- National Wildlife Federation
- U.S. Navy
- Woodlands Conservancy
- Audubon Species Survival Center
- Various cities, including Monroe and West Monroe

Maine

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 79 Leighton Road, Suite 12
    - City/State/Zip: Augusta, ME 04330
    - Phone: 207-629-5181

- State task force: Maine Feral Swine Working Group
    - Member organizations:
        - Maine Department of Inland Fisheries and Wildlife
        - Maine Department of Inland Fisheries and Wildlife/Landowner Relations and Maine Warden Service
        - Maine Department of Agriculture, Conservation, and Forestry
        - USDA APHIS Veterinary Services
        - USDA APHIS Wildlife Services

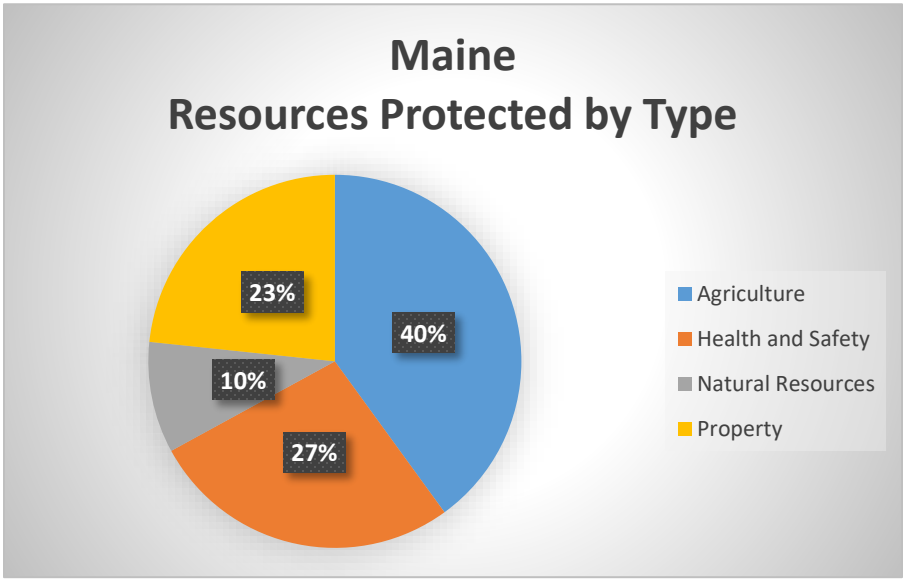
- Objectives:
    - Share information on feral swine.
    - Stay current and consistent on feral swine response.
    - Outreach and surveillance of feral swine.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Created Memorandums of Understanding with state agencies.
        - Created standard operating procedures with the Feral Swine Working Group.
        - Identified, mapped, and monitored reports of feral swine.
    - 2015
        - Presented about feral swine awareness at Maine's Animal Control Officers (ACO's) annual meeting.
        - Collected samples from feral swine brought into the state in coordination with the state veterinarian and USDA VS.
    - 2016
        - Conducted surveillance for pigs released on the island, near all reported sighting areas, farms, and high fence hunt parks.
        - Provided feral swine outreach information to municipalities and animal control officers throughout Maine.
        - Completed feral swine database and uploaded all sightings from 2012.
    - 2017
        - Conducted outreach to improve reporting of feral swine sightings: distributed 3,077 leaflets, 250 dashboard calendars, and networked with more than 600 participants.
        - Investigated nine sightings of pigs throughout Maine which required contacting landowners, setting cameras, determining if pigs are domestic or feral, and working on each case with local law enforcement, animal control officers, Maine Department of Agriculture, Conservation, and Forestry, and Maine Department of Inland Fisheries and Wildlife.

- 2018
    - Until the draft MOU is finalized, a protocol was prepared in cooperation with the MDACF, MDIFW, and ACO's Animal Welfare on triggering events that determine when WS should be deployed to conduct direct control activities. WS will work on all projects where an owner can't be identified to remove pigs. When an owner is identified, WS will not conduct direct control activities and an ACO will be notified.
    - Participated as a guest in an inspection by MDACF at a large game shooting area (LGSA) to understand how pig hunts are managed.
    - Initiated an effort to enhance surveillance, outreach, and education through the creation of employee specific zones. Within these zones, employees are responsible for outreach and education to numerous high priority outlets including but not limited to Maine IFW regional staff and game wardens, ACOs, police departments, and municipalities. A total of 190 networking contacts were made, 300 leaflets were distributed, and three major presentations were completed.
    - Investigated seven sightings of pigs throughout Maine, which required contacting landowners, setting cameras, determining if pigs are domestic or feral, and working on each case with local law enforcement, ACOs Maine Department of Agriculture, Conservation, and Forestry, and Maine Department of Inland Fisheries and Wildlife.
        - Of these sightings, WS is currently conducting game camera surveillance around the property of a swine breeder who supplies purebred and hybrid Eurasian swine to LGSAs. This breeder's swine routinely escape their enclosure causing concern amongst state agencies and locals. WS learned about this breeder through networking activities in the spring of 2018.

- Future directions and goals related to feral swine management over the next five years:
    - Continue to participate in quarterly Feral Swine Working Group meetings as well as actively respond to requests for assistance.
    - Continue networking throughout the state as it has been determined that networking efforts have influenced prompter reporting by individuals who observe swine in the wild.
    - Conduct surveillance and deploy traps where feral swine are determined to exist.
    - Research all swine calls to determine whether or not the animal is an escaped domestic or one without ownership. Swine without owners will be captured and removed.

- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$0	$68,000
2015	$68,000	$0	$0	$68,000
2016	$68,000	$0	$0	$68,000
2017	$68,000	$0	$0	$68,000
2018	$68,000	$0	$0	$68,000
Total	**$340,000**	**$0**	**$0**	**$340,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Maine Department of Agriculture Conservation and Forestry
    - Animal Welfare Department
  - Maine Department of Inland Fisheries and Wildlife
  - Maine Animal Control Officers' Association

Maryland

- FY18 funding level: Detection phase
- Point of Contact: State Director
    - Address: 1568 Whitehall Road
    - City/State/Zip: Annapolis, MD 21401
    - Phone: 410-349-8055

- State task force: Maryland Feral Swine Task Force
    - Member organizations:
        - Maryland Department of Agriculture
        - USDA APHIS Veterinary Services
        - USDA APHIS Wildlife Services
        - Maryland Department of Natural Resources
        - Delaware Natural Resources and Environmental Conservation

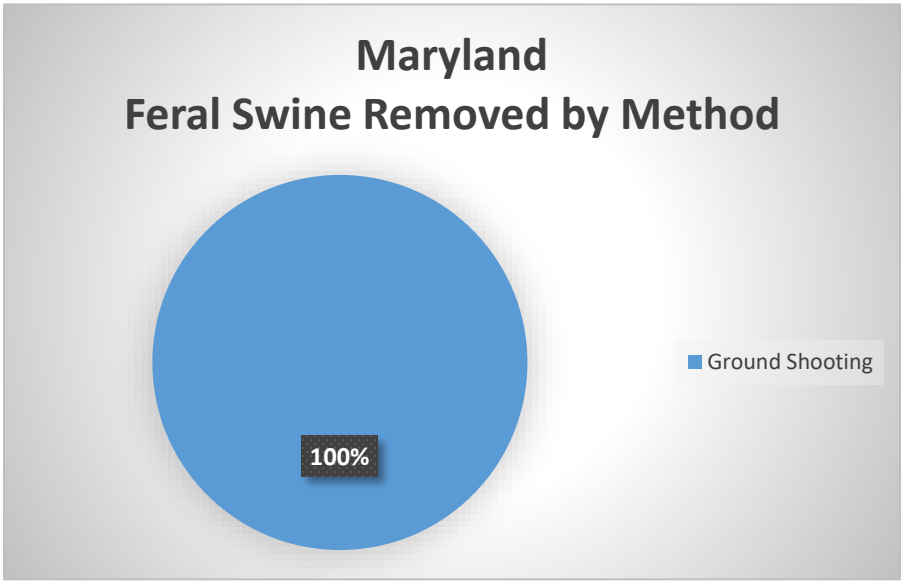
- Objectives:
    - To continue outreach and advise individuals to report any feral swine sightings to the Maryland Department of Agriculture (MDA), Maryland Department of Natural Resources (MDNR), or WS.
    - To provide outreach materials to deer processors and advise them to contact the MDA MDNR, or WS if anyone brings in swine shot in the state.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Escaped swine that were possibly reproducing out of captivity were reported. The owner of the swine captured 30-40 animals and moved them from Taylor's Island in Dorchester County to Goldsboro in Caroline County. Dr. Mike Radebaugh, from the MDA confirmed the swine were in captivity. Six adult and juvenile swine that were left behind and not in captivity were removed. WS and FWS investigated swine sightings off Taylor's Island on Blackwater NWR. Numerous camera survey stations were set up and the presence of one large boar was confirmed. This boar has not been seen since September 2014 and may no longer persist. Over 12 landowners in Dorchester County agreed to allow access to survey for swine. WS worked closely with APHIS Veterinary Services and MDA to ensure all necessary samples are taken and submitted. In this case, no samples were submitted for these swine as they were determined to be escapees or transitional pigs. Additionally, MDA collected blood from the approximately 40 animals captured and put back in captivity.
    - 2015
        - Continued to follow-up on all swine sighting calls, no credible evidence of feral swine in Maryland.
    - 2016
        - MDNR provided WS outreach material to all deer processors to advise WS if anyone was aware of any feral swine, dead or alive.
    - 2017
        - Shipped two road kill swine samples to the NWRC to be DNA tested and gain information on their origin.
        - Delivered metal signs with feral swine information to all deer processors along the Pennsylvania/Maryland border.

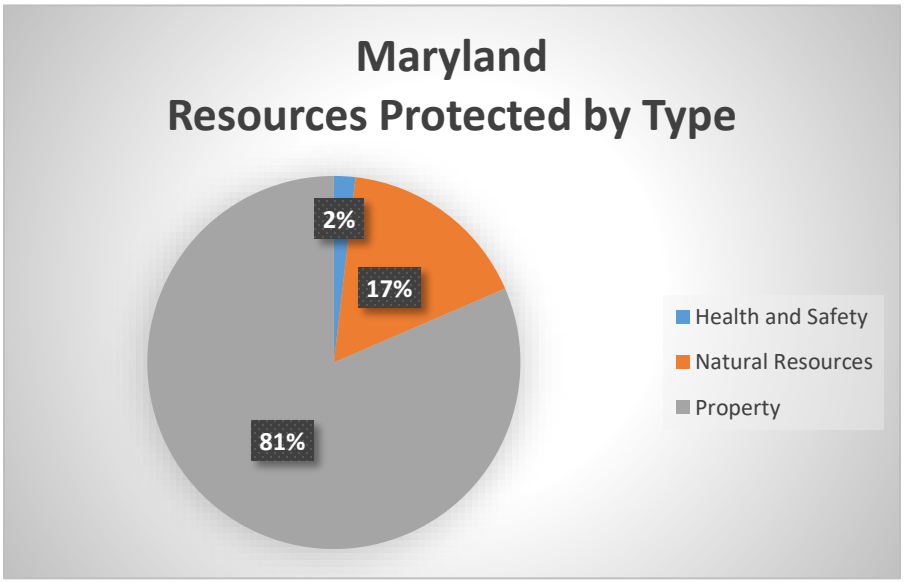
        - Continued monitoring for feral swine statewide through partners and reports from the public.
    - 2018
        - Completed surveillance, no credible signs of swine.
        - Attended monthly animal health meetings with MDA, DNR, and VS.

- Future directions and goals related to feral swine management over the next five years:
    - No longer be part of the feral swine program in 2019 as there is no feral swine in the state.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$0	$0	$0	$0
2015	$68,000	$0	$0	$68,000
2016	$42,000	$0	$0	$42,000
2017	$42,000	$0	$0	$42,000
2018	$42,000	$0	$0	$42,000
Total	**$194,000**	**$0**	**$0**	**$194,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Maryland Department of Agriculture
    - Maryland Department of Natural Resources
    - U.S. Fish and Wildlife Service
    - USDA APHIS Veterinary Services

Michigan

- FY18 funding level: 2
- Point of Contact: State Director
    - Address: 2803 Jolly Road, Suite 100
    - City/State/Zip: Okemos, MI 48864
    - Phone: 517-336-1928

- State task force: Michigan Feral Swine Working Group
    - Member organizations:
        - Michigan Department of Natural Resources
        - Michigan Department of Agricultural and Rural Development
        - Michigan United Conservation Clubs
        - Michigan State University
        - USDA APHIS Wildlife Services
        - Local commodity association

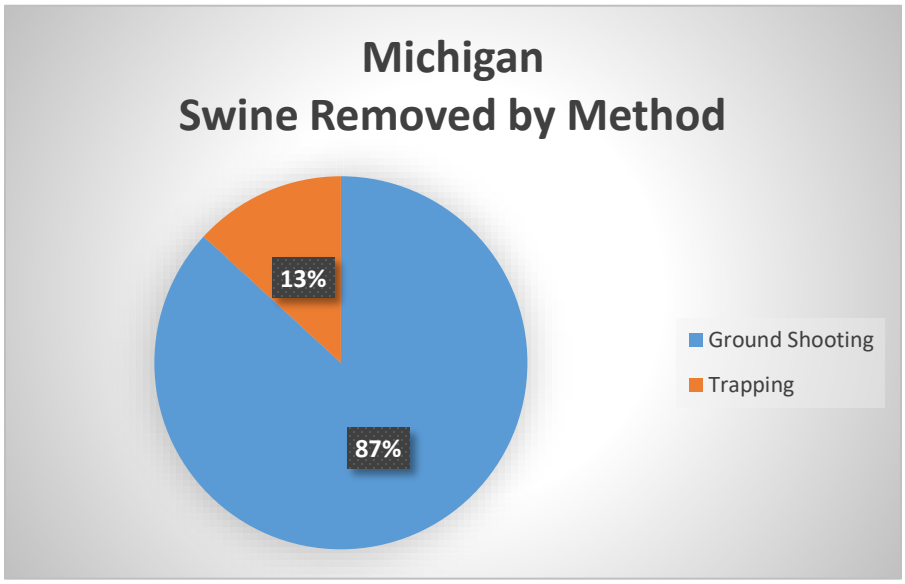
- Objectives:
    - Proceed with the USDA Wildlife Services Feral Swine Elimination Plan for Michigan, finalized in FY17.
    - Disseminate information of feral swine activity to group members.
    - Identify priorities in removing feral swine in Michigan.
    - Identify feral swine research priorities.
    - Locate and collar or remove "Eurasian type" and all other feral swine.
    - Finalize protocol to survey the Lower Peninsula and continue to investigate all feral swine reports.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Investigated feral swine reports throughout the state and entered verified reports into the WS database.
        - Assisted Michigan State University in a feral swine ecology study.
    - 2015
        - Implemented use of the "Judas Pig" technique, which allowed for harvest of feral swine using telemetry data collected from the Michigan State University (MSU)/Michigan Department of Natural Resources (MDNR) research project.
        - Trapped and radio-collared four feral swine as a part of the MSU/MDNR research project.
    - 2016
        - Implemented Verizon platform cameras and traps, allowing for remote monitoring and activation of traps.
        - Used helicopters to locate feral swine in the Lower Peninsula.
        - Removed last known "Russian Type" feral swine from the Lower Peninsula.
    - 2017
        - Finalized WS' Feral Swine Elimination Plan for Michigan.
        - Surveyed approximately 79,000 acres via helicopter in the Upper Peninsula.
        - Successfully radio-collared two sows in the Upper Peninsula.
        - Responded to and investigated 44 new feral swine reports.

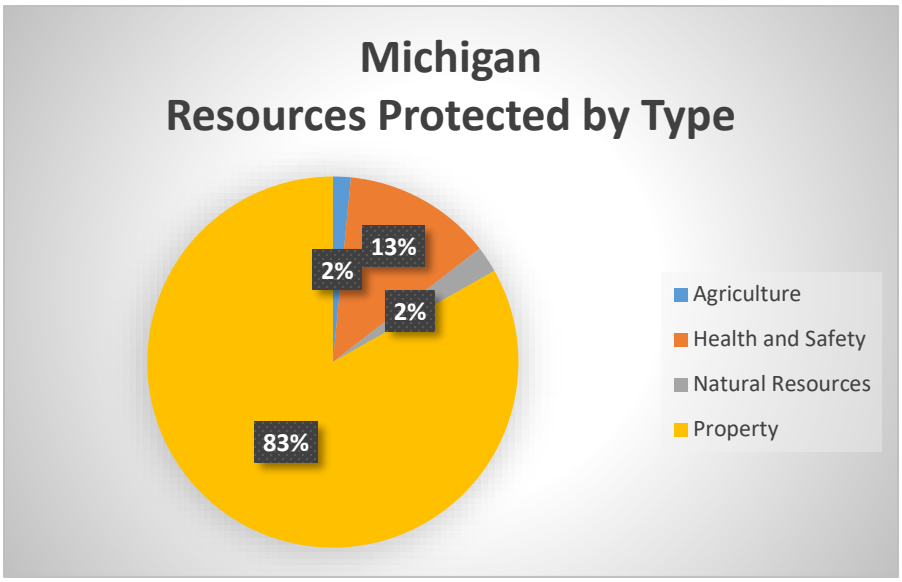
        - Collaborated with MDNR to have swine sighting questions added to deer check stations and deer harvest surveys.
        - Developed protocol for monitoring feral swine activity within the state.
    - 2018
        - Implemented protocol for monitoring feral swine activity in Michigan.
        - Responded to and investigated 31 new feral swine reports.
        - Removed the two radio-collared sows from the Upper Peninsula.
        - Field-tested new trap gate trigger mechanism for use in remote areas.
        - Field-tested new feral hog attractant to aid in detection of feral hogs.
        - Three employees attended the 2018 Wild Pig Conference in Oklahoma City, OK.

- Future directions and goals related to feral swine management over the next five years:
    - Remove last remaining feral swine from the Upper Peninsula.
    - Continue to monitor feral swine activity statewide and eliminate any feral swine detected.
    - Continue outreach efforts to inform the public regarding feral swine.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$235,000	$70,000	$139,571	$444,571
2015	$235,000	$0	$0	$235,000
2016	$165,000	$70,000	$6,072	$241,072
2017	$165,000	$70,000	$124,619	$359,618
2018	$165,000	$287,564	$103,996	$556,560
Total	**$965,000**	**$497,564**	**$374,258**	**$1,836,822**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Michigan Department of Natural Resources
  - Michigan Department of Agriculture and Rural Development
  - Michigan State University
  - Great Lakes Restoration Initiative
  - Michigan United Conservation Clubs
  - Local commodity association
  - University of Michigan - Flint
  - Michigan Animal Control Officers Association

Minnesota

- FY18 funding level: Detection phase
- Point of Contact: State Director
    - Address: 644 Bayfield Street, Suite 215
    - City/State/Zip: St. Paul, MN 55107
    - Phone: 651-224-6027

- State task force: Minnesota Feral Swine Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Minnesota Department of Natural Resources
        - Minnesota Department of Natural Resources, Enforcement Division
        - Minnesota Board of Animal Health
        - USDA APHIS Veterinary Services

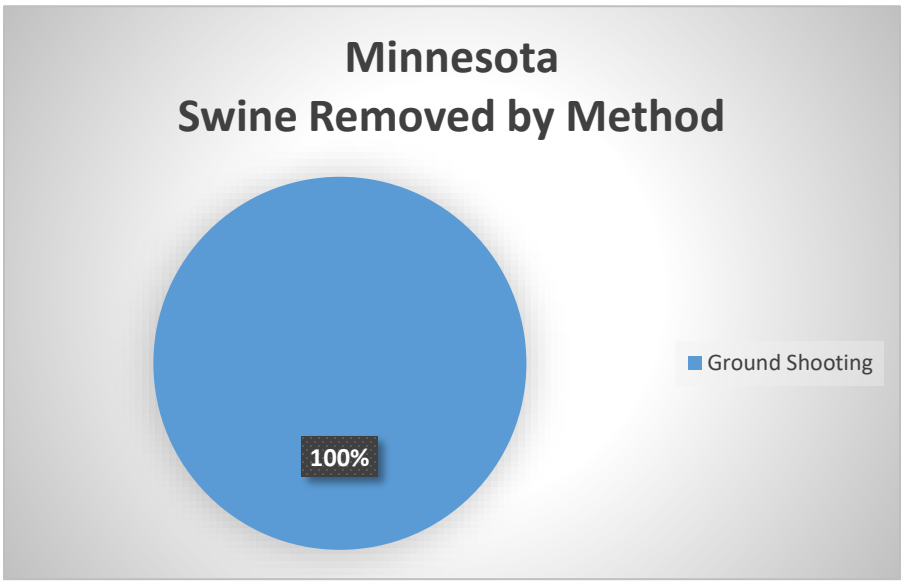
- Objectives:
    - Prevent establishment of feral swine in Minnesota (maintain feral swine free status).
    - Provide a framework for detection and surveillance of feral swine and upon detection, use established protocol for initiating elimination of feral swine.
    - Promote outreach and educate the public, government entities, tribes, and other groups and individuals on feral swine issues in Minnesota.
    - Provide ongoing input and updates to Minnesota Feral Swine Response Plan.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Feral Swine Working group formalized and met twice.
        - Purchased basic control and surveillance equipment: trail timers and cameras, remote triggered gates and trapping supplies, a trailer, and a rifle/scope combination.
    - 2015
        - Provided trapping and equipment demonstrations to 80 Minnesota Department of Natural Resources (MNDNR) employees in three different regions.
        - State statute passed prohibiting the possession and/or release of feral swine and authorizes the removal of swine at large, or feral swine.
        - Provided an interview on feral swine damage to local Outdoor News with a readership of 150,000.
        - Assisted the State in the removal of a loose domestic pig that was at large for several weeks, causing damage and posing a threat to a nearby state wildlife area and private property.
    - 2016
        - Removed free-ranging domestic swine from a Wildlife Management Area that had reproductive success out of captivity.
        - Responded to several reports of loose domestic swine; utilized trail timers and cameras to monitor reported activity and provided assistance in resolving these reports in cooperation with MNDNR and the Board of Animal Health.
    - 2017
        - Jointly investigated 12 reports of feral swine/loose domestic swine in seven different counties.
        - Deployed trail timers, cameras, and trapping equipment for multiple investigations.

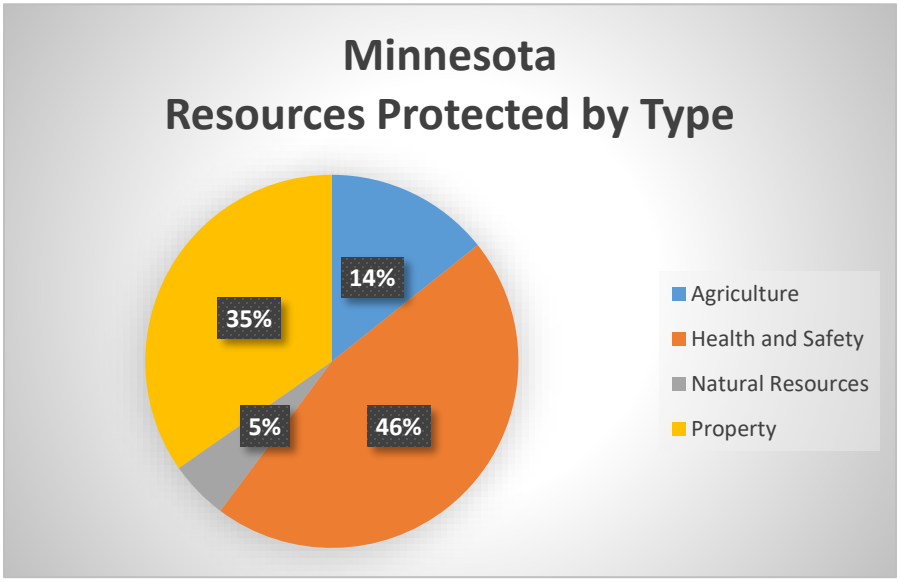
        - Promoted awareness of feral swine and their impact on natural resources, property, and to the industry.
        - Assisted WS Wisconsin with a large feral swine removal effort of several hundred pigs.
    - 2018
        - Jointly investigated/responded to 13 reports of feral swine in nine different counties, coordinating investigative activities with other working group members.
        - Promoted awareness of feral swine and their impact on natural resources, property, and the domestic swine industry.

- Future directions and goals related to feral swine management over the next five years:
    - Ensure statewide prevention of the establishment of feral swine in the state of Minnesota.
    - Coordinate with other Minnesota Feral Swine Working Group members to investigate and take action as necessary on reports of feral swine or loose domestic swine in Minnesota.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$0	$0	$0	$0
2015	$68,000	$0	$5,000	$73,000
2016	$68,000	$0	$6,000	$74,000
2017	$68,000	$0	$62,400	$130,400
2018	$42,000	$0	$58,500	$100,500
Total	**$246,000**	**$0**	**$131,900**	**$377,900**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Minnesota Department of Natural Resources
  - Minnesota Board of Animal Health
  - USDA APHIS Veterinary Services

Mississippi

- FY18 funding level: 4
- Point of Contact: State Director
    - Address: Rm 200 Thompson Hall, 775 Stone Boulevard
    - City/State/Zip: Mississippi State, MS 39762
    - Phone: 662-325-3014

- State task force: Mississippi Wild Hog Task Force
    - Member organizations:
        - Mississippi Department of Wildlife, Fisheries, and Parks
        - Mississippi Department of Agriculture
        - Mississippi Forestry Commission
        - Mississippi Board of Animal Health
        - Mississippi Extension Service
        - Mississippi State University, School of Veterinary Medicine
        - Mississippi River Levee Board
        - U.S. Fish and Wildlife Service
        - U.S. Army Corps of Engineers
        - USDA APHIS Veterinary Services
        - USDA APHIS Wildlife Services
        - Mississippi Humane Society
        - National Park Service
        - Local farm association
        - Delta Wildlife
        - U.S. Forest Service
        - Local livestock associations

- Objectives:
    - Expand the educational campaign of feral swine and the damages they cause through the formation of a subcommittee of the WS state task force.
    - Promote awareness among natural resource policy makers and the general public, including hunters, about existing and potential problems associated with feral swine populations.
    - Work with policy makers to develop strategic policies and procedures to facilitate reducing feral swine populations throughout the state.
    - Provide effective instruction to assist both private and public land managers with controlling feral swine populations and reducing property damage.
    - Promote and encourage vigilance of state and county law enforcement regarding illegal transport and relocation of feral swine.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - First aerial removal project completed along the coast.
        - Bought vehicles and much needed equipment and supplies.
        - Mississippi Department of Marine Resources brought on as a new cooperator.

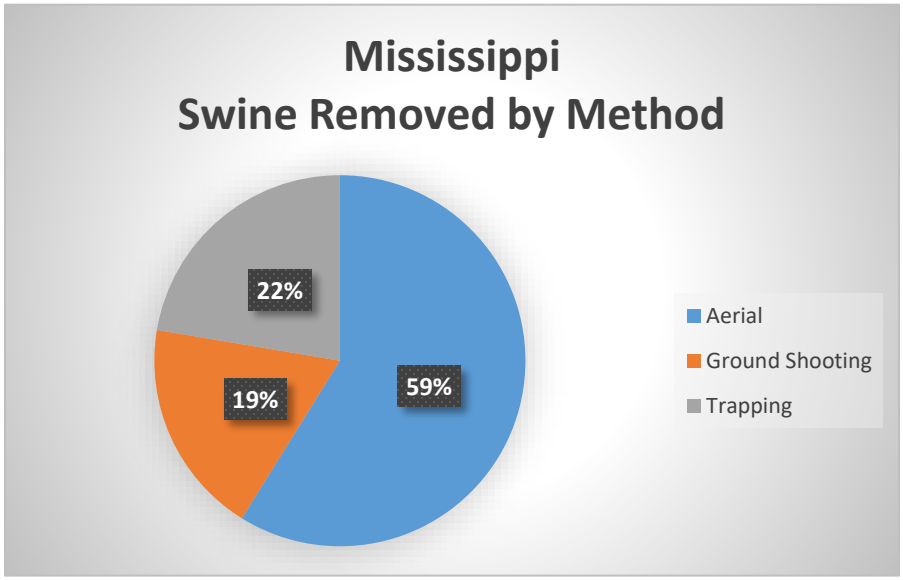
- Attended numerous meetings, educational talks, and workshops to promote new funding and capabilities.
- Began large-scale removal efforts on Panther Swamp NWR, Stennis Space Center, and Camp Shelby.

- 2015
  - Conducted large-scale feral swine removal by aerial operation on state, federal, and private lands in the Mississippi Delta and Mississippi Gulf Coast marsh.
  - Worked with Mississippi State Extension Service assisting in statewide feral swine workshops.
  - Assisted Alcorn State University in feral swine removal; also loaned the university equipment to set up a feral swine removal assistance program with rural farmers in southwest Mississippi.
- 2016
  - Increased feral swine aerial operations efforts in the Mississippi Delta and Gulf Coast region by conducting large-scale feral swine removal by aerial operation on state, federal, and private lands in Yazoo, Holmes, Humphreys, Sunflower, Issaquena, Sharkey, Bolivar, Jackson, Harrison, and Hancock counties.
  - Established agreement with the Mississippi River Levee Board to control feral swine on the main line level and Yazoo backwater levee.
- 2017
  - Added private and federal property to aerial operations.
  - Continued feral swine control at the Theodore Roosevelt NWR complex, the Panther Swamp NWR, Hillside NWR, and Morgan Brake NWR; worked extensively with private landowners near these refuges to address feral swine damage.
  - Provided technical assistance and direct control to multiple state and federal agencies, private landowners, and land managers with feral swine problems across the state.
  - Worked with the National Park Service to reduce feral swine damage on the Natchez Trace Parkway.
  - Obtained a H120 helicopter and leased a hangar at Yazoo City to establish a headquarters for future Mississippi aerial operations.
  - Provided a grant to Mississippi Extension Service for educational outreach campaigns on feral swine.
- 2018
  - Added additional acreage to aerial operations.
  - Completed winter, summer, and fall aerial operation activities across the Mississippi Delta and Mississippi coastal marsh.
  - Requested vacancy to be filled on Panther Swamp NWR.
  - Added request to fill new positions at Dahomey NWR, as well as 50/50 position between swine and rabies out of the Perkinston District office.
  - Continued to assist private landowners across the Mississippi Delta and reduced damage to agriculture.
  - Accomplished disease target collections.
  - Conducted numerous workshops including several with Faith Based minority farmers, students at Mississippi State University and the State Chapter of The Wildlife Society.
  - Implemented a Grant for $50,000 with Mississippi State Extension Service to educate segments of the public about detrimental effects of feral swine. Products will be distributed across the state of Mississippi – including print and radio products. Work was also done in conjunction with the state Feral Swine Working Group.

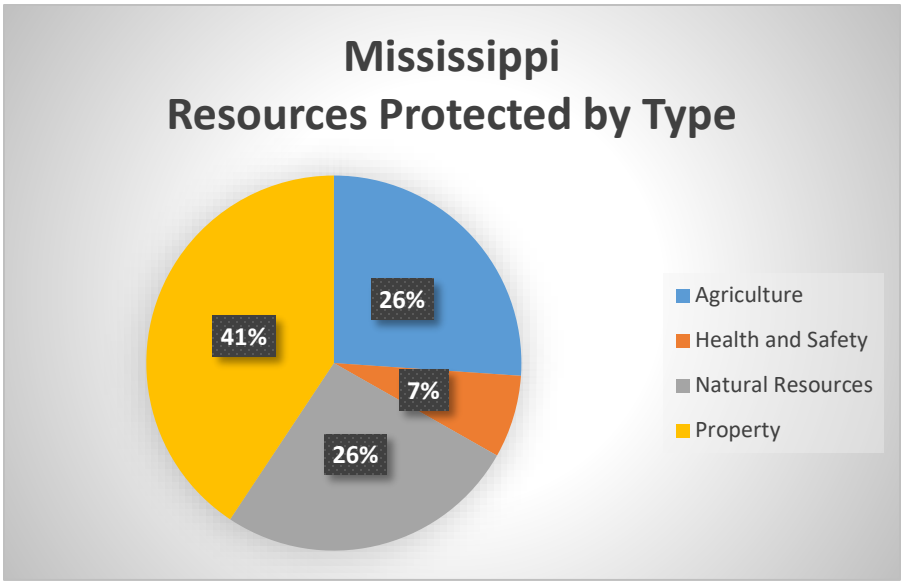
- Presented a PowerPoint on feral swine control at the Mississippi River Land Alliance (MRLA) meeting. This group is comprised of large landowners along the Mississippi River with interests in a large-scale feral swine damage management plan. Many of these landowners participated in the aerial operations of FY18.
- Continued to complete feral swine control work with the Mississippi River Levee Board to reduce feral swine damage on the MS River Levee. Assisted with feral swine control on the Yazoo Back Water Levee during the flood. Protecting this structure is critical to the agriculture community of Mississippi.

- Future directions and goals related to feral swine management over the next five years:
  - Fulfil requests to expand services along the Mississippi Gulf Coast and northeast Mississippi.
  - Develop partnerships and hire additional personnel.
  - Increase helicopter and pilot time for aerial removal operations.
  - Utilize advancements in technology. Begin to use drones in FY19. Both feral swine biologists will take the UAS course administered by the National Training Academy in January.
  - Continue working with NWRC and Mississippi State University, as well as others as requested, with research projects.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$295,000	$240,000	$58,088	$593,088
2015	$295,000	$90,000	$85,833	$470,833
2016	$295,000	$150,000	$87,244	$532,244
2017	$303,850	$185,000	$88,813	$577,623
2018	$303,850	$315,500	$90,000	$709,350
Total	**$1,492,700**	**$980,500**	**$409,979**	**$2,883,179**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	26.5	53.5	128.4	78.9	98.1
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Panther Swamp National Wildlife Refuge
  - Stennis Space Center
  - Camp Shelby
  - Mississippi Department of Marine Resources
  - Mississippi Department of Wildlife, Fisheries and Parks
  - U.S. Fish and Wildlife Service
  - Mississippi State Extension Service
  - Mississippi Department of Agriculture and Commerce
  - Delta Wildlife Foundation

Missouri

- FY18 funding level: 3
- Point of Contact: State Director
    - Address: 1714 Commerce Court, Suite C
    - City/State/Zip: Columbia, MO 65202
    - Phone: 573-449-3033

- State task force: Missouri Feral Hog Partnership
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Missouri Department of Conservation
        - U.S. Forest Service – Mark Twain National Forest
        - Missouri Department of Natural Resources
        - Fort Leonard Wood Department of Parks and Wildlife Natural Resources Branch
        - Missouri Department of Agriculture
        - U.S. Army Corps of Engineers – Kansas City and Little Rock Districts
        - Ozark National Scenic Riverways of the National Park Service
        - Missouri Department of Health and Senior Services
        - U.S. Fish and Wildlife Service – Mingo National Wildlife Refuge
        - USDA APHIS Veterinary Services

- Objectives:
    - Implement the Missouri Statewide Strategic Elimination plan.
    - Prevent expansion and establishment of local feral swine populations and greatly reduce the total number of feral swine statewide.
    - Work towards eliminating the take of feral swine on public lands.
    - Strengthen state regulations on the illegal transport and release of feral swine.
    - Develop one consistent definition for feral swine.
    - Distribute a one-page bullet point document regarding all laws relevant to feral swine in Missouri.
    - Monitor and test for disease threats to livestock, wildlife, and humans.
    - Work together within the respective statutory mandates to cooperate in the elimination of feral swine on private and public land by utilizing to the extent possible funds, staff, and equipment.
    - Combine the respective skills, experience, and expertise for the development of a collaborative effort to eliminate feral swine in Missouri and address the threats posed by them.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Established a cooperative aerial removal program with the Missouri Department of Conservation (MDC).
        - Established landowner contacts and received permission for an elimination project on up to nine square miles within Vernon County.
        - Coordinated the training of an additional MDC aerial firearms expert and pilot for aerial removal activities by Aviation Safety, Training, and Operations Center (ATOC).
        - Coordinated with Kansas for trapping along the Missouri/Kansas border.

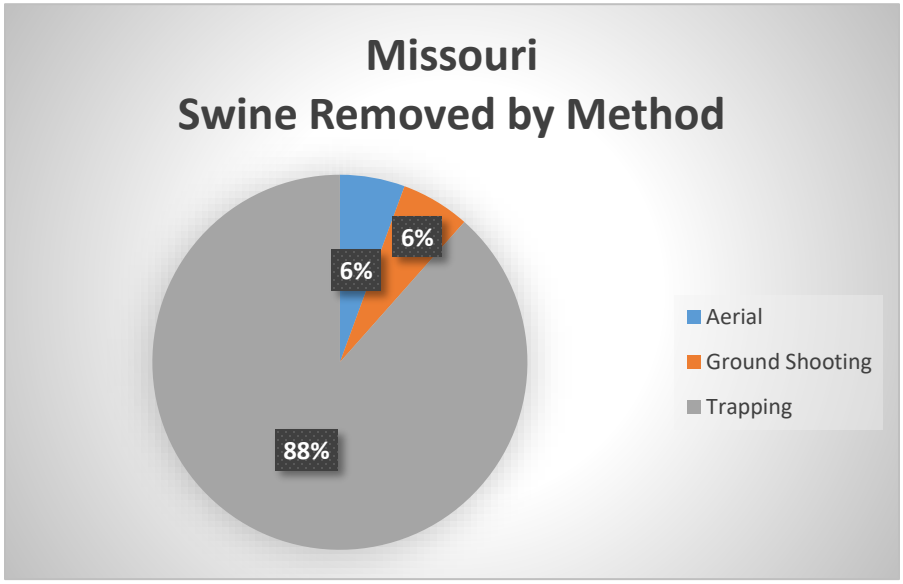
- Loaned traps and gates and provided technical advice to other state and federal agencies as well as private landowners on feral swine eradication.

- 2015
  - Designed and developed Missouri Drop Trap to facilitate capture of feral swine by mitigating swine trap avoidance behavior, thus increasing capture rate and capture numbers per capture event.
  - Established a Missouri Feral Swine Cooperative in southeast Missouri.
  - Coordinated with the MDC for aerial removal operations, used a MDC helicopter, firearms experts, and pilot in support of USDA APHIS WS feral swine aerial operations.
  - Eliminated feral swine from northwest Clark County, Vernon County, and Little Indian Creek Conservation Area in Washington County.
  - Created a Missouri Feral Hog GIS Database App to track feral swine removal and trapping efforts by all Missouri agencies.
  - Hosted a one-day feral swine workshop/training for wildlife professionals from five mid-western states. Requested to make this an annual event/training for cooperating agencies that were present. Attendees included wildlife agency representatives from five states, USFWS, USFS, MO/State Parks, two universities and one NGO.
  - Switched from using rooter style gates to guillotine drop gates. A set of engineered drawings were been developed, manufactured, and put on CAD (computer aided design) for use by cooperating agencies.
  - Signed a $46,000 agreement with Fort Leonard Wood Army Base and hired a full-time feral swine Biological Science Technician.
- 2016
  - Eliminated feral swine from Black Island Conservation Area in Pemiscot County and eradicated an outbreak of feral swine in Callaway County.
  - Initiated projected five-year feral swine elimination project on USFWS Mingo NWR in conjunction with NWRC research project. Collaboratively removed 509 feral swine from the Mingo Basin watershed.
  - Provided support to MDC and other cooperators, assisting them with increased removal efforts directly tied to the passage of a ban on feral swine hunting on MDC owned, leased, and managed lands.
  - Developed a combined strategic direction and elimination plan for feral swine in Missouri in conjunction with the Missouri Feral Hog Partnership; this plan focused on identifying elimination areas, isolating populations, and border protection.
  - Refined and expanded the use of the Missouri Drop Trap. A complete set of CAD engineered drawings is now available for distribution to other agencies and partners. This new trap design is producing dramatic results, with one catch consisting of 62 swine in April of 2017.
  - Increased agreement with Fort Leonard Wood Army Base to $50,000 for feral swine Biological Science Technicians.
- 2017
  - Received $1.865 million in cooperative funding from the Missouri Department of Conservation to hire additional staff for feral swine elimination.
  - Received approval to access U.S. Forest Service Wilderness Areas for baiting, trap placement, and aerial operations.
  - Met with U.S. Congressional Staffer Bernie Cook, with U.S. Congressman Jason Smith's office in Rolla, Missouri.

        - Continued to provide leadership and coordination of feral swine outreach and education through hosting and conducting local public meetings, and assisting in the formation of local cooperatives in coordination with key inter-agency staff.
        - Dramatically increased removal of feral swine statewide. In calendar year 2017, Missouri WS, in conjunction with cooperating agencies, exponentially increased the feral swine removal to 6,567, the highest removal recorded in Missouri in a given year.
        - Utilized a local flooding event along the Little River drainage in the Southeast District and removed 105 feral swine by aerial removal from the Hornersville Swamp and Big Lake wetland complex by USDA aerial operations, drastically reducing the local swine population.
        - Increased agreement with Fort Leonard Wood Army Base to $56,000 for feral swine Biological Science Technicians.
        - Signed CSA with $10,000 in funding to supplement the continued USDA WS feral swine elimination project on USFWS Mingo NWR. Removed 464 feral swine from the Mingo Basin within the fiscal year, totaling 973 feral swine over the course of the project.
    - 2018
        - Hired 20 additional Biological Science Technicians to fully staff Elimination Zones (EZs) 1, 2, and 4 and provide additional staff in Elimination Zones 3, 5, and 6.
        - Increased removal effort resulting from fully staffing EZ1 and EZ2 associated with the statewide elimination strategy has resulted in over an 80% increase in the number of feral swine removed from EZ1 and EZ2 in FY18 compared to the same quarter period in FY17.
        - Reduced known feral swine population in EZ1 to less than 100.
        - Increased agreement with Fort Leonard Wood Army Base to $80,500 for feral swine Biological Science Technicians.
        - Surpassed over 1,200 feral swine removed off Fort Leonard Wood Army Base over the course of three years of control work.
        - Planted 25 acres of corn in four different fields to establish “lure crops” as a control method at Fort Leonard Wood Army Base.
        - Renewed CSA with $10,000 funding to supplement the continued feral swine elimination project on USFWS Mingo NWR. Removed 553 feral swine from the Mingo Basin within the fiscal year, bringing the total number of swine removed over a three-year period (of the projected five-year project) to 1,526.
        - Established a focused feral swine elimination effort by targeting USGS hydrologic units (12-digit code) areas for eradication and subsequent monitoring efforts.

- Future directions and goals related to feral swine management over the next five years:
    - Inform the public of the problems feral hogs cause and the need to eliminate them.
    - Prevent new populations from establishing, control sources of feral hogs, and remove incentives for releasing feral hogs.
    - Implement a strategy to eliminate feral hogs where they currently exist.
    - Obtain population metrics, and define and develop a way to measure success.
    - Monitor areas where elimination has been achieved to ensure no new populations become established.

- Feral swine removed by method:



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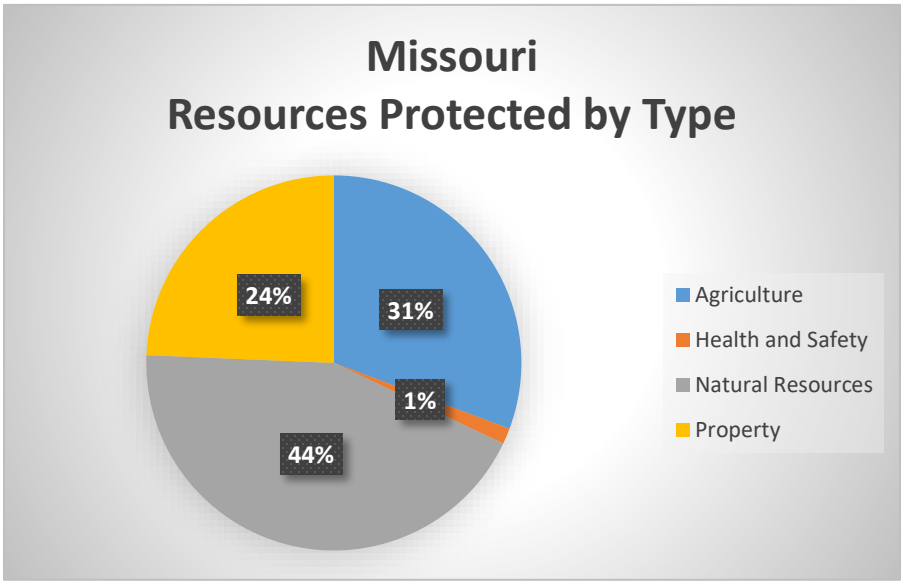


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$235,000	$120,000	$147,300	$502,300
2015	$235,000	$120,000	$301,295	$656,295
2016	$235,000	$220,000	$497,770	$952,770
2017	$242,050	$446,000	$767,545	$1,455,595
2018	$242,050	$220,000	$2,102,395	$2,564,445
Total	**$1,189,100**	**$1,106,000**	**$3,816,305**	**$6,131,405**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	32.5	48.7	39.4	39
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Missouri Department of Conservation
    - U.S. Forest Service, Mark Twain National Forest
    - Missouri Department of Natural Resources
    - Missouri Department of Agriculture
    - Missouri Department of Health and Senior Services
    - USDA APHIS Veterinary Services
    - U.S. Army Corps of Engineers (Includes: St. Louis, Little Rock, and Kansas City Districts)
    - U.S. Fish and Wildlife Service
    - The Ozark National Scenic Riverways of the National Park Service
    - Fort Leonard Wood, Directorate of Public Works Natural Resources Branch

Nevada

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 8775 Technology Way
    - City/State/Zip: Reno, NV 89521
    - Phone: 775-851-4848

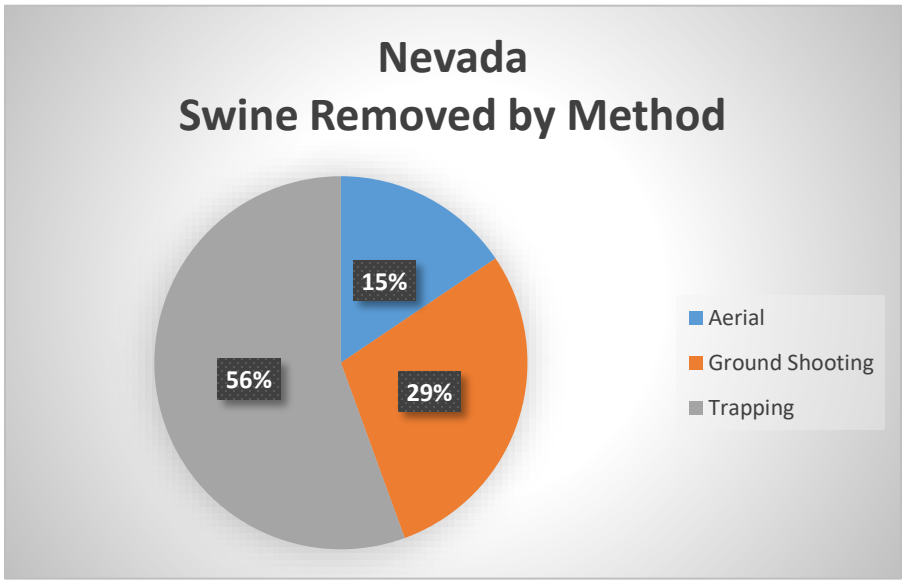
- State task force: Nevada Feral Swine Task Force
    - Member organizations:
        - U.S. Bureau of Land Management
        - U.S. Forest Service
        - Nevada Department of Agriculture
        - Nevada Department of Wildlife
        - USDA APHIS Wildlife Services

- Objectives:
    - Continue to educate the public and other stakeholders regarding feral swine.
    - Eliminate the newly reported population of feral swine in Paradise Valley.
    - Continue detection and corresponding elimination of feral swine in Nevada.
    - Work with the state to enforce existing laws banning the release of feral swine and hunting of astray swine.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Attended the Joint Meeting for Feral Swine and Biological Collections.
        - Identified feral swine populations and estimated feral swine numbers within the state.
        - Communicated with stakeholders concerning feral swine monitoring and control activities.
    - 2015
        - Eliminated the novel feral swine population in Moapa.
        - Reduced the feral swine populations in Paradise Valley and Panaca.
    - 2016
        - Eliminated the feral swine population in Panaca.
        - Further reduced the Paradise Valley feral swine population.
    - 2017
        - Eliminated the feral swine population in Caliente.
        - Continued monitoring of the Paradise Valley population, 15-30 individuals estimated to remain, but severe flooding prevented access most of the year.
        - Distributed feral swine outreach materials and provided technical assistance regarding feral swine issues.
    - 2018
        - Reduced the Paradise Valley population by 13 feral swine.
        - Continued monitoring for feral swine in Caliente.
        - Distributed feral swine outreach materials and provided technical assistance regarding feral swine issues.
        - Provided two feral swine outreach presentations/instructional sessions.

- Future directions and goals related to feral swine management over the next five years:
    - Continue to educate the public and other stakeholders about negative consequences of releasing feral swine.
    - Eliminate feral swine from public lands and private property under agreement.
    - Continue to persuade private property owners that maintain feral swine populations to stop this behavior and allow WS to remove feral swine on their properties.
    - Continue detection and corresponding elimination of feral swine in Nevada.
    - Continue to distribute feral swine outreach materials and provide technical assistance regarding feral swine issues.
    - Continue to work with the state to enforce existing laws banning the release of feral swine and hunting of astray swine.

- Feral swine removed by method:



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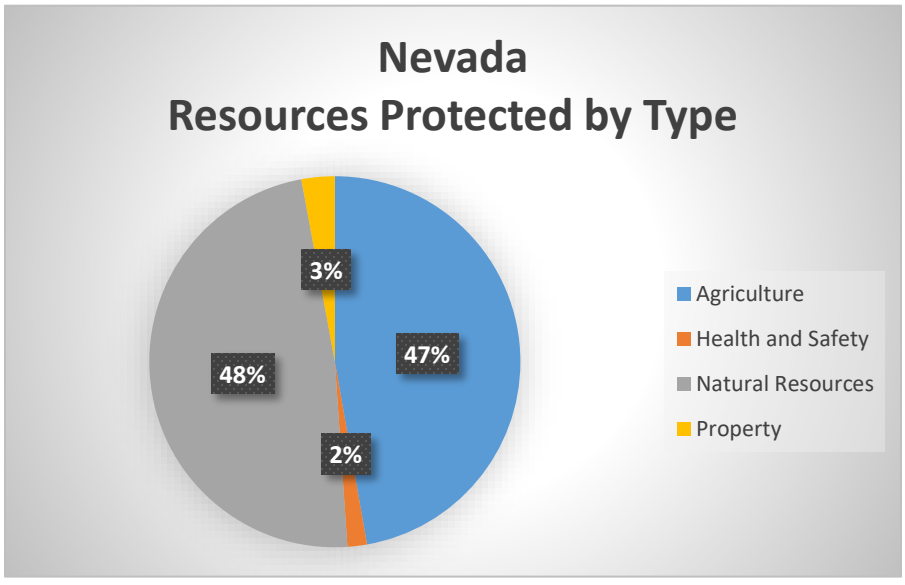


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$0	$68,000
2015	$68,000	$0	$0	$68,000
2016	$68,000	$7,000	$0	75,000
2017	$68,000	$2,000	$0	$70,000
2018	$68,000	$0	$0	$68,000
Total	**$340,000**	**$9,000**	**$0**	**$349,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	38.5	11.8	25.3	18.4	40.4

- Major cooperators:
    - U.S. Bureau of Land Management
    - U.S. Forest Service
    - Nevada Department of Agriculture
    - Nevada Department of Wildlife
    - Private landowners

New Hampshire

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 59 Chenell Drive, Suite 7
    - City/State/Zip: Concord, NH 03301
    - Phone: 603-223-6832

- State task force: New Hampshire/Vermont Feral Swine Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - New Hampshire Fish and Game Department
        - New Hampshire Department of Agriculture, Markets, and Food
        - Vermont Fish and Wildlife Department
        - Vermont Agency of Agriculture, Foods, and Market
        - USDA APHIS Veterinary Services

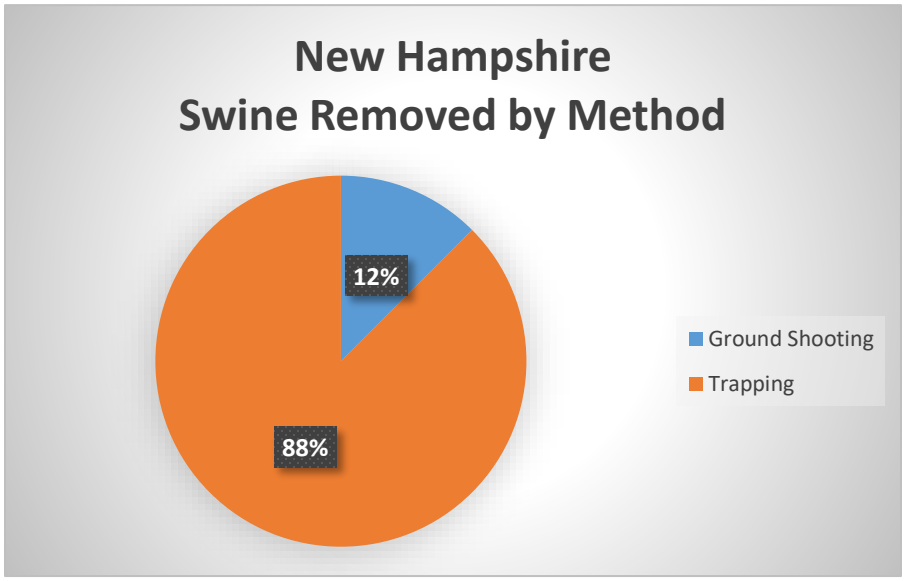
- Objectives:
    - Monitor for and continue surveillance of free-ranging populations, emigration, and areas with historical presence of feral swine.
    - Investigate all feral swine reports, verify credible reports through site visits, and assist landowners with damage management, disease surveillance, and removal efforts.
    - Eliminate all accessible populations and collect samples for disease surveillance.
    - Work with cooperators to identify and protect high-risk resources.
    - Continue to build cooperative base statewide with the U.S. Forest Service, USDA NRCS, Farm Service Agency, New Hampshire and Vermont Farm Bureau Federations, and Regional Pork Producer's Council.
    - Continue to educate the public through media outlets, informative presentations, and expos.
    - Upgrade infrastructure to support an integrated feral swine management program.
    - Expand and improve upon management techniques, damage data collection, and reporting.
    - Continue to train field staff and cooperators to identify feral swine signs, report damage, conduct trapping, and disease sampling techniques.
    - Monitor and evaluate results of management actions.
    - Work with national and international partners to develop a regional management strategy.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Organized and met with the Feral Swine Task Force to identify goals and align responsibilities.
        - Conducted four media interviews with Colebrook News and Sentinel, Hippo Magazine, and New Hampshire Public Radio outlets to inform the public.
        - Ran articles on the New Hampshire Fish and Game website, in the Hunting Bulletin Wildlife Journal, and twice in the New Hampshire Department of Agriculture, Markets, and Food Market Bulletin.
        - Instituted a program-wide feral swine database and reporting system.

- 2015
  - Worked on methods to improve and expand control activities through incorporating newly developed methods for removal operations.
  - With assistance from the NFSP, worked with the Kentucky/Tennessee WS aerial program to plan and conduct a fixed-wing aerial survey for feral swine covering approximately 1,000 km^2, specifically targeting areas surrounding a high-fenced hunting operation containing feral swine and other facilities known to have housed feral swine historically.
  - Obtained permission from the New Hampshire Fish and Game Department to monitor all state wildlife management areas for feral swine activity.
- 2016
  - Conducted aerial surveys along the Connecticut River.
  - Developed two information fact sheets for landowners selected for camera surveys to explain the survey and identify feral swine signs.
  - Completed a summer trail camera survey to determine feral swine presence and activities in specific areas – gained property permissions from private landowners and state cooperators and deployed cameras at 90 locations over the 875 km^2 core study area in Sullivan Country.
  - Developed new trapping techniques and gained access to more property for removal efforts within target zones.
- 2017
  - Communicated frequently with the Quebec Ministry of Forests, Wildlife, and Parks to discuss feral swine surveillance along the U.S.-Canada border due to concern over a reproducing population of about 50 feral swine in Canada, approximately 50 miles from the border.
  - Continued cooperation with the superintendent of a high-fenced hunting operation with feral swine and discussed WS feral swine activities and current reports of sightings from the public.
  - Participated in two print media articles in two local newspapers and attended the Agricultural and Forest Exposition and New Hampshire Fish and Game's Wild New Hampshire Day held for the public, reaching several thousand stakeholders.
  - Conducted an aerial survey of the feral swine zone, no observations.
- 2018
  - Continued discussions with biologists from the Quebec Ministry of Forests, Wildlife and Parks to determine border feral swine surveillance.
    These are likely escapees from one of a number of high-fenced hunting operations in Quebec, Canada. Wildlife Disease Biologist Anthony Musante met with Isabelle Laurion from the QMNR at the Wild Pig Meeting in Oklahoma in April.
  - Participated in discussions with local hunters and landowners in areas with reported swine activities to gain access to adjoining property, as well as surveyed the area on foot.
  - Deployed a trap at the Croydon, NH location.
  - Distributed feral swine brochures and posters to stores, kiosks on state management areas, as well as a number of landowners in suspect areas and along the Canadian border.

- Future directions and goals related to feral swine management over the next five years:
    - Continue developing the duel state, international Feral Swine Task Force/Working Group.
    - Continue to increase media outreach, press releases, dairy conferences, farm shows, sportsman shows, Facebook, and NH radio presence.
    - Increase outreach at the town level, via town clerks, town meetings, etc.
    - Continue educational seminars with NHFG Biologist & Law Enforcement, NHAAMF, VS, the agricultural community, and the general public through talks and the NH nuisance wildlife helpline.
    - Implement a trail camera trap survey along the identified emigration routes along the Quebec border and the CT River Valley.
    - Maintain Feral Swine notification page in NH Hunting Bulletin.
    - Convert to OARS to improve recording, monitoring, and reporting efforts.
    - Work with the hunting community for trail camera reporting.
    - Conduct control activities: trapping and shooting identified feral swine populations.
    - Continue to improve operations through the Feral Swine Task Force with VT/NH state & federal agencies with jurisdictional authority.
    - Respond to all reports of feral swine with increased surveillance of suspect areas.
    - Work with our federal partners to monitor federal lands in NH.
    - Remove feral swine from NH.
    - Move NH to a Detection status once current population is removed and remains feral swine free for at least two years.

- Feral swine removed by method:



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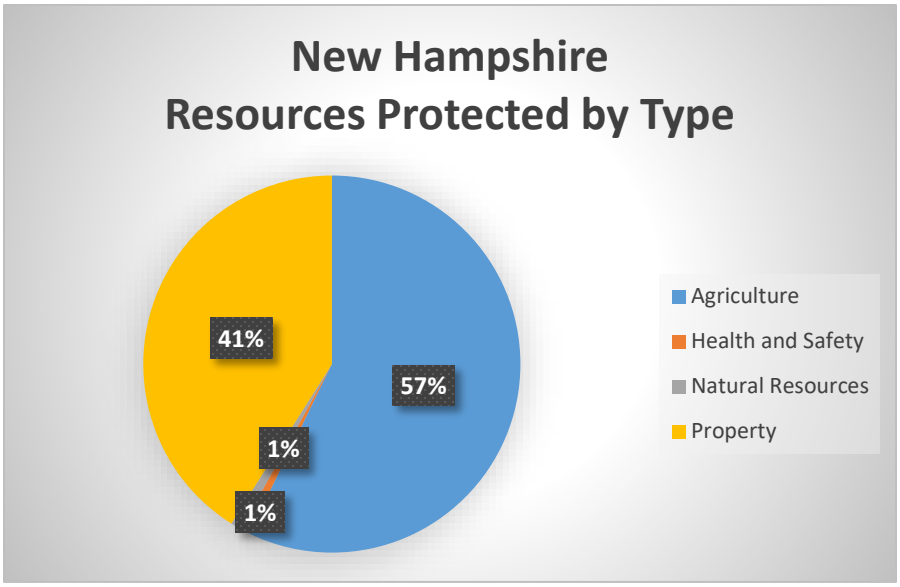


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$0	$68,000
2015	$68,000	$0	$0	$68,000
2016	$68,000	$0	$0	$68,000
2017	$68,000	$0	$0	$68,000
2018	$68,000	$0	$0	$68,000
Total	**$340,000**	**$0**	**$0**	**$340,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - New Hampshire Fish and Game
  - USDA APHIS Veterinary Services
  - New Hampshire Department of Agriculture, Markets, and Food
  - Quebec, CN Ministry of Forests, Wildlife and Parks

New Jersey

- FY18 funding level: Detection phase
- Point of Contact: State Director
    - Address: 140-C Locust Grove Road
    - City/State/Zip: Pittstown, NJ 08867
    - Phone: 908-735-5654

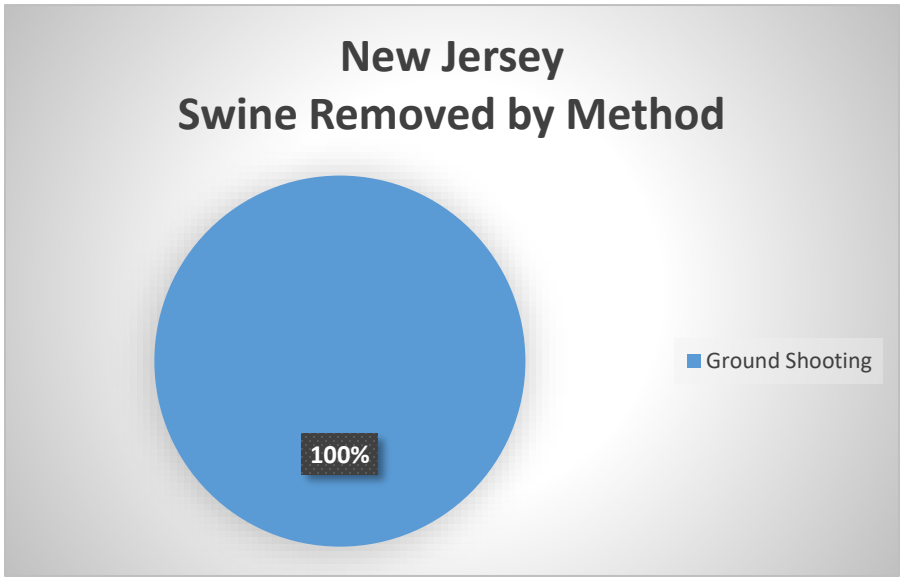
- State task force: New Jersey Feral Swine Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - New Jersey Division of Fish and Wildlife
        - New Jersey Department of Agriculture
        - USDA APHIS Veterinary Services

- Objectives:
    - Investigate all reports of feral swine.
    - Identify and address any potential sources of introduction.
    - Remove free-roaming swine from the natural landscape.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Purchased vehicles and other necessary equipment.
        - Created a Feral Swine Working Group, an email distribution list with contacts for instant notification, and feral swine signs for posting on state lands.
        - Incorporated swine reporting and take information into the 2014-2015 New Jersey Hunting and Trapping Digest.
        - Divided feral swine responsibilities amongst partner agencies.
    - 2015
        - Verified that the vast majority of the known feral swine range is free of feral swine.
        - Implemented a feral swine surveillance strategy.
        - Participated in a joint outreach program with the New Jersey Department of Agriculture to inform swine producers of diseases associated with feral swine.
        - Conducted outreach to multiple local government organizations in the counties surrounding known feral swine ranges.
        - Last known feral swine removed from New Jersey.
    - 2016
        - Moved from a Level 1 state to a Detection Phase state.
    - 2017
        - Continued monitoring through outreach, working group meetings, and investigations of reports to ensure feral swine have been eliminated statewide.
        - Investigated credible reports of feral swine.
    - 2018
        - Continued monitoring through outreach, working group meetings, and investigations of reports to ensure feral swine have been eliminated statewide.
        - Investigated credible reports of feral swine.
        - Verified that all reports received were either free-ranging domestic pot-bellied pigs or recently escaped domestic swine that were recaptured by the owner.

- Future directions and goals related to feral swine management over the next five years:
    - Continue to utilize the taskforce to coordinate the collection and investigation of any reports of feral swine.

- Feral swine removed by method:



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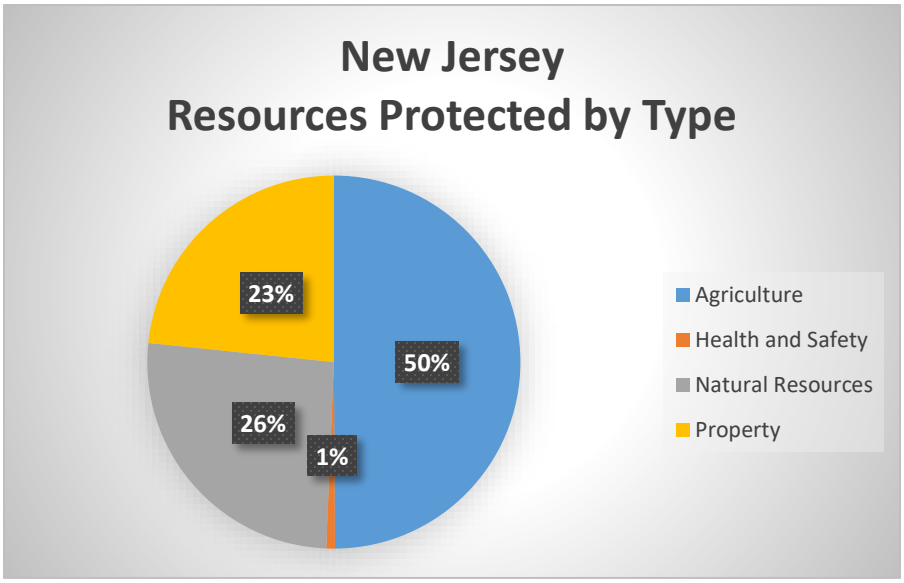


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$57,000	$0	$125,000
2015	$68,000	$30,000	$0	$98,000
2016	$68,000	$32,000	$0	$100,000
2017	$42,000	$0	$0	$42,000
2018	$42,000	$0	$0	$42,000
Total	**$288,000**	**$119,000**	**$0**	**$407,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - USDA APHIS Veterinary Services
    - New Jersey Division of Fish and Wildlife
    - New Jersey Department of Agriculture

New Mexico

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 8441 Washington St. Northeast
    - City/State/Zip: Albuquerque, NM 87113
    - Phone: 505-346-2640

- State task force: New Mexico Feral Swine Eradication Team
    - Member organizations:
        - New Mexico Department of Agriculture
        - New Mexico Game and Fish
        - New Mexico State Land Office
        - New Mexico Livestock Board
        - New Mexico Cooperative Extension
        - New Mexico Department of Health
        - U.S. Forest Service
        - U.S. Bureau of Reclamation
        - Mescalero Apache Tribe
        - Bureau of Indian Affairs
        - New Mexico Association of Counties
        - Local commodity associations
        - USDA APHIS Wildlife Services

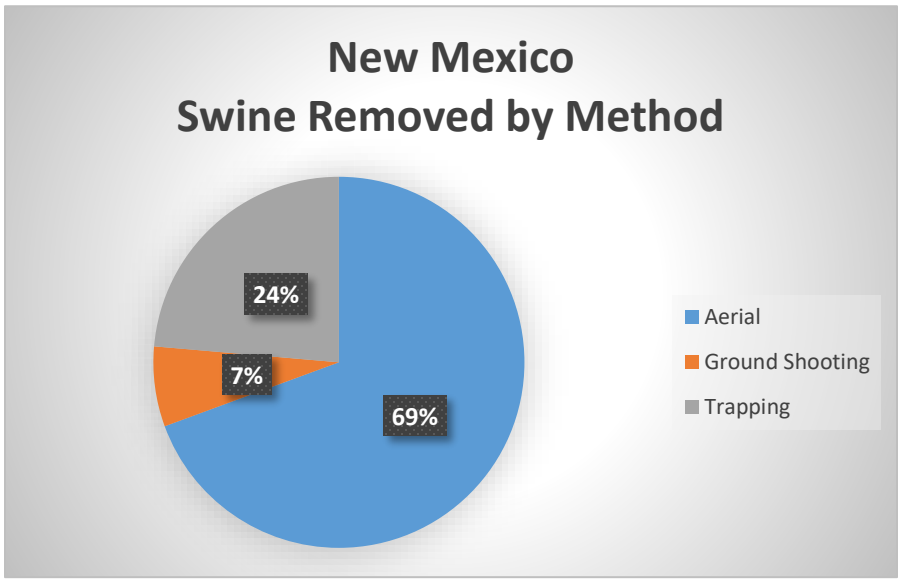
- Objective:
    - Eradicate feral swine from all areas where WS has access in New Mexico.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Eliminated feral swine from approximately 10 of 17 counties thought to have feral swine.
        - Worked with the U.S. Forest Service to gain access to a large wilderness area in south-central New Mexico.
        - Participated in discussions with a private company about the potential use of drones for surveillance.
    - 2015
        - Obtained U.S. Forest Service concurrence to begin feral swine removal using an integrated approach in the White Mountain Wilderness Area of the Lincoln National Forest.
        - Eliminated feral swine from an additional two counties.
    - 2016
        - Began using environmental DNA (eDNA) for feral swine surveillance in remote areas.
        - Twelve counties, totaling nearly 19 million acres, were cleared.
        - Developed radio public service announcements in both English and Spanish with help from the New Mexico Department of Agriculture and Cooperative Extension, asking individuals to report any feral swine sightings to WS, and were distributed to multiple outlets across eastern New Mexico.

- 2017
  - Three additional feral swine were radio collared as part of the effort to utilize the "Judas Pig" technique to locate additional feral swine.
  - Met with Coronado National Forest staff to develop feral swine detection and removal strategies, and signed agreements for control.
  - Began working with Lincoln National Forest staff to protect two federally listed species and their habitats.
  - Successfully used eDNA to target specific areas and remove feral swine.
- 2018
  - Significant populations of feral swine remain in only two NM counties. Small scattered sounders and individual pigs remain in many other areas. WS does not currently have access to some of these areas. The remaining areas with significant feral swine numbers are covered with ponderosa pine forest and the 47,000-acre USFS White Mountain Wilderness Area.

- Future directions and goals related to feral swine management over the next five years:
  - Elimination of feral swine in the two remaining counties with significant populations in south central New Mexico.
  - Continued statewide feral swine surveillance and rapid response to reports of feral swine.
  - Expand the feral swine elimination zone along the Texas state line to increase the barrier for potential repopulation.

- Feral swine removed by method:



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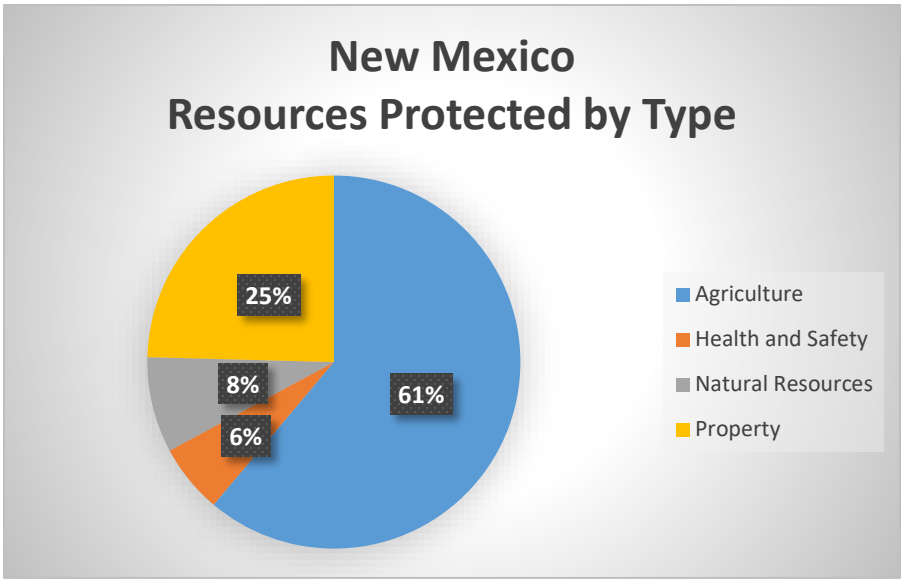


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$165,000	$193,000	$415,000	$773,000
2015	$165,000	$275,714	$120,000	$560,714
2016	$165,000	$308,000	$123,500	$596,500
2017	$68,000	$258,000	$139,000	$465,000
2018	$68,000	$187,000	$165,000	$420,000
Total	**$631,000**	**$1,221,714**	**$962,500**	**$2,815,214**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	250.5	281.4	263.3	164.9	163.7
Fixed-wing	43.3	39.6	24.4	11.8	0

- Major cooperators:
  - New Mexico Game and Fish
  - New Mexico Department of Agriculture
  - New Mexico State Land Office
  - U.S. Forest Service
  - U.S. Bureau of Land Management
  - New Mexico Department of Health
  - Local livestock association
  - Local commodity association
  - Mescalero Apache Reservation
  - Bureau of Indian Affairs
  - New Mexico Cooperative Extension Service
  - U.S. Bureau of Reclamation
  - New Mexico Association of Counties

New York

- FY18 funding level: Eliminated
- Point of Contact: State Director
    - Address: 572 Third Avenue Extension, Suite 2
    - City/State/Zip: Rensselaer, New York 12144-5630
    - Phone: 518-477-4837

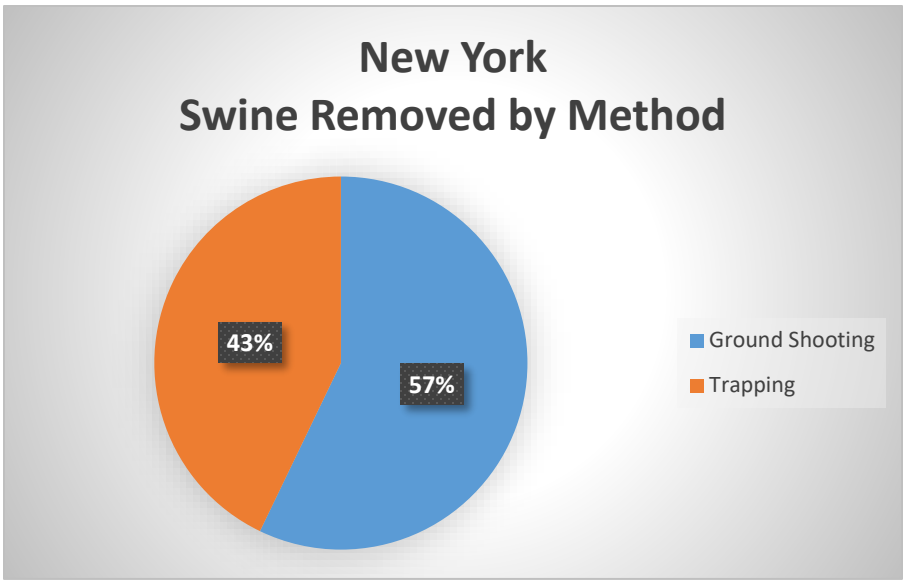
- State task force: New York Feral Swine Task Force
    - Member organizations:
        - New York Department of Environmental Conservation
        - New York Department of Agriculture and Markets
        - New York Parks and Historic Preservation
        - USDA APHIS Wildlife Services

- Objectives:
    - To conduct feral swine management, disease surveillance, and public outreach with the goal of eliminating feral swine from the state of New York.

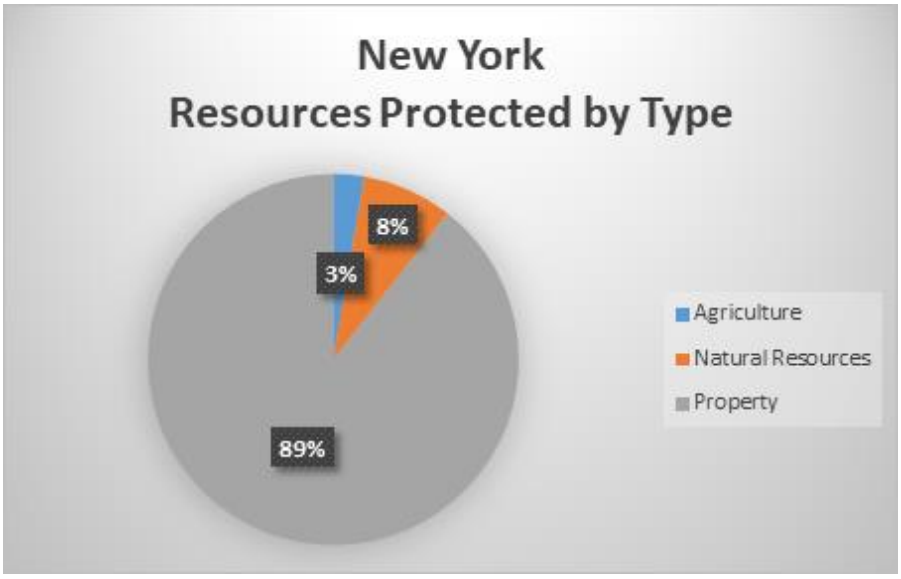
- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Conducted surveys to locate and remove feral swine in New York.
        - Developed a feral swine early detection network through public outreach efforts, which reports all feral swine sighting for investigation.
        - Continued to investigate feral swine reports throughout the state to determine validity.
        - Acquired access to more than 62,000 acres of land for feral swine management efforts.
    - 2015
        - Conducted aerial surveys over portions of six counties formerly with feral swine and no feral swine or signs were detected.
        - Conducted detection dog surveys over portions of six counties and no feral swine were detected.
    - 2016
        - Completed second year of ground, aerial, and detection dog surveys to document feral swine elimination in New York.
    - 2017
        - Maintained five-prong approach to document the elimination of feral swine populations from NY. Investigated 36 reports of feral swine from the public and determined all reports to be false.
    - 2018
        - Maintained five-prong approach to document the elimination of feral swine populations from NY. Investigated 28 reports of feral swine from the public and determined all reports to be false.

- Future directions and goals related to feral swine management over the next five years:
    - The goal for NYS Department of Environmental Conservation and Wildlife Services is to maintain our elimination status and keep the state free of feral swine.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$50,000	$340,000	$458,000
2015	$68,000	$75,000	$340,000	$483,000
2016	$42,000	$0	$340,000	$382,000
2017	$42,000	$0	$165,000	$207,000
2018	$0	$0	$165,000	$165,000
Total	**$220,000**	**$125,000**	**$1,350,000**	**$1,695,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	16.1	0	0	0	0
Fixed-wing	0	23.8	0	23.9	0

- Major cooperators:
  - New York State Department of Environmental Conservation
  - New York State Department of Agriculture and Markets
  - New York State Department of Transportation
  - New York State Office of Parks, Recreation, and Historic Preservation
  - USDA APHIS Veterinary Services
  - Audubon Society of New York
  - USDA Farm Service Agency
  - USDA National Resources Conservation Service
  - Local game association
  - New York State Fish and Wildlife Management Board
  - New York City Department of Environmental Protection
  - New York State Conservation Council

North Carolina

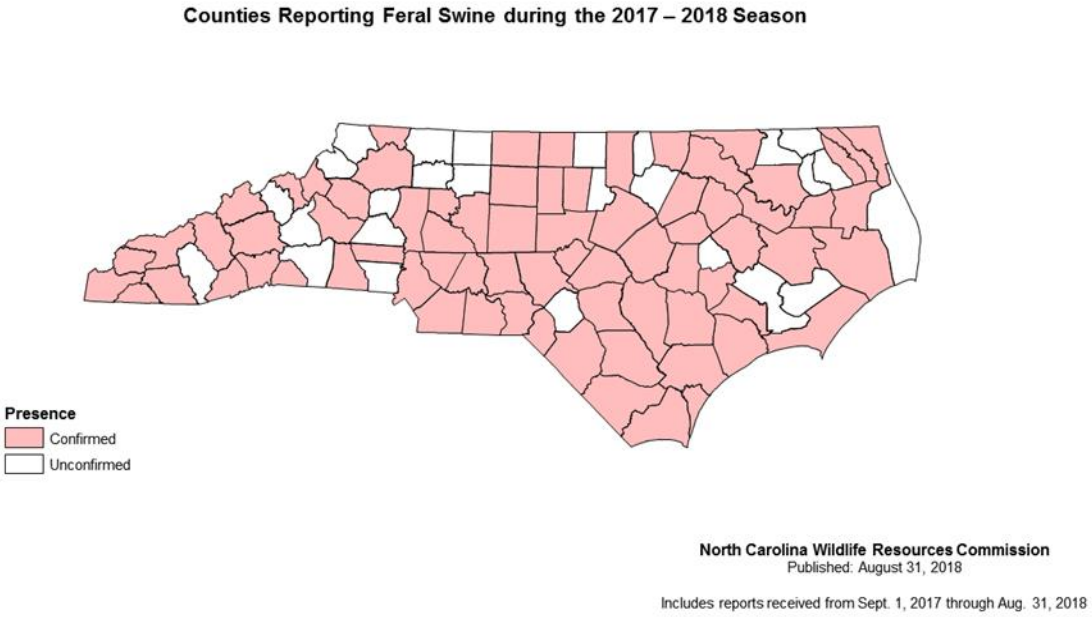
- FY18 funding level: 4
- Point of Contact: State Director
    - Address: 6213-E Angus Drive
    - City/State/Zip: Raleigh, NC 27617
    - Phone: 919-326-6924

- State task force: North Carolina Feral Swine Damage Management Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - USDA APHIS Veterinary Services
        - USDA National Resources Conservation Service
        - North Carolina Wildlife Resources Commission, Management
        - North Carolina Wildlife Resources Commission, Enforcement
        - North Carolina Department of Agriculture
        - North Carolina State Parks
        - Local farm association
        - North Carolina Forestry Association
        - Southern Appalachian Highlands Conservancy
        - The Nature Conservancy
        - Eastern Band of Cherokee Indian Tribe
        - Local commodity associations
        - Local livestock associations

- Objectives:
    - Expand outreach through new and existing partnerships to identify feral swine population levels and distribution; provide notifications to landowners, farmers, sportsmen, and the public about the availability of assistance with feral swine damage.
    - Increase the capacity to assist landowners with feral swine damage management.
    - Establish a method of sharing data on feral swine locations, populations, and disease sampling between WS, the North Carolina Department of Agriculture & Consumer Services (NCDA&CS), and the North Carolina Wildlife Resources Commission (NCWRC).
    - Identify cost-sharing funding sources, including The Nature Conservancy and co-ops (e.g., peanut, soybeans).
    - Continue to provide high quality feral swine damage management services.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Established task force and focus areas.
        - Targeted feral swine removal efforts in top domestic pig production counties.
        - Established outreach activities and interactions, including presentations, with public regarding feral swine.
    - 2015
        - Performed damage management and disease sampling throughout North Carolina, primarily focused in the southeastern portion of the state where commercial swine operation density is highest and disease threats are most consequential. Other damage

management projects were undertaken in other regions to protect agricultural resources, threatened and endangered species, and human health and safety.
    - Initiated projects in Avery and Mitchell Counties to assist the Southern Appalachian Highlands Conservancy (SAHC), NCWRC, North Carolina State Parks, and U.S. Forest Service.
    - Initiated a project along the Virginia border to assist the U.S. Fish and Wildlife Service to control feral swine and reduce damage to sensitive marsh habitats and other natural resources.
    - Performed outreach activities with private and government entities regarding feral swine, including presentations at Smithfield Farms, Murphy Brown, The Wildlife Society, SAHC, and NCWRC.
- 2016
    - Secured a commitment from NCWRC to instigate a change in state legislation that prevented the use of aircraft to control feral swine – NCWRC successfully changed the law to allow for use of aircraft in the state.
    - Established a database for recording reports of feral swine locations and information.
    - Initiated three trapping workshops, one in each geographic region of the state.
- 2017
    - Conducted first aerial operation removing a significant proportion of the feral swine population in support of the elimination goal on the Barrier Islands and Currituck County.
    - Initiated first "Judas pig" project with three GPS collars on feral swine at Caswell Game Lands.
    - Assisted universities with disease studies related to feral swine – West Virginia University tick study and North Carolina Agriculture and Technology internal microbial study.
    - Performed outreach and public education by working with cooperative extension offices, state and federal entities, NGOs, and private landowners on the impacts of feral swine and the need to eradicate populations rather than promote them as a hunting resource.
- 2018
    - Implemented a new online mapping application based in ArcGIS with a mobile APP which includes a 10-km grid overlay to expand database population levels and distribution information to track the spread or decline of feral swine, and can be shared between agencies. Baseline indices of population came from: staff, candid critters: http://www.nccandidcritters.org/, and the NCWRC Human Wildlife Interaction Hotline (866-318-2401). This multi-organizational statewide outreach campaign will help increase communications and dispel misinformation as well as help report sightings and damage by citizens. This will be the tool to establish a rapid response system to react to reports of new sightings and introductions of feral swine in focus and elimination areas.

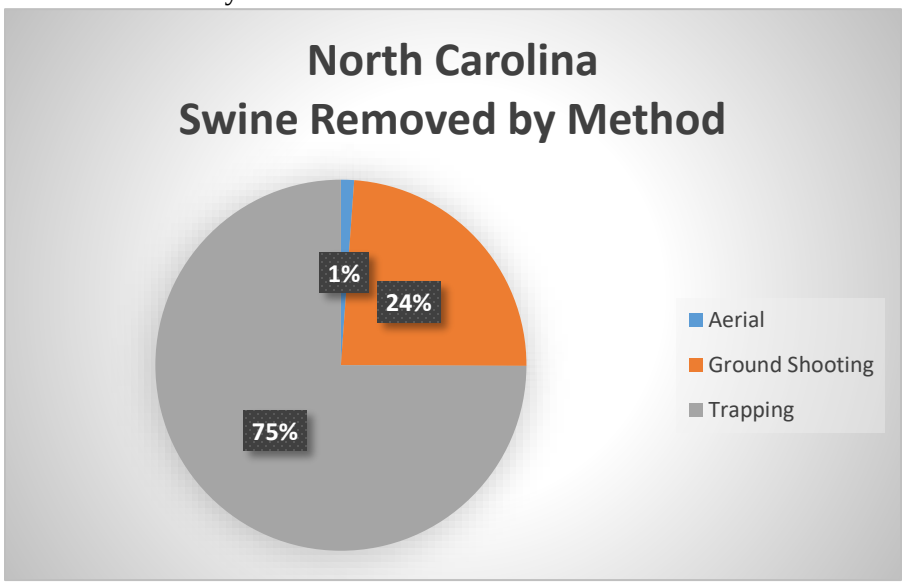


- Established MOUs with Eastern Band of Cherokee Indians and Coharie Indian Tribe.
- Implemented protocols and a damage data worksheet to document successes and provide a cost to benefit ratio towards reducing damages in collaboration with the informal NC Feral Swine Task Force.
- NCDA&CS and NCWRC initiated legislative actions/approaches to discourage feral swine as a hunting resource by creating a communications plan for outreach to the hunting community, including key messages. Additional objectives include: removing incentives to intentionally release feral swine by changing the legal status of feral swine hunting; prohibit the take of feral swine on lands owned, leased, or managed by NCWRC; work with the state legislature to pass legislation to decrease opportunities to pursue feral swine therefore decreasing incentives for intentional releases and legislation that places tougher penalties on individuals caught releasing or transporting feral swine; NCDA&CS to clarify and/or modify regulations regarding feral swine as needed to reduce the likelihood of transport; provide clarification of existing regulations in the educational outreach to law enforcement, prosecutors, and judges to aid enforcement efforts; develop a document that outlines existing regulations related to feral swine; create incentives for the public to report illegal transportation and release of feral swine like Operation Game Thief; work with local law enforcement and prosecutors to gain support for enforcing existing regulations; and initiate a NC Feral Swine Partnership Communication Plan.
- Informal task force working group with NCDA&CS, NCWRC, VS, and WS identified public affairs/public information officers from each organization to develop a public communication program and coordinate releases. NCDA&CS to develop a feral swine webpage and coordinating an educational booth in the swine barn with a display at the NC State Fair.

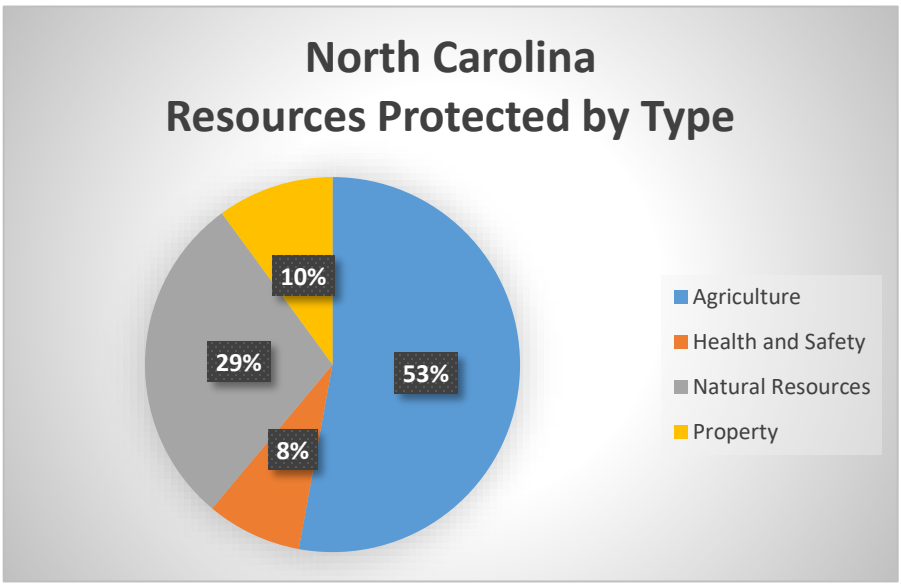
- Plans are underway to meet the state plan goal of developing a NC Feral Swine Partnership Communication Plan to make sure all partners are using the same messages.
- The collaboration between WS, North Carolina State University, University of North Carolina Wilmington, Western Carolina University, and NCWRC through the NC Chapter of TWS drafted a research funding proposal project titled, "One Health" Concept: Feral Swine Damage Management Research in North Carolina.
  Study Goals:
  1. Develop a model to accurately determine feral swine absence or presence within the local elimination projects in North Carolina.
  2. Develop methods to collect economic losses and averted damages by feral swine to determine a cost to benefit analysis.
  3. Develop methods to measure feral swine damage management successes of economic impacts and benefits.
  4. Conduct human dimension surveys to provide outreach to the hunting community to communicate why feral swine damage management is important in North Carolina.

- Future directions and goals related to feral swine management over the next five years:
  - NCWRC to maintain statewide distribution feral swine heat map.
  - NCDA&CS to work with the Governor to establish a formal NC Feral Swine Task Force, statewide mission statement with goals, and change definition of feral swine to eliminate "sporting" swine in administrative codes.
  - Continue to eradicate isolated populations of feral swine and reduce agricultural damages around commercial swine operations.
  - Develop communication plan between task force members.
  - Expand outreach plan to include more workshops and listening sessions to the public to educate the hunting community.
  - Develop strategic management plan to reduce financial incentives to the hunting community. NCWRC to take the lead similar to current coyote and alligator management plans.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$295,000	$25,000	$0	$320,000
2015	$295,000	$50,000	$0	$345,000
2016	$295,000	$79,631	$0	$374,631
2017	$303,850	$136,840	$9,000	$449,690
2018	$355,221	$373,850	$9,000	$738,071
Total	**$1,544,071**	**$665,321**	**$18,000**	**$2,227,392**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	24.3	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - USDA APHIS Veterinary Services
  - USDA Natural Resources Conservation Service
  - Fort Bragg/Pope Air Force Base
  - North Carolina Wildlife Resources Commission, Management
  - North Carolina Wildlife Resources Commission, Enforcement
  - North Carolina Department of Agriculture & Consumer Services
  - North Carolina State Parks
  - Local farm association
  - North Carolina Forestry Association
  - Southern Appalachian Highlands Conservancy
  - Local livestock association
  - Eastern Band of Cherokee Indians
  - Coharie Indian Tribe

North Dakota

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 2110 Miriam Circle, Suite A
    - City/State/Zip: Bismarck, ND 58501
    - Phone: 701-355-3300

- State task force: North Dakota Feral Swine Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - USDA APHIS Veterinary Services
        - North Dakota Board of Animal Health
        - North Dakota Game and Fish Department
        - North Dakota Department of Health
        - U.S. Fish and Wildlife Service
        - U.S. Forest Service
        - National Park Service

- Objectives:
    - Respond to reports of feral swine and implement elimination efforts if feral swine presence is confirmed in North Dakota according to the state response plan.
    - Continue meetings with the North Dakota Feral Swine Working Group to exchange information surrounding feral swine issues.
    - Improve infrastructure to aid in detection, monitoring, and removal of feral swine at low population levels.
    - Strengthen cooperative relationships with various organizations in Canada, including the University of Saskatchewan, Saskatchewan Crop Insurance Corporation, Moose Mountain Wild Boar Eradication Committee, and others to help understand and reduce risks associated with potential wild boar movements from Canada into the U.S.
    - Improve the information transfer to agriculture organizations and the general public regarding the negative consequences of feral swine as well as current laws in North Dakota regarding possessing, releasing, hunting, and trapping.
    - Increase information sharing about feral swine activities in surrounding states and provinces that may impact North Dakota.

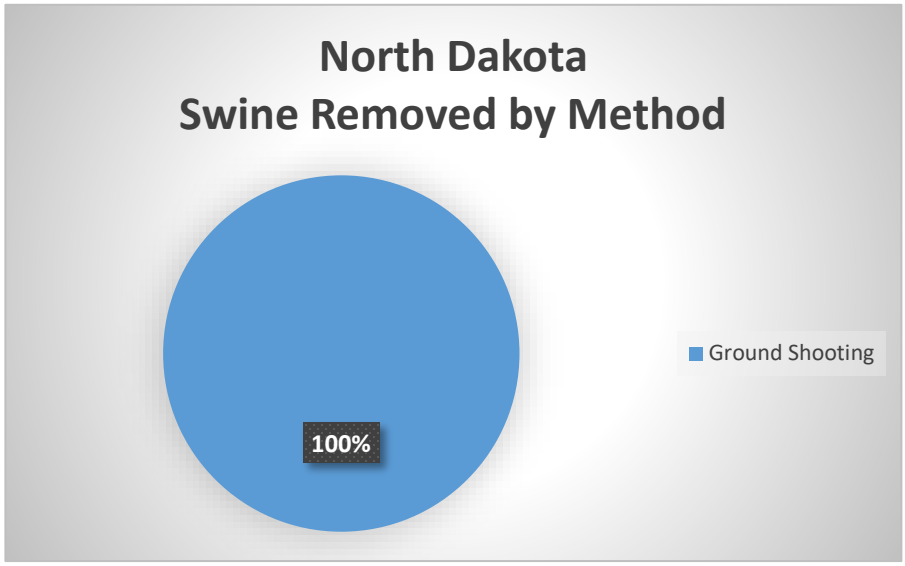
- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Began a two-year research project with the University of Saskatchewan.
        - Purchased research equipment for collaborative use in North Dakota and Canada.
        - Continued to coordinate feral swine issues with the multi-agency North Dakota Feral Swine Working Group.
    - 2015
        - Responded to reports of feral swine in North Dakota and implemented elimination efforts when presence was confirmed in cooperation with the North Dakota Board of Animal Health.
        - Continued the cooperative research project with the University of Saskatchewan and USDA APHIS VS to help understand risks associated with the potential wild boar movements from Canada into the U.S.

- 2016
  - Strengthened cooperative relationships with numerous agencies and organizations in Saskatchewan and promoted management efforts in Saskatchewan that would benefit feral swine management in the U.S.
- 2017
  - Worked collaboratively with the North Dakota Outdoors magazine on an article regarding feral swine issues to inform the public and encourage reporting.
  - Responded immediately to seven feral swine reports throughout North Dakota.
  - Continued a collaborative feral swine research with the University of Saskatchewan.
  - Conducted a feral swine management workshop in Canada with the Saskatchewan Crop Insurance Corporation.
  - Collaborated with the University of Saskatchewan and Canadian Wildlife Health Cooperative during feral swine recapture efforts in Canada to conduct necropsies and collect disease surveillance samples.
  - Met with personnel from the U.S. Department of Homeland Security regarding feral swine issues surrounding the Dakota Access Pipeline protest.
  - Provided information and education outreach at the 2017 USDA ARS Agricultural Producers Day.
- 2018
  - Attended eight water resource district meetings throughout North Dakota and gave presentations on feral swine elimination efforts in the state.
  - Met with state and federal personnel on the North Dakota Feral Swine Working Group to discuss annual activities.
  - Worked with the North Dakota Board of Animal Health and the Barnes County Sherriff's Department on a case where domestic swine were being allowed to live in a feral state.
  - Responded immediately to two feral swine reports (Pembina & Grand Forks County) where the animals at large were determined to be pot-bellied pigs.
  - Coordinated follow-up efforts with the North Dakota Board of Animal Health and the North Dakota Game and Fish Department after receiving a feral swine report in Dickey County where domestic swine escaped a Hutterite colony en route to a local butcher facility.
  - Two ND WS personnel attended the 2018 International Wild Pig Conference to stay abreast of research efforts and management actions regarding feral swine.

- Future directions and goals related to feral swine management over the next five years:
  - Continue to respond to reports of feral swine and implement elimination efforts if feral swine presence is confirmed in North Dakota according to the state response plan.
  - Continue meetings with the North Dakota Feral Swine Working Group to exchange information surrounding feral swine issues.
  - Continue monitoring advancements in technology that aid in detection, monitoring, and removal of feral swine at low population levels.
  - Maintain relationships with various organizations in Canada, including the University of Saskatchewan, Saskatchewan Crop Insurance Corporation, Moose Mountain Wild Boar Eradication Committee, amongst others, to help understand and reduce risks associated with potential feral swine movements from Canada into the U.S.
  - Improve the information transfer to agriculture organizations and the general public regarding the negative consequences of feral swine as well as current laws in North Dakota regarding possessing, releasing, hunting, and trapping.

- Increase information sharing about feral swine activities in surrounding states and provinces that may impact North Dakota.

- Feral swine removed by method:



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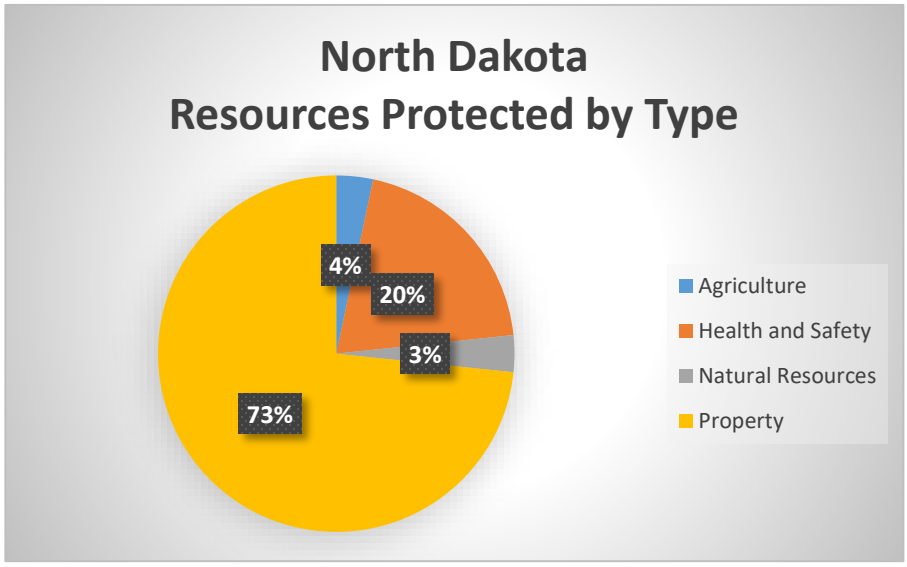


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$85,000	$0	$153,000
2015	$68,000	$0	$39,705	$107,705
2016	$68,000	$0	$39,073	$107,073
2017	$68,000	$0	$12,950	$80,950
2018	$68,000	$0	$0	$68,000
Total	**$340,000**	**$85,000**	**$91,728**	**$516,728**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	3.5	0	0

- Major cooperators:
    - USDA APHIS Veterinary Services
    - North Dakota Board of Animal Health
    - North Dakota Game and Fish Department
    - North Dakota Department of Health
    - U.S. Fish and Wildlife Service
    - U.S. Forest Service
    - National Park Service
    - University of Saskatchewan

Ohio

- FY18 funding level: 2
- Point of Contact: State Director
    - Address: 4469 Professional Parkway
    - City/State/Zip: Groveport, OH 43125
    - Phone: 614-993-3444

- State task force: Ohio Joint Agency Feral Swine Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - USDA APHIS Veterinary Services
        - Ohio Department of Natural Resources, Division of Wildlife
        - Ohio Department of Agriculture

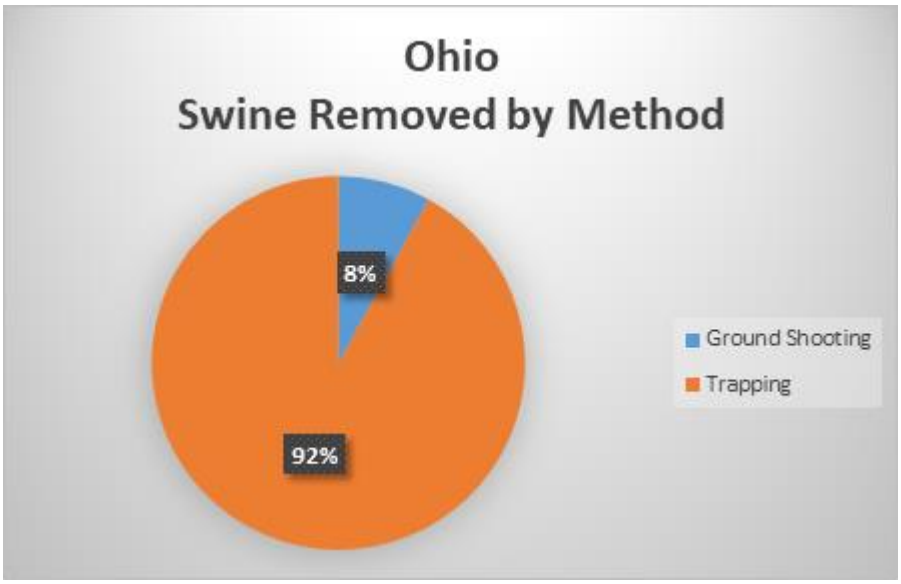
- Objectives:
    - Eliminate feral swine from the state.
    - Investigate all new reports in areas previously unoccupied by feral swine.
    - Eliminate feral swine in areas previously unoccupied and where feral swine pose a significant risk to commercial swine operations.
    - Eliminate feral swine in other areas previously unoccupied by feral swine but where natural resources and agricultural products, other than commercial swine, are to be protected.
    - Specifically target feral swine in areas where they have become established and the goal is to limit damage, control the population, and reduce the further spread of the species.
    - Collect samples from a minimum of 30 feral swine annually to support national disease surveillance efforts.
    - Utilize new technology and research to compliment elimination efforts as all opportunities arise.
    - Develop presentations and other outreach materials that remain consistent, clear, and easily understood by the general public.
    - Enforce existing laws and regulations prohibiting the movement of feral swine.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Conducted feral swine elimination activities under 29 cooperative service agreements, totaling 159,360 acres.
        - Conducted outreach: 32 personal consultations, eight instructional sessions, six radio/television appearances, and nine exhibits – totaling 4,110 participants; distributed 1,756 leaflets to the general public.
        - Added snares and aerial removal to the Ohio Department of Natural Resources, Division of Wildlife permit.
        - Investigated reports of 17 newly emergent populations.
    - 2015
        - Removed the last known feral swine from Lorain County.
        - Updated the Ohio Joint Agency Feral Swine Elimination Plan.
        - Secured over 1,000,000 acres of access for feral swine work.

- 2016
  - Verified agricultural damage decreased from $151,273 in FY15 to $8,696 in FY16. Primarily in Vinton County (but also statewide). Primary resource damaged was wetlands, but included field/sweet corn, soybeans, and hay fields.
  - Received Honorable Mention from USDA Forest Service 2016 Honor Awards for WS Wayne National Forest-Feral Swine Eradication Program.
- 2017
  - Assisted Ohio Department of Agriculture with the depopulation of feral swine in a quarantined hunting preserve.
  - Conducted two aerial crop damage reconnaissance operations utilizing Ohio Department of Natural Resources Division of Wildlife pilot and aircraft.
  - Conducted an evaluation of customer satisfaction with 52 cooperators in an effort to assess any new or existing feral swine damages and ensure transparency – the feedback was positive and provided insight to new damages to evaluate in future endeavors.
  - Obtained written concurrence from the Ohio Department of Natural Resources Division of Wildlife to implement foot snares as another tool for feral swine management.
- 2018
  - Began systematic approach in removing elimination zones in the southeastern part of the state.
  - Conducted aerial crop damage reconnaissance operations with USDA fixed-winged aircraft. All seven elimination zones, Tuscarawas County, and Adams County were surveyed during this operation.

- Future directions and goals related to feral swine management over the next five years:
  - Remove all seven eliminations zones from Ohio feral swine map when agreed upon by the Ohio Feral Swine Task Force.
  - Eliminate feral swine population in Adams County and emergent populations of feral swine in Pike and Tuscarawas counties.
  - Continue to reduce damage to key ecosystems such as wetland habitats due to high cost of restoration and protecting threatened and endangered species.

- Feral swine removed by method:



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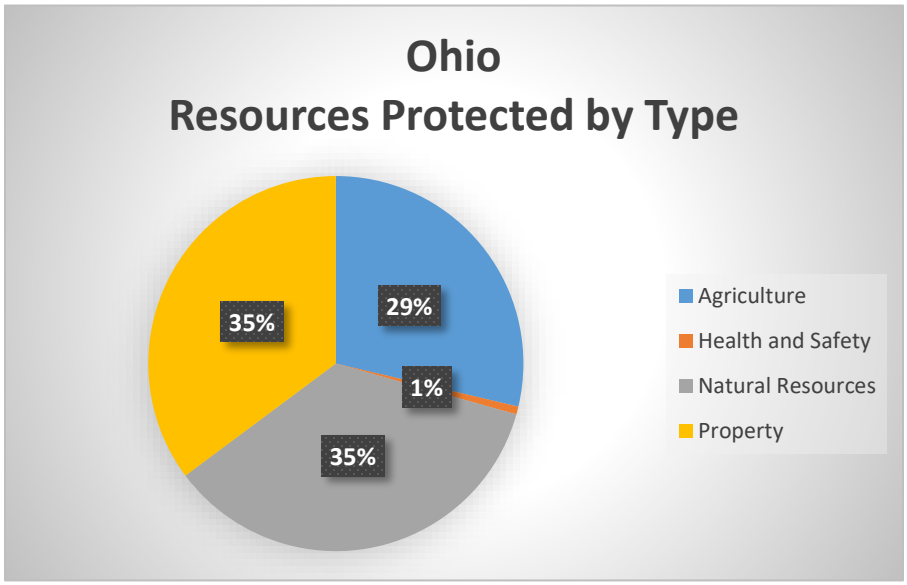


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$165,000	$100,000	$51,000	$316,000
2015	$165,000	$60,000	$150,000	$375,000
2016	$165,000	$100,000	$171,084	$436,084
2017	$165,000	$100,000	$264,675	$529,675
2018	$165,000	$100,000	$223,475	$488,475
Total	**$825,000**	**$460,000**	**$860,234**	**$2,145,234**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	4.7	19.4	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Ohio Department of Agriculture
    - Ohio Department of Health
    - USDA APHIS Veterinary Services
    - U.S. Forest Service
    - County Soil and Water Conservation Districts
    - Lorain County Metropolitan Parks
    - The Ohio State University
    - Ohio Department of Natural Resources: Division of Wildlife, Forests, and Parks
    - Local farm association
    - Edge of Appalachia Preserve
    - Buckeye Trail Association
    - Rural Action: Duck, Mud, Monday, Sunday, and Raccoon Creek Watershed Groups
    - Great Lakes Restoration Initiative
    - Lake Erie Allegheny Partnership
    - Local commodity association
    - Local game association

Oklahoma

- FY18 funding level: 5
- Point of Contact: State Director
    - Address: 2800 North Lincoln Boulevard
    - City/State/Zip: Oklahoma City, OK 73105
    - Phone: 405-521-4039

- State task force: Oklahoma Feral Swine Task Force
    - Member organizations:
        - Oklahoma Department of Agriculture Food and Forestry
        - Oklahoma Conservation Commission
        - Oklahoma Department of Wildlife Conservation
        - Local farm association
        - Sam Roberts Noble Foundation
        - USDA APHIS Wildlife Services

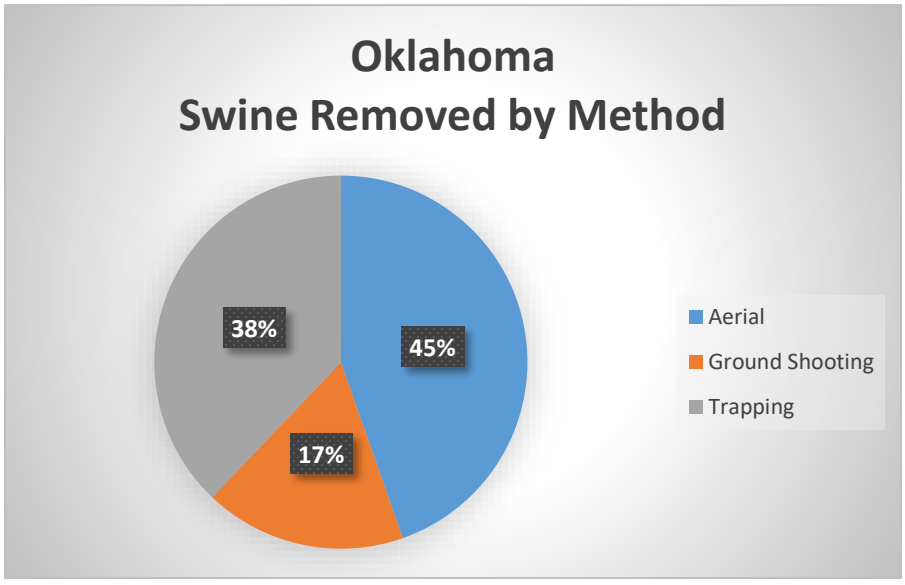
- Objectives:
    - Strengthen and enhance regulations dealing with illegal feral swine transport and possession – the overall goal being to eliminate transport of feral swine.
    - Accurately log and document damage estimates to property in Oklahoma.
    - Work toward eliminating 'sporting' opportunities of feral swine take.
    - Strengthen and enhance cohesiveness between government agencies and private landowners where the common goal is elimination.
    - Work towards increasing the trust between federal and state landholdings and private landowners experiencing damage from swine primarily residing on publically owned property.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Completed Feral Swine Environmental Assessment.
        - Strategic shift of personnel to feral swine management activities.
        - Increased and modernized tools and methodologies.
        - Increased and maximized efficiency of the aerial program.
    - 2015
        - Increased tribal involvement.
        - Proposal of a feral swine-free zone for Oklahoma.
        - First official stakeholder meeting.
    - 2016
        - Significant feral swine population reduction at Fort Sill Army Base.
        - Partnership from Oklahoma Soybean Board – provided funds for partial employee and/or material resources.
    - 2017
        - Continued surveillance of the Feral Swine Free Zone in the northwest counties of the state, primarily utilizing increasing aerial surveillance in that region of the state.
        - Worked in conjunction with the OK Soybean Board to increase the supply of traps and trap gates in the field.

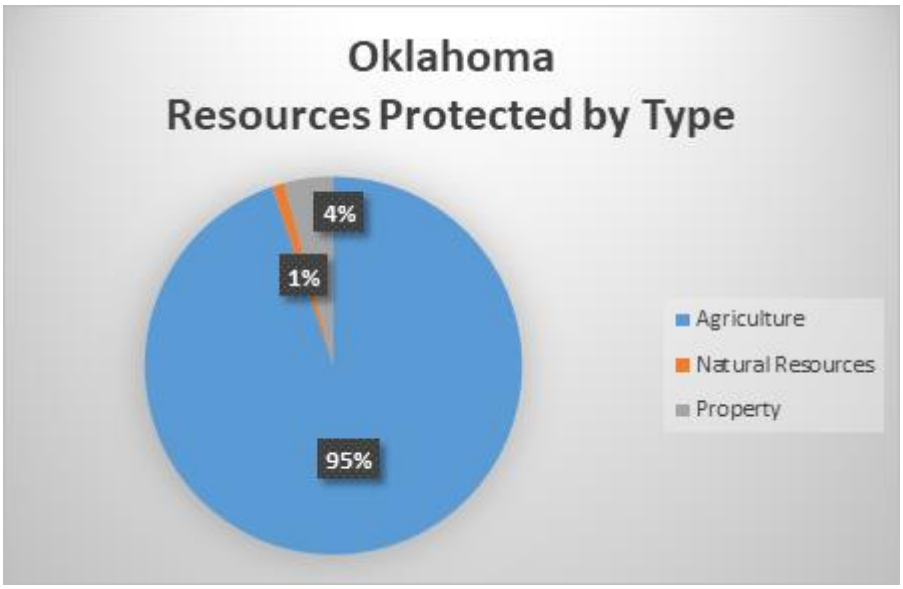
        - Implemented the use of seven ‘smart’ camera trapping systems, allowing personnel to remotely monitor traps without visiting the trap on a daily basis and trigger the trap remotely when the targeted group of feral swine is inside.
    - 2018
        - Declared Beaver, Texas, and Cimarron counties feral swine free.
        - Performed 39 feral swine management workshops across the state with significant tribal outreach.
        - Partnered with Oklahoma Department of Agriculture Food and Forestry and Oklahoma Conservation Commission to distribute loaner swine trap gates to all conservation districts in the state.
        - Implemented an additional 18 “smart” camera/trigger systems to the program’s trap inventory. These additional systems attributed a near 100% increase in trapped swine.
        - Performed a joint operation with the Texas program in providing aerial services to agricultural producers on either side of the Red River hoping to eliminate the transition of populations to the opposite side of the river from where operations are being conducted.

- Future directions and goals related to feral swine management over the next five years:
    - Complete further networking with stakeholders, cooperators, and commodity groups.
    - Work to completely eliminate the legality of transport and temporary containment of feral swine.
    - Establish a stronger, more vocal feral swine task force.
    - Attempt to begin a north to south elimination of populations from counties on the Kansas border and progressing southward.
    - Establish support to increase aerial activities in the state.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$325,000	$0	$200,000	$525,000
2015	$325,000	$0	$250,000	$575,000
2016	$325,000	$0	$298,000	$623,000
2017	$334,750	$44,615	$301,000	$680,365
2018	$334,750	$191,544	$334,000	$860,294
Total	**$1,644,500**	**$236,159**	**$1,383,000**	**$3,263,659**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	338.3	422.8	283.8	313	290.1
Fixed-wing	188.5	165.4	302.5	236	154.6

- Major cooperators:
  - Oklahoma Department of Agriculture, Food, and Forestry
  - Oklahoma Department of Wildlife Conservation
  - Noble Research Institute
  - Local commodity association
  - The Nature Conservancy
  - U.S. Army – Fort Sill
  - Local farm association

Oregon

- FY18 funding level: 3
- Point of Contact: State Director
    - Address: 6135 NE 80th, Suite A-8
    - City/State/Zip: Portland, OR 97218
    - Phone: 503-326-2346

- State task force: Oregon Feral Swine Task Force
    - Member organizations:
        - Oregon Department of Fish and Wildlife
        - Oregon Department of Agriculture
        - U.S. Bureau of Land Management

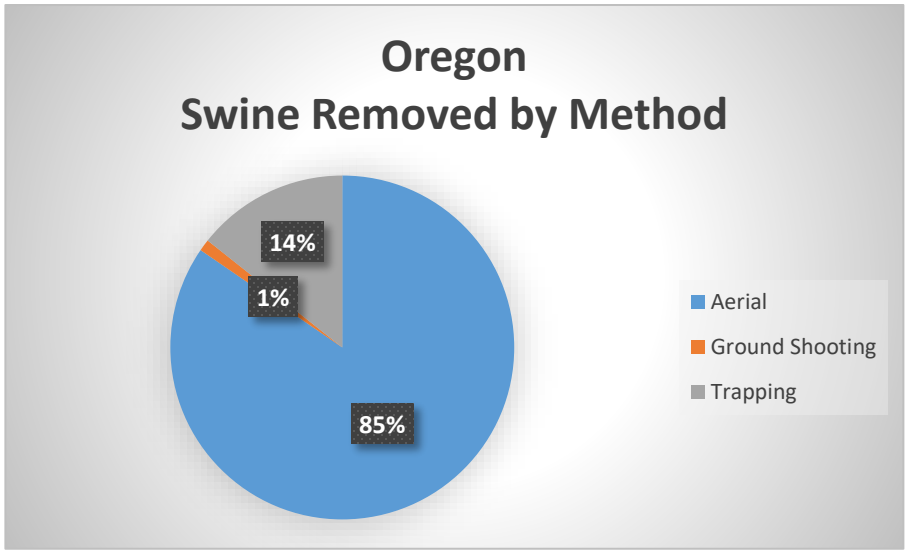
- Objectives:
    - Update Oregon Feral Swine Action Plan and continue efforts to eradicate feral swine from Oregon by implementing the Feral Swine Action Plan.
    - Ensure collaboration between stakeholders to be as effective as possible in order to eradicate feral swine.
    - Increase outreach efforts, including incorporating the NFSP display at several venues across the state.
    - Attend quarterly meetings of the Oregon Invasive Species Council (OISC), as well as maintain a presence on the OISC board.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Held the first multi-federal/state/local agency meeting to discuss feral swine eradication to direct and prioritize the use of incoming Feral Swine funding.
        - Initiated completing of a feral swine Environmental Assessment to meet NEPA requirements.
        - Held discussions with the WS Disease Program and the Oregon Department of Agriculture to expand disease sampling.
        - Purchased telemetry ear tags and a telemetry receiver to apply to sows that are netted from helicopters or captured in coral traps for creating "Judas pigs."
        - Conducted follow-up investigations on all reports called in to the "Squeal on Pigs" hotline.
    - 2015
        - Utilized technology to assist in swine eradication efforts, including radio ear tag on one Judas pig, remote monitoring trail cameras, and remote picture technology using cell phones.
        - Monitored feral swine eradication areas #1 and #2 as identified in the Oregon Feral Swine Action Plan.
    - 2016
        - Combined ground and aerial operations to effectively remove swine.
        - Hired a Feral Swine Coordinator.
    - 2017
        - Increased outreach efforts to include presentations on the impacts of feral swine at the Oregon Invasive Species Council, Cattle Growers Association, Sheep Growers Association, and Oregon Farm Bureau.

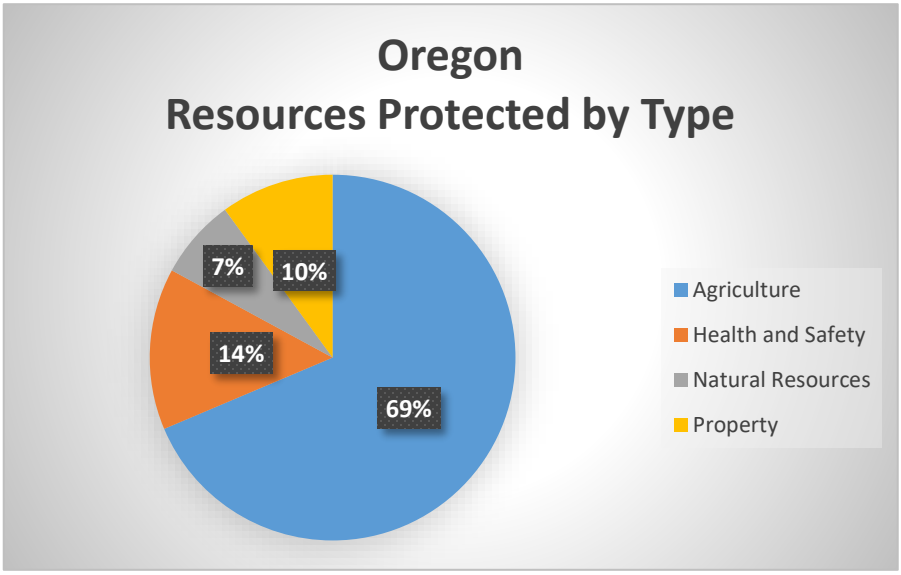
        - Strengthened relationships with other agencies within Oregon to increase awareness of the feral swine issue, aid in access to lands, and strengthen the need for reporting sightings.
    - 2018
        - Presented at the Oregon/Washington Wildlife Society Annual Meeting, Sheep Growers Association, and OISC.
        - Expanded detection areas to include areas known to have feral swine in the past.
        - Gave interviews to KOIN 6 and the Bend Bulletin.

- Future directions and goals related to feral swine management over the next five years:
    - We hope to achieve eradication within five years
    - Set up a detection network along the California border

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$165,000	$100,000	$166,161	$431,161
2015	$165,000	$85,000	$0	$250,000
2016	$165,000	$65,000	$0	$230,000
2017	$242,050	$52,000	$0	$294,050
2018	$242,050	$0	$0	$242,050
Total	**$979,100**	**$302,000**	**$166,161**	**$1,447,261**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	64.1	139.9	92	36	23
Fixed-wing	36	20.4	33	16.5	35

- Major cooperators:
    - Oregon Department of Agriculture
    - Oregon Department of Fish and Wildlife
    - Oregon Soil and Water Conservation Districts
    - Oregon Invasive Species Council
    - Bureau of Land Management
    - U.S. Forest Service
    - USDA APHIS Veterinary Services

Pennsylvania

- FY18 funding level: 2
- Point of Contact: State Director
    - Address: PO Box 60827
    - City/State/Zip: Harrisburg, PA 17106
    - Phone: 717-236-9451

- State task force: Pennsylvania Feral Swine Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Pennsylvania Game Commission
        - Pennsylvania Department of Agriculture
        - Pennsylvania Department of Conservation and Natural Resources
        - USDA APHIS Veterinary Services
        - Local commodity association
        - Western Pennsylvania Conservancy
        - Local farm association

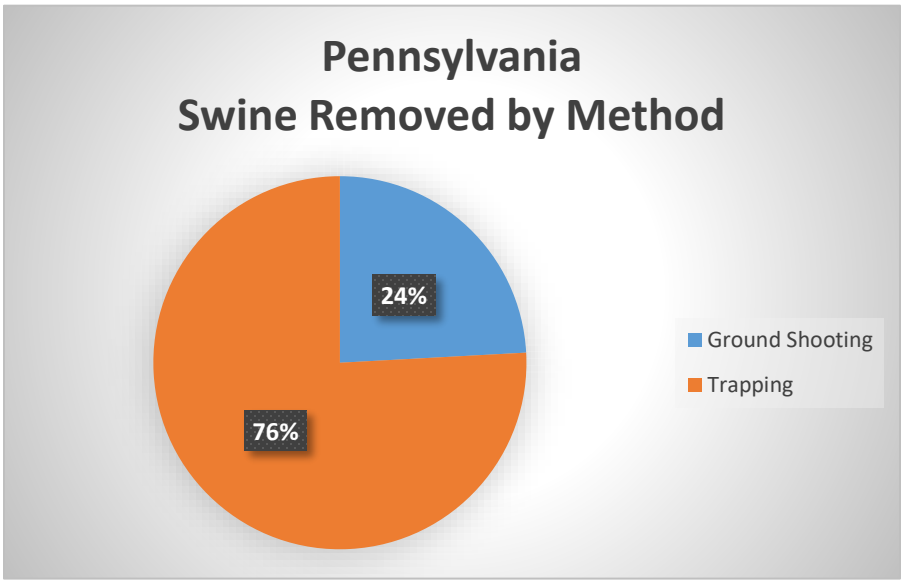
- Objectives:
    - To work collaboratively to develop strategies to control feral swine populations. This includes increased reporting of feral swine, management of known swine on the landscape, education programs to the public and government organizations, and disease surveillance.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Conducted several aerial flights with fixed-wing aircraft to locate feral swine within the state with assistance from the Tennessee WS Program.
        - Identified and surveyed existing feral swine shooting preserves within the state to get an idea on industry size and location.
    - 2015
        - Creation of database on shooting preserves and pasture-raised pork industry; site surveys conducted.
        - Increased coordination with the Pennsylvania Game Commission, allowing for faster response to incidents, removal of animals prior to establishment, education of local landowners, and collection of disease samples.
        - Experienced a significant increase in control activities and removal of feral swine, as well as increased statewide documentation of feral swine (ground and air) and response to newly identified problems – ability to make visits with historic sites on feral swine activity and determine if feral swine are still active in those areas; removal of some sites from active swine maps.
        - Educated other stakeholder groups on the issues of feral swine and sources of feral swine in Pennsylvania, including increased interactions with USDA NRCS and the Pennsylvania Association of Sustainable Agriculture (PASA) that promotes the pasture pig industry, a significant source of swine escapes.
        - Coordinated with USDA VS on foreign animal disease high-risk sites, including hog farms near feral populations, and the locations of shooting preserves and pasture farms.

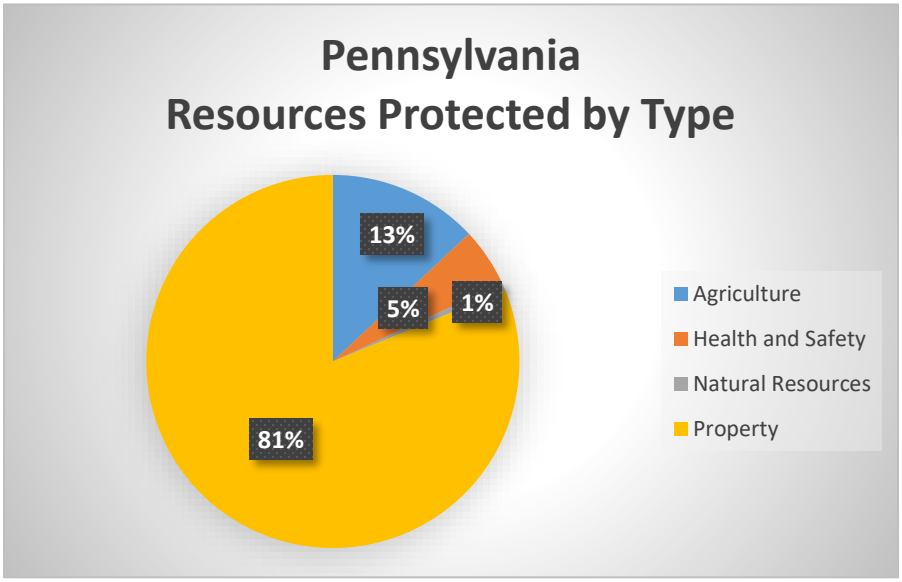
- 2016
  - Performed rapid response to three different swine shooting/breeding facility escapes – assessment and management actions taken and follow-up surveys and findings reports were disseminated to Pennsylvania Game Commission and Pennsylvania Department of Agriculture.
  - Created a Memorandum of Understanding with the Pennsylvania Department of Conservation and Natural Resources allowing for rapid response to swine sightings on 2.4 million acres of State Forest and State Park property.
  - Increased education of other stakeholder groups on the issues of feral swine and sources of feral swine in Pennsylvania, including increased interactions with Pennsylvania Department of Conservation and Natural Resources.
- 2017
  - Continued monitoring of historic feral swine population areas for damage, signs, and sightings.
  - Conducted a survey of feral swine shooting preserves to determine risks of escapees; surveillance and identifying cooperative contacts near those with the highest risks also took place.
  - Responded to feral swine reports on both public and private lands.
- 2018
  - Continued monitoring of historic feral swine population areas for damage, signs, and sightings.
  - Responded to feral swine reports on both public and private lands.
  - Continued monitoring of shooting and breeding facilities to ensure swine depopulation after closure or that swine have not escaped from high risk operations.
  - Signed Work Initiation Document (WID) which allows for USDA WS to access over 1.5 million acres of State Game lands owned by the Pennsylvania Game Commission.
  - Continued education programs to the public and stakeholder groups on feral swine, specifically targeting local groups where feral swine have been identified in the past to help increase reporting and awareness.

- Future directions and goals related to feral swine management over the next five years:
  - Continue to respond to feral swine reports by the public and cooperating agencies.
  - Increase surveys in historic and suspected feral swine areas to determine status of feral swine and ultimately increase area of confirmed elimination.
  - Continue education programs, including targeting of local communities and groups providing education on reporting of feral swine and identification of swine damage.
  - Revisit feral swine shooting facilities to identify those that are no longer operating and identify any new facilities that have become established.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$165,000	$0	$70,000	$235,000
2015	$165,000	$0	$0	$165,000
2016	$165,000	$80,000	$0	$245,000
2017	$165,000	$80,000	$0	$245,000
2018	$165,000	$80,000	$0	$245,000
Total	**$825,000**	**$240,000**	**$70,000**	**$1,135,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Pennsylvania Department of Agriculture
    - Pennsylvania Game Commission
    - Pennsylvania Department of Conservation and Natural Resources
    - Local commodity association
    - Western Pennsylvania Conservancy
    - PennAg Industry Association
    - Local farm association

Puerto Rico

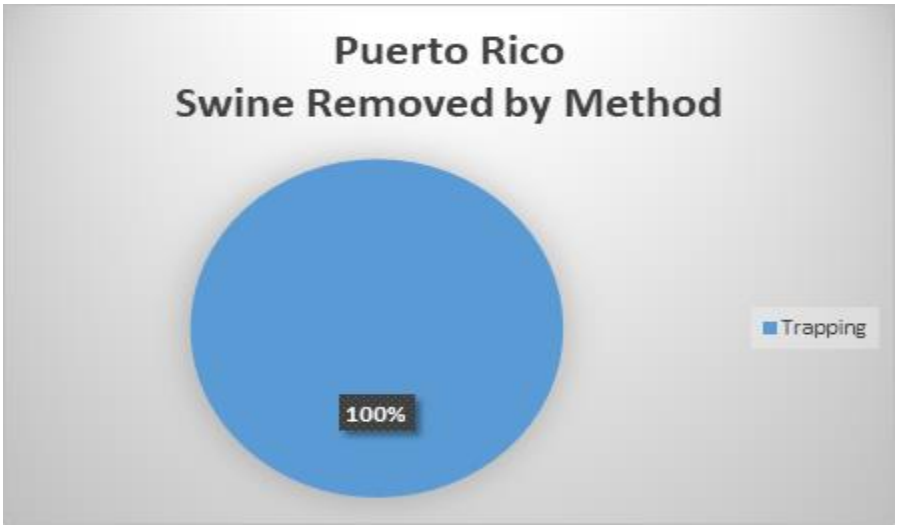
- FY18 funding level: Territory funding
- Point of Contact: State Director (Alabama)
    - Address: School of Forestry and Wildlife, 602 Duncan Drive
    - City/State/Zip: Auburn University, AL 36849
    - Phone: 334-844-5670

- State task force: Not established at this time.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Established feral swine program.
        - Worked with Puerto Rico Department of Natural and Environmental Resources (PR DNER), USDA VS.
    - 2015
        - Removed sufficient numbers of feral swine to allow farmers to replant fields and/or maintain farming.
    - 2016
        - Assisted subsistence farmers with feral swine damage in Aguas Buenas.
        - Eliminated agriculture damage to Aguas Buenas area.
    - 2017
        - Moved feral swine removal operations to Comerio to assist additional farmers with damage.
        - Feral swine program impacted by Hurricane Maria.
    - 2018
        - Continued removal operations to reduce agricultural damage to subsistence farmers.
        - Established additional feral swine position to further reduce swine damage.

- Future directions and goals related to feral swine management over the next five years:
        - Increase funding to allow for increased feral swine personnel.

- Feral swine removed by method:



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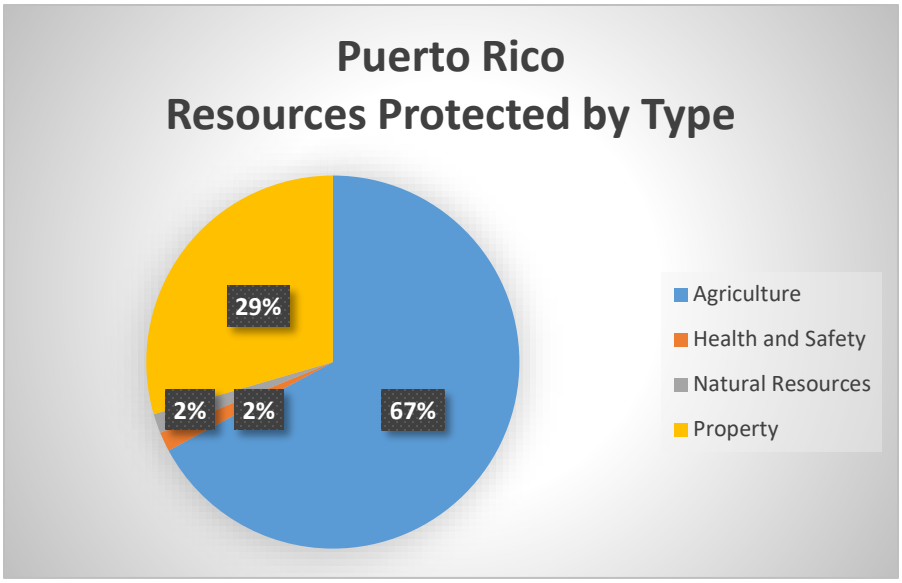


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$125,000	$0	$25,000	$150,000
2015	$110,000	$0	$25,000	$135,000
2016	$100,000	$0	$25,000	$125,000
2017	$125,000	$0	$25,000	$150,000
2018	$125,000	$0	$25,000	$150,000
Total	**$585,000**	**$0**	**$125,000**	**$710,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Puerto Rico Department of Natural and Environmental Resources
  - USDA APHIS Veterinary Services
  - Island Conservation

South Carolina

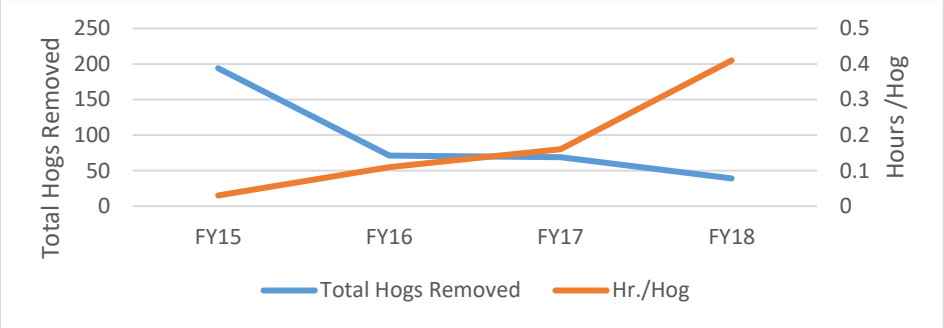
- FY18 funding level: 4
- Point of Contact: State Director
    - Address: 400 Northeast Drive, Suite L
    - City/State/Zip: Columbia, SC 29203
    - Phone: 803-786-9455

- State task force: South Carolina Wild Hog Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - U.S. Forest Service
        - National Park Service
        - Clemson University
        - Clemson University Livestock Poultry Health
        - Clemson University Cooperative Extension
        - South Carolina Department of Natural Resources
        - U.S. Fish and Wildlife Service
        - Savannah River National Laboratory, Savannah River Nuclear Solutions
        - University of Georgia, Savannah River Ecology Lab
        - USDA APHIS Veterinary Services
        - Local farm association
        - Lexington Country Soil and Water Conservation District
        - South Carolina Department of Agriculture
        - South Carolina State Parks and Recreation

- Objectives:
    - Develop and issue statewide guidance and planning documents.
    - Support and oversee the ongoing feral swine population survey, monitoring, and assessment work in South Carolina.
    - Conduct and prepare a statewide risk assessment on feral swine in South Carolina associated with the population expansion of these animals in existing areas, as well as range expansion into new or heretofore unoccupied areas of the state.
    - Support legislative actions associated with feral swine in South Carolina.
    - Develop, conduct, and support public education and outreach associated with feral swine.
    - Develop a statewide plan for managing feral swine in South Carolina.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Increased the number of cooperators requesting aerial removal services to reduce localized feral swine populations.
        - Initiated a feral swine eradication program on a barrier island; intense monitoring using trail cameras and track plots.
        - Initiated a genetic analysis study looking at feral swine taken on the mainland and those taken on an adjacent barrier island to determine if they are of the same lineage.
        - Initiated work on state and federal property to reduce damage to natural resources, historic sites, agriculture and timber, and threatened and endangered species.
        - Partnered with Clemson University on a feral swine trap research project and perceived damage estimates for the state.

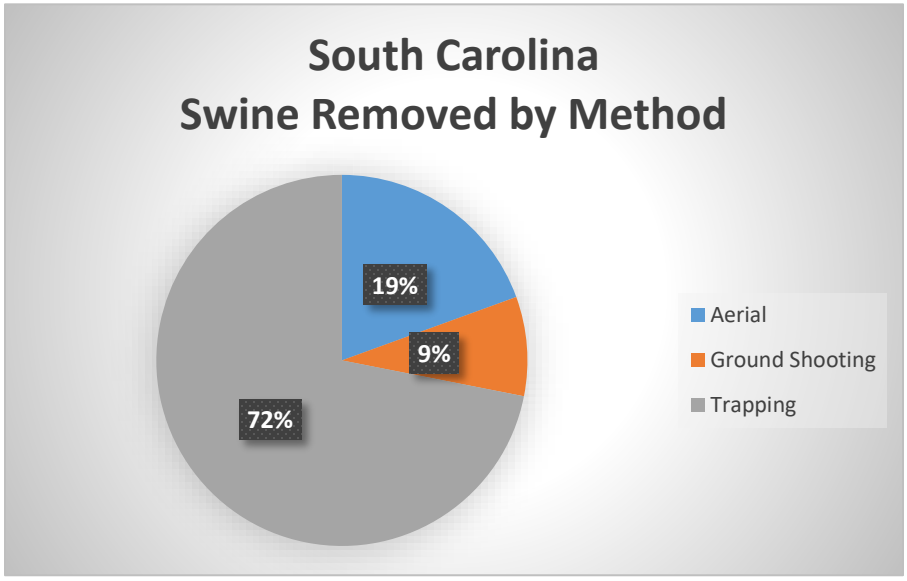
- 2015
  - Showed a reduction in the feral swine population on the North Island special project.
  - Initiated a pilot project to reduce agricultural damage in Anderson County.
  - Developed partnerships with state and federal agencies to reduce feral swine problems or augment existing programs.
- 2016
  - Increased acres protected via enhanced cooperator support and increased aerial removal.
  - Eradication completed on the North Island special project.
- 2017
  - Entered into an agreement with Berkeley Soil and Water Conservation District to assist local farmers and property owners with feral swine damage management.
  - Increased aerial operation efforts, implemented VHF/GPS collar to a "Judas pig" to define travel corridors and sounder elimination via shooting, undertook night removal operations for the Jehossee Island Local Eradication Project.
  - Increased acres protected and provided assistance to low income rural landowners neighboring Congaree National Park by implementing a local project.
- 2018
  - Initiated effort through the SC Wild Hog Task Force and Farm Bureau to close several loopholes and increase fines regarding the states feral swine transportation legislation.
  - Jehossee Island – Time/Unit Effort. Noticeable decrease in feral swine taken indicating reduction in overall population:



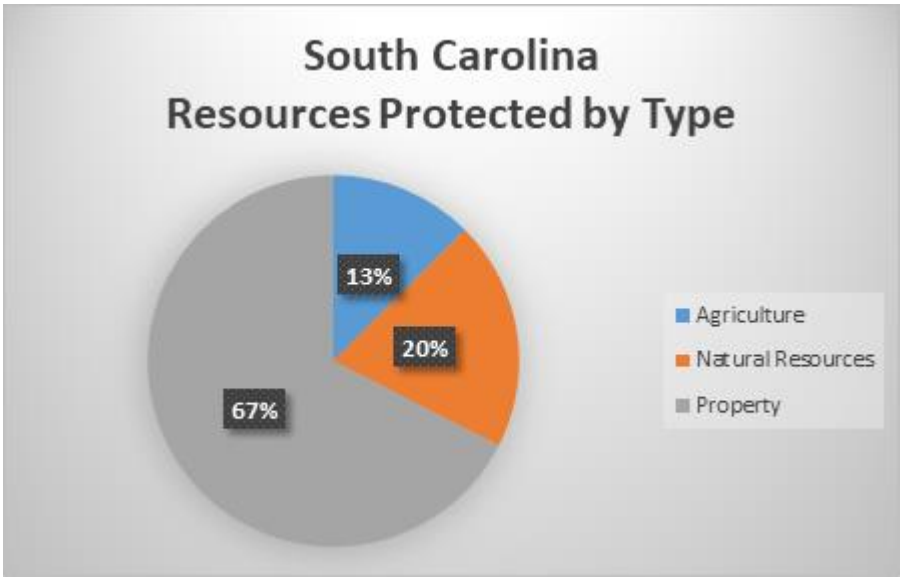
  - Expanded trapping to new areas on Forest Service's Enoree District and adjacent private property.

- Future directions and goals related to feral swine management over the next five years:
  - Increase cooperative funding.
  - Increase overall feral swine budget and hire one-two additional biological science technicians.
  - Increase amount of acreage flown via UAV for damage assessment purposes.
  - Increase services to farmers to decrease damage to agriculture, property, and natural resources.
  - Implement GIS software for data collection statewide.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$295,000	$72,500	$34,960	$367,500
2015	$295,000	$76,000	$186,678	$557,678
2016	$295,000	$30,796	$95,629	$421,425
2017	$303,850	$157,500	$196,008	$657,358
2018	$303,850	$213,000	$207,042	$723,892
Total	**$1,492,700**	**$549,796**	**$685,357**	**$2,727,853**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	17.1	22.9	40.9	58.5	59.9
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - South Carolina Department of Natural Resources
  - National Park Service
  - U.S. Forest Service
  - South Carolina Parks and Recreation
  - Clemson University
  - Clemson University Extension Service
  - Local farm associations
  - Savannah River Ecology Lab
  - South Carolina Department of Agriculture
  - The Belle W. Baruch Foundation
  - Berkeley Soil and Water Conservation District

Tennessee

- FY18 funding level: 3
- Point of Contact: State Director
    - Address: 537 Myatt Drive
    - City/State/Zip: Madison, TN 37115
    - Phone: 615-736-5506

- State task force: Wild Hog Eradication Action Team (WHEAT)
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Tennessee Wildlife Resources Agency
        - Tennessee Department of Agriculture
        - Local farm association
        - University of Tennessee Cooperative Extension
        - Tennessee Wildlife Resources Foundation
        - Tennessee Department of Environment and Conservation
        - Tennessee Department of Health
        - Local commodity association
        - Tennessee Wildlife Federation
        - Local livestock associations
        - The Nature Conservancy
        - Tennessee Ornithological Society
        - Tennessee Association of Conservation Districts
        - Foothills Land Conservancy
        - University of Tennessee Institute of Agriculture
        - National Park Service, Great Smoky Mountain National Park
        - USDA National Resources Conservation Service
        - Quality Deer Management Association
        - Local game association
        - Middle Tennessee Agriculture Club
        - Tennessee Chapter of The Wildlife Society

- Objectives:
    - WHEAT: to eradicate feral swine from Tennessee by eliminating incentives to illegally translocate feral swine, creating effective means of feral swine control, and conducting adequate outreach.
    - WHEAT Steering Committee: to provide guidance, recommendations, and general direction to the 24-member WHEAT Task Force.
    - Roan Highlands: coordinate feral swine control measures for the greater Roan Highlands in Tennessee and North Carolina.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - The WHEAT group continued to provide outreach and technical assistance and developed and distributed a feral swine video.

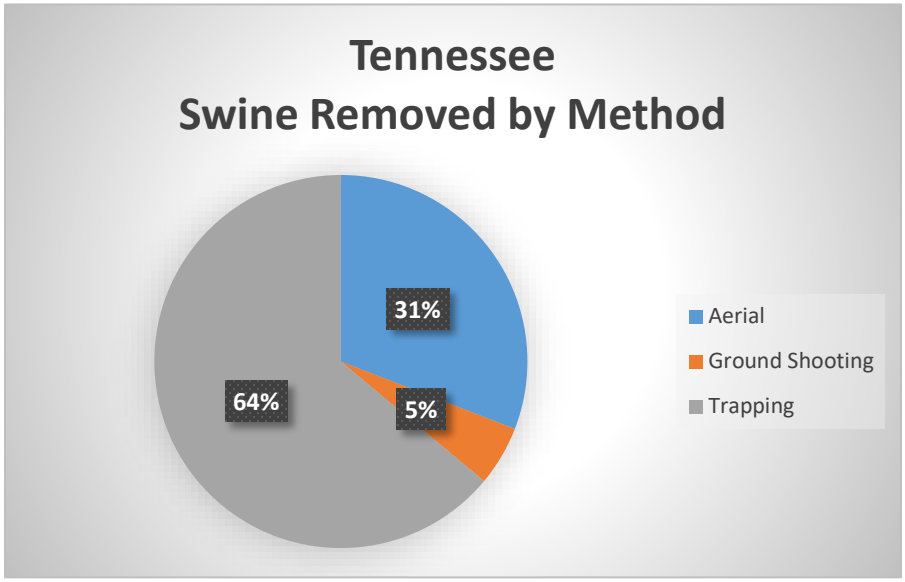
- Initiated direct control measures and aerial operations to manage feral swine populations.
- Coalition building and outreach efforts initiated.

- 2015
  - Utilized the WHEAT group to defeat proposed legislation (SB0702/HB0611) that would have created incentives for feral swine hunting with dogs and potentially led to greater feral swine populations and increased agricultural damages.
  - Initiated a research project with the University of Tennessee and other WHEAT partners to assess feral swine damages in Tennessee.
  - Reduced the majority of the feral swine population in Sumner and Lake Counties.
  - Initiated widespread surveillance activities (aerial and ground) in McMinn and Hancock counties.
  - Initiated population reduction activities in McMinn and Hancock counties.
- 2016
  - Completed outreach efforts on the Tennessee/Kentucky/Virginia border, including postcard mailings to 66,702 residents on the Tennessee border; completed aerial survey damage and a population estimate on approximately 1.9 million acres along the border project.
  - Managed the aviation resources for feral swine management in the Eastern Region.
  - Virtually eliminated the Sumner and Wilson County feral swine populations.
  - Reduced the majority of the feral swine population in Hancock and Lake Counties.
  - Increased widespread surveillance activities (aerial and ground) in McMinn and Hancock counties.
  - Updated our state map associated with our county feral swine status protocol with new status for Sumner and Lake Counties.
- 2017
  - Identified, located, and eliminated the vast majority of the feral swine at the Land Between the Lakes National Recreation Area.
  - Conducted numerous aerial and ground surveillance efforts combined with Virginia WS and combined outreach efforts in the Tri-State Project area of Tennessee, Kentucky, and Virginia to confirm feral swine activity was limited to a single population in Hancock County.
  - Increased widespread surveillance activities (ground and aerial) in numerous areas: conducted aerial surveillance for feral swine population detection and feral swine damage assessments on approximately 4.5 million acres of private and public land in 11 states in the Eastern Region; conducted feral swine aerial removal operations on nearly 2 million acres of public and private land in Eastern Region states.
  - Hosted seven feral swine damage management workshops in collaboration with various partners, including the University of Tennessee Cooperative Extension, U.S. Forest Service, and Tennessee Wildlife Resources Agency.
- 2018
  - Eliminated feral swine in Sumner County – no reports of swine or damage in three years.
  - Reduced feral swine populations in Hancock, Jackson, Bledsoe, and McMinn counties.
  - Changed the status of Wilson, Lake, Lincoln, Madison, and Meigs counties to detection status.
  - Conducted numerous aerial and ground surveillance efforts combined with VA WS and combined outreach efforts in TN, KY, and VA to confirm feral swine activity limited to a single population in Hancock County.

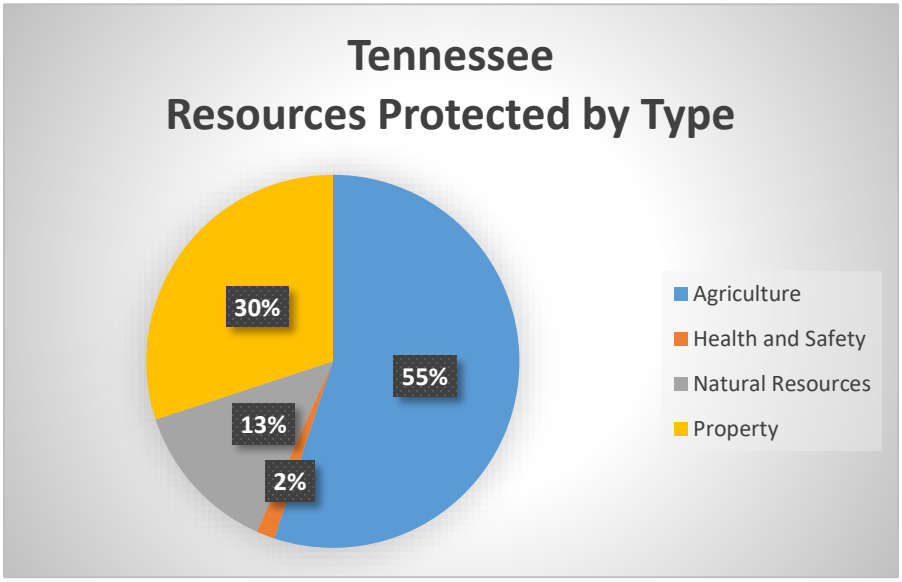
- Increased widespread surveillance activities (aerial and ground) in McMinn, Bledsoe, Jackson, and Hancock counties.
- Increased population reduction activities in McMinn, Bledsoe, Jackson, and Hancock counties.
- Increased outreach efforts in Hancock, Sumner, Meigs, Bledsoe, and McMinn counties.
- Continued monitoring and/or control efforts in each of the 14 counties that were previously funded through this request.
- Increases statewide take by 109% in the first three quarters of FY18.
- Re-engaged Fort Campbell Army Base.

- Future directions and goals related to feral swine management over the next five years:
  - Eradicate feral swine on land between the Lakes National Recreation Area.
  - Eradicate feral swine on Fort Campbell Army Base.
  - Complete a countywide aerial survey for the entire state.
  - Eliminate feral swine in the following counties: Grundy, Montgomery, Wilson, Smith, and Stewart.
  - Continue to implement the TN county feral swine protocol, in an effort to eradicate feral swine from all counties with in TN.
  - Increase aerial operations in support of the TN county feral swine protocol.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$235,000	$40,000	$29,000	$304,000
2015	$235,000	$62,000	$30,000	$327,000
2016	$235,000	$142,671	$40,000	$417,671
2017	$242,050	$165,825	$42,500	$450,375
2018	$242,050	$205,862	$57,800	$505,712
Total	**$1,189,100**	**$616,358**	**$199,300**	**$2,004,758**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	17.1	73.5	75.2	38.5	210.3
Fixed-wing	0	0	1.4	0	0

- Major cooperators:
  - Tennessee Wildlife Resources Agency
  - U.S. Forest Service
  - U.S. Fish and Wildlife Service
  - Tennessee Department of Agriculture
  - Tennessee Department of Environment and Conservation
  - University of Tennessee Cooperative Extension
  - Local farm association

Texas

- FY18 funding level: 5
- Point of Contact: State Director
    - Address: PO Box 690170
    - City/State/Zip: San Antonio, TX 78269
    - Phone: 210-472-5451

- State task force: Texas Feral Hog Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Texas Natural Resources Conservation Service/Texas Invasive Species Council
        - Texas Department of Agriculture
        - Texas A&M AgriLife Extension Service
        - Local farm association
        - Local commodity associations
        - Texas Animal Health Commission
        - Texas Wildlife Association
        - North Texas Council of Governments

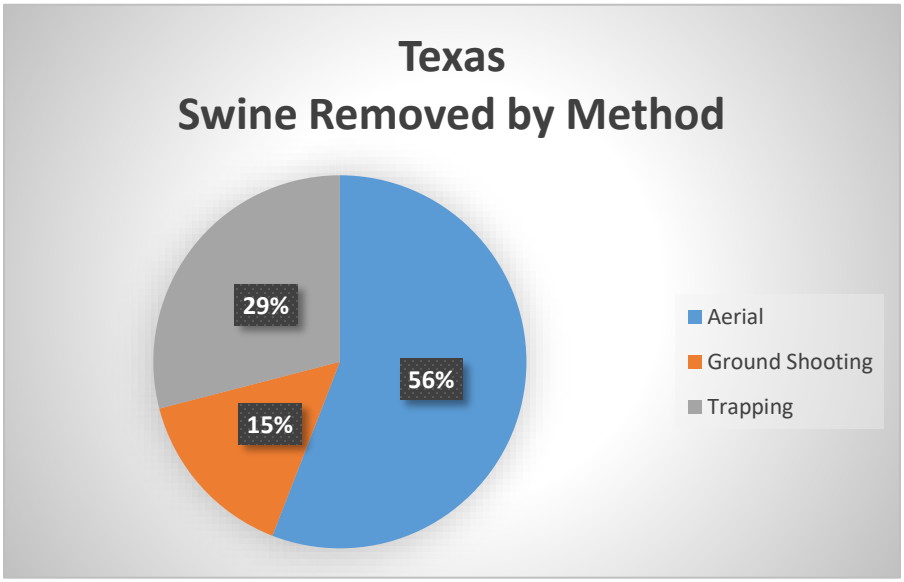
- Objectives:
    - Reduce damage through direct management and outreach to private landowners.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Expanded surveillance for feral swine populations along the New Mexico border with operation control to support the New Mexico eradication effort.
        - Increased supply of traps, night vision, and monitoring equipment.
        - Engaged with Texas A&M University-Kingsville regarding interns.
        - Conducted 844 outreach events, totaling more than 19,000 participants and 5,421 brochures distributed.
    - 2015
        - Recruited new employees from underrepresented groups through work details.
    - 2016
        - Participated in international outreach and coordination to collaborate on research projects.
    - 2017
        - Held over 1,400 outreach events to public and private entities to increase awareness of feral swine and the damage they cause.
        - Assisted four other states with feral swine management.
        - Supported international collaboration with three workshops for Mexican landowners and Mexican government entities.
        - Presented feral swine contraceptive needs at the Humane Society of the United States-sponsored Contraceptives in Wildlife Conference.
    - 2018
        - Held 1,491 outreach events reaching 8,988 individuals. Distributed 1,606 leaflets on feral swine and damage and diseases.
        - Worked more than 5 million acres removing more than 28,000 feral swine in Texas.

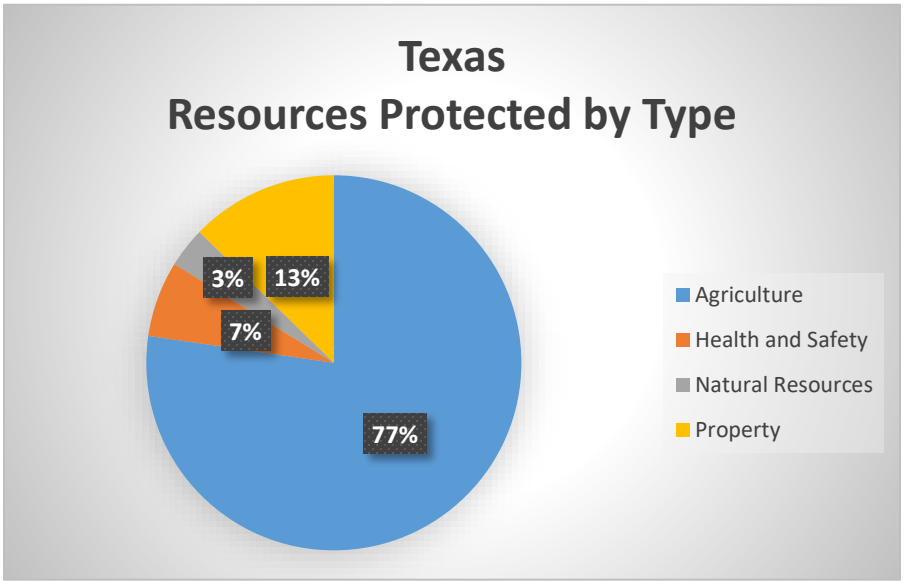
- Supported four other states with helicopter and ground operations.
- Sampled over 550 feral swine, collecting more than 1,800 total samples.

- Future directions and goals related to feral swine management over the next five years:
  - Continue damage abatement and look for opportunities to eradicate on a watershed basis.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$325,000	$200,000	$2,829,000	$3,354,000
2015	$325,000	$160,000	$2,650,800	$3,135,800
2016	$325,000	$200,000	$3,100,000	$3,625,000
2017	$357,500	$300,000	$3,320,000	$3,977,500
2018	$357,500	$440,000	$3,485,000	$4,282,500
Total	**$1,690,000**	**$1,300,000**	**$15,384,800**	**$18,374,800**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	1,057.1	999.5	1,169.3	926.3	903.6
Fixed-wing	409.3	337.1	530.8	306.8	380.5

- Major cooperators:
  - Texas A&M University – AgriLife Extension Service
  - Texas Wildlife Damage Management Association
  - Local livestock association
  - Local commodity associations
  - Texas Department of Agriculture
  - Texas Adjutant General's Office
  - Department of Defense – Naval Air Station Orange Grove
  - 120 County Commissions

U.S. Virgin Islands

- FY18 funding level: Territory funding
- Point of Contact: State Director (Alabama)
    - Address: School of Forestry and Wildlife, 602 Duncan Drive
    - City/State/Zip: Auburn University, AL 36849
    - Phone: 334-844-5670

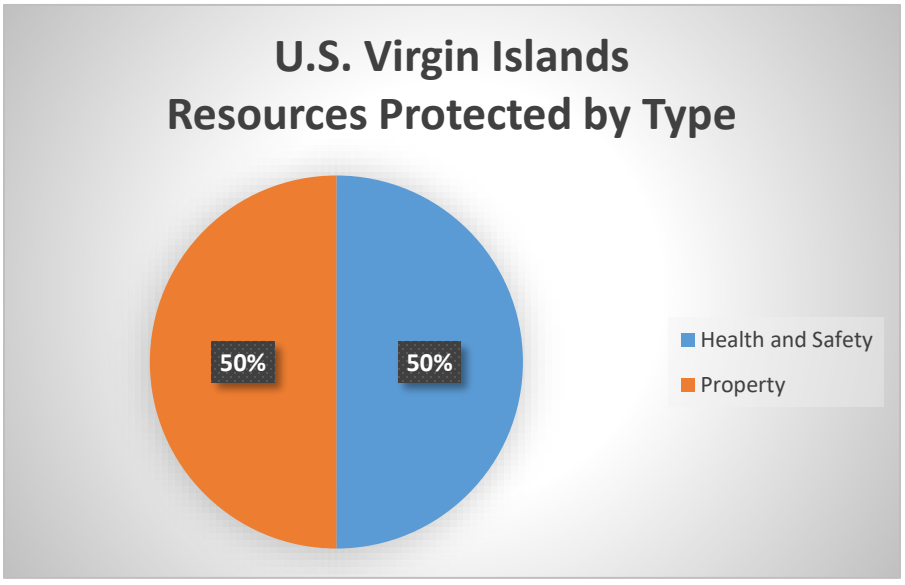
- State task force: Not established at this time

- Objectives:
    - Reduce feral swine damage to agricultural crops and natural resources.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2017
        - Sporadic removal of local populations of feral swine on St. John Island.
        - Assisted the National Park Service with removal of feral swine on federally managed lands.
    - 2018
        - First year of federal feral swine program.
        - Procuring and transporting 5,000 pounds of feral swine equipment to the Caribbean.
        - Establishing contacts and work initiation documents.
        - Developing relationships with USPS, USFWS, USVI Department of Agriculture, and USVI DNR.

- Future directions and goals related to feral swine management over the next five years:
    - Assist landowners and U.S. Government/Territorial agencies with feral swine damage reduction.
    - Build cooperative programs with U.S. Government/Territorial agencies.

- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2017	$0	$0	$10,000	$10,000
2018	$125,000	$0	$30,000	$155,000
Total	**$125,000**	**$0**	**$40,000**	**$165,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

Utah

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 1860 West Alexander Street, Suite A
    - City/State/Zip: West Valley City, UT 84119
    - Phone: 801-975-3315

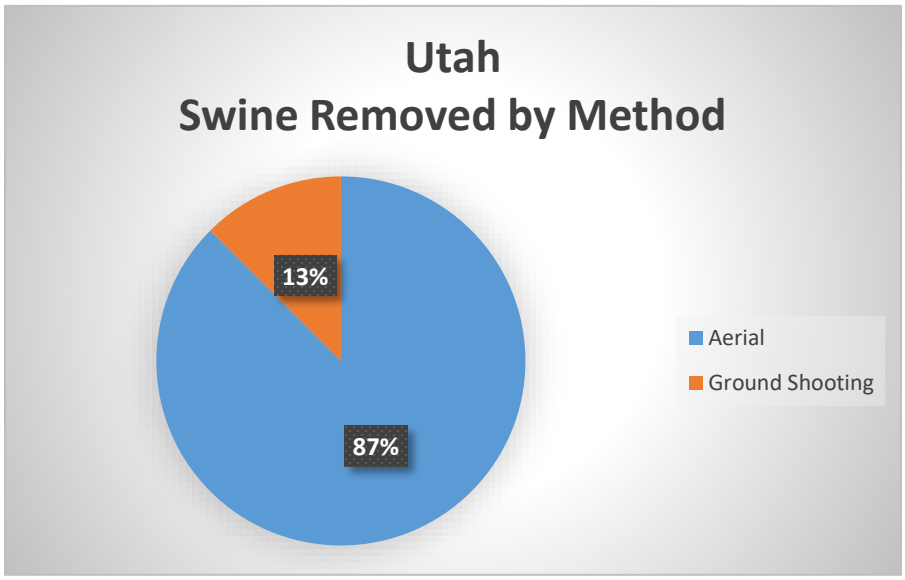
- State task force: Utah Feral Swine Working Group
    - Member organizations:
        - Utah Department of Agriculture and Food
        - Utah Division of Wildlife Resources
        - USDA APHIS Wildlife Services

- Objectives:
    - Identify and monitor isolated populations.
    - Reduce and eliminate known populations, when possible.
    - Educate the general public of the damage feral swine can cause and solicit their help in reporting sightings.
    - Continue monitoring in areas of removal to confirm removal was successful.

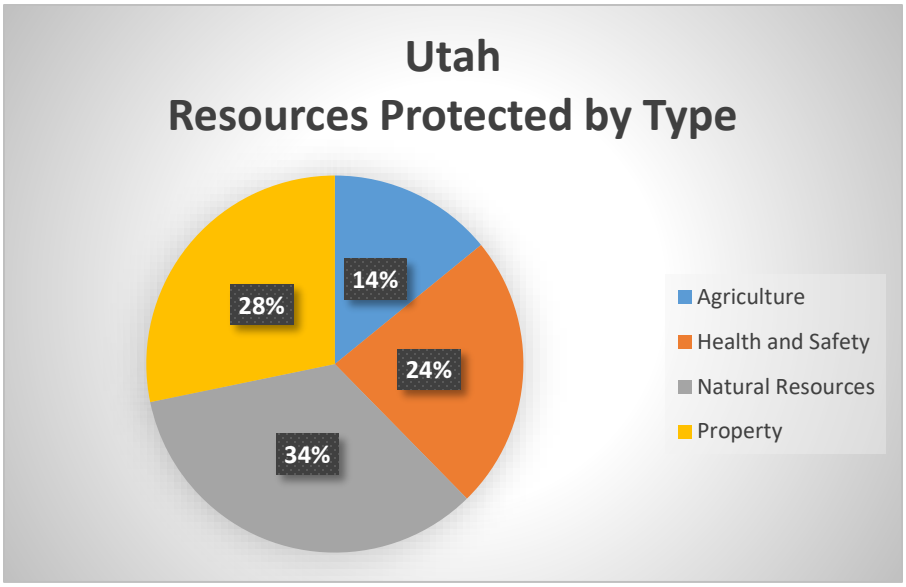
- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Confirmed feral swine removal from central Utah and conducted surveillance to determine whether the population was established or if the incident was isolated.
        - Coordinated efforts with Nevada and Arizona to conduct surveillance and removal of feral swine known to inhabit the Arizona Strip area of southwestern Utah, northwestern Arizona, and southeastern Nevada.
    - 2015
        - Removed a small isolated population of feral swine from Fremont Island – monitored closely for reintroduction.
        - Confirmed the absence of feral swine from Millard County.
    - 2016
        - Removed feral swine from the Ogden Bay/Fremont Island area where wild boar were released for hunting purposes.
    - 2017
        - Continued monitoring for feral swine in areas where feral swine have previously been removed through aerial surveys.
    - 2018
        - Signed agreement with USFWS where we will be monitoring and looking for feral swine though the use of trail cameras and bait stations.
        - Working with AZ to start a surveillance and monitoring project on the UT/AZ border where we have had several feral swine sightings.

- Future directions and goals related to feral swine management over the next five years:
    - Establish a task force.
    - Conduct surveillance/monitoring projects and if feral swine are confirmed, move towards elimination.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$0	$68,000
2015	$68,000	$0	$0	$68,000
2016	$68,000	$0	$0	$68,000
2017	$68,000	$0	$0	$68,000
2018	$68,000	$0	$0	$68,000
Total	**$340,000**	**$0**	**$0**	**$340,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	3.3	7.5	40.4	7.1	9.3
Fixed-wing	9.6	22.6	77.8	27.2	31.4

- Major cooperators:
    - Utah Department of Agriculture and Food
    - Utah Division of Wildlife Resources

Vermont

- FY18 funding level: 1
- Point of Contact: State Director
    - Address: 59 Chenell Drive, Suite 7
    - City/State/Zip: Concord, NH 03301
    - Phone: 603-223-6832

- State task force: New Hampshire/Vermont Feral Swine Task Force
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Vermont Fish and Wildlife Department
        - Vermont Agency of Agriculture, Foods, and Market
        - New Hampshire Fish and Game Department
        - New Hampshire Department of Agriculture, Markets, and Food
        - USDA APHIS Veterinary Services

- Objectives:
    - Monitor for free-ranging populations, emigration, and relocations.
    - Define and survey emigration routes from CT and surrounding states.
    - Conduct site visits on all feral swine reports to determine validity.
    - Educate and assist landowners with damage management solutions.
    - Eliminate all accessible populations statewide and collect disease surveillance, DNA, and fecal samples.
    - Work with cooperators to identify and protect high-risk resources.
    - Continue to build our cooperative base statewide with the U.S. Forest Service, USDA NRCS, and Farm Service Agency, New Hampshire and Vermont Farm Bureau Federations, and the Regional Pork Producers Council.
    - Continue to educate the public through media outlets, presentations, expos, and visual notifications.
    - Upgrade infrastructure to support an Integrated Feral Swine Management Program.
    - Expand and improve upon management techniques, damage data collection, and reporting.
    - Continue to train field staff to identify feral swine signs, damage reporting, trapping, and disease sampling techniques.
    - Monitor and evaluate results of management actions.
    - Work with national and international partners to develop a regional management strategy.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Met with Vermont Fish and Wildlife Department (VFWD), Vermont Agency of Agriculture, Food, and Markets, USDA APHIS VS, and Veterinary Services Border Inspection. Planned to meet with Farm Service Agency and the Vermont Farm Bureau.
        - Conducted two interviews with the Reformer Newspaper and Vermont Public Radio, prepared a press release through VFWD to inform the public, and conducted an interview on WCAX.

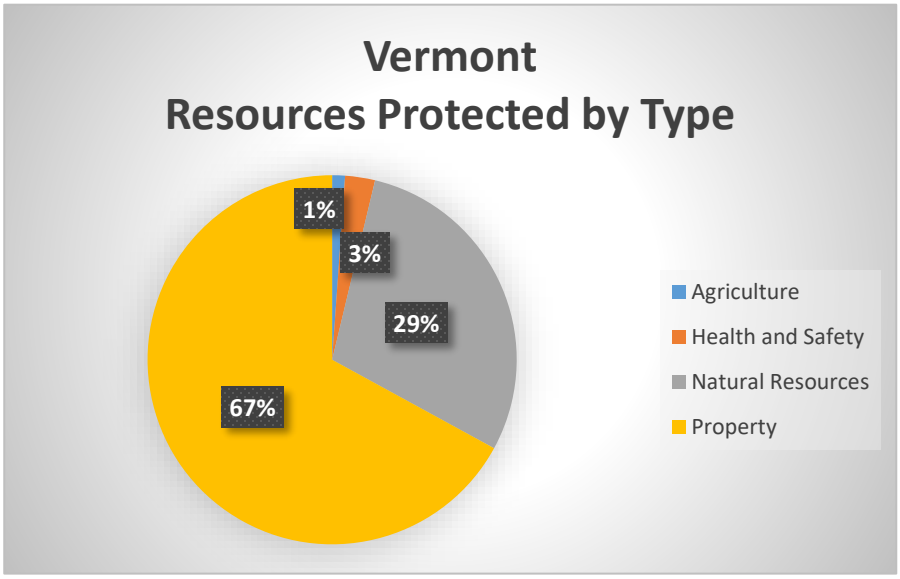
- Conducted educational seminars with VFWD biologists and law enforcement, the Vermont Agency of Agriculture, Food, and Markets, Veterinary Services, the agricultural community, and the general public through talks and the Vermont Rabies hotline.

- 2015
  - Verified three of four credible reports of feral swine sightings, deployed cameras along the Quebec border, and implemented a trail camera trap survey along the Connecticut River Valley (VT's eastern border with NH).
  - Performed outreach efforts at the Vermont Farm Show and a large dairy farm conference.
  - Obtained permission from the VFWD to monitor all state wildlife management areas for feral swine activity.
- 2016
  - Conducted aerial surveys along the Connecticut River.
  - Instituted a program-wide feral swine database and reporting system.
  - Developed two information fact sheets for landowners selected for camera surveys to explain the survey and identify hog signs.
- 2017
  - Deployed trail cameras in Windsor County, in the Connecticut River Valley along the New Hampshire border, and adjacent to recent sightings in New Hampshire where feral swine had been recently sighted.
  - Communicated frequently with the Quebec Ministry of Forests, Wildlife, and Parks to discuss border feral swine surveillance due to the reproducing population of about 50 feral swine in Canada, approximately 50 miles north of the New Hampshire and Vermont borders – an invitation to join the Feral Swine Task Force was extended to Canadian counterparts.
  - Continued contacts with the Missiquoi NWR, located along the eastern shore of Lake Champlain and the Canadian border, due to recent feral swine observations in Quebec.
  - Conducted an aerial survey of the feral swine zone, no observations.
  - Participated in both the Vermont Farm Show and the Vermont Sportsmen Show and presented feral swine information to the public.
- 2018
  - Investigated three feral swine reports in: Guilford, Sharon, and Danville, VT. The Guilford hog was brought to VT from Florida. The state agriculture agency collected DNA and serum samples from the captive animal. No swine evidence was found at the Sharon site, but cameras and bait were deployed. A landowner from Danville, VT submitted trail camera photos of a feral swine to VFWD. Three weeks later a landowner in the Lyndonville area submitted five photos of two feral swine to WS. WS and state officials verified the camera locations and initiated baiting.
  - WS is also spoke with local hunters and landowners in the Danville and Lyndonville areas to gain access to adjoining property, as well as surveyed the area on foot.
  - A trap was deployed at the Lyndonville location.
  - Initiated obtaining property access for summer trail camera surveillance in northern VT along the Canadian border. Contacted residents and farm owners in proximity to the border where feral swine reports have been generated in the past. Feral swine brochures were distributed to a number of landowners.

- WS NH/VT continued discussions with biologists from the Quebec Ministry of Forests, Wildlife and Parks to determine border feral swine surveillance. These are likely escapees from one of a number of high-fenced hunting operations in Quebec, CN. Wildlife Disease Biologist Anthony Musante met with Isabelle Laurion from the QMNR at the Wild Pig Meeting in OK in April.
- Continued to work with VT Fish and Wildlife Department (VFWD), VT Dept. of Agriculture, Food & Markets (VAAFM) and USDA VS border agents to identify high-risk resources in VT and outline goals/expectations of feral swine program.
- Met with new wardens to discuss feral swine surveillance, identifying feral swine damage and WS role in the statewide monitoring effort.

- Future directions and goals related to feral swine management over the next five years:
  - Continue developing the duel state, international Feral Swine Task Force/Working Group.
  - Continue to increase media outreach and press releases at dairy conferences farm shows, sportsman shows, on Facebook and on Vermont radio stations.
  - Increase outreach at the town level, via town clerks, town meetings, etc.
  - Continue educational seminars with VFWD Biologist & Law Enforcement, VAAFM, VS, agricultural community, and the general public through talks and the VT Rabies Hotline.
  - Implement a trail camera trap survey along the identified emigration routes along the Quebec border and the CT River Valley.
  - Maintain the Feral Swine notification page in VT Hunting Digest.
  - Convert to OARS to improve recording, monitoring, and reporting efforts.
  - Work with the hunting community for trail camera reporting.
  - Conduct control activities, including trapping and shooting of identified hog populations.
  - Continue to improve operations through the Feral Swine Task Force with VT/NH state & federal agencies with jurisdictional authority.
  - Respond to all reports of feral swine with increased surveillance of suspect areas.
  - Work with federal partners to monitor federal lands in Vermont.
  - Remove all accessible feral swine from Vermont.
  - Move VT to a Detection status once current population is removed.

- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$0	$68,000
2015	$68,000	$0	$0	$68,000
2016	$68,000	$0	$0	$68,000
2017	$68,000	$0	$0	$68,000
2018	$68,000	$0	$0	$68,000
Total	**$340,000**	**$0**	**$0**	**$340,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Vermont Fish and Wildlife Department
    - Vermont Agency of Agriculture, Food, and Markets
    - USDA APHIS Veterinary Services
    - Quebec, CN Ministry of Forests, Wildlife and Parks

Virginia

- Current funding level: 3
- Point of Contact: State Director
    - Address: PO Box 130
    - City/State/Zip: Moseley, VA 23120
    - Phone: 804-739-7739

- State task force: Virginia Feral Swine Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - Virginia Department of Game and Inland Fisheries
        - U.S. Fish and Wildlife Service
        - Virginia Department of Agriculture and Consumer Services
        - USDA Natural Resource Conservation Service
        - U.S. Forest Service
        - National Park Service
        - Virginia Cooperative Extension Service

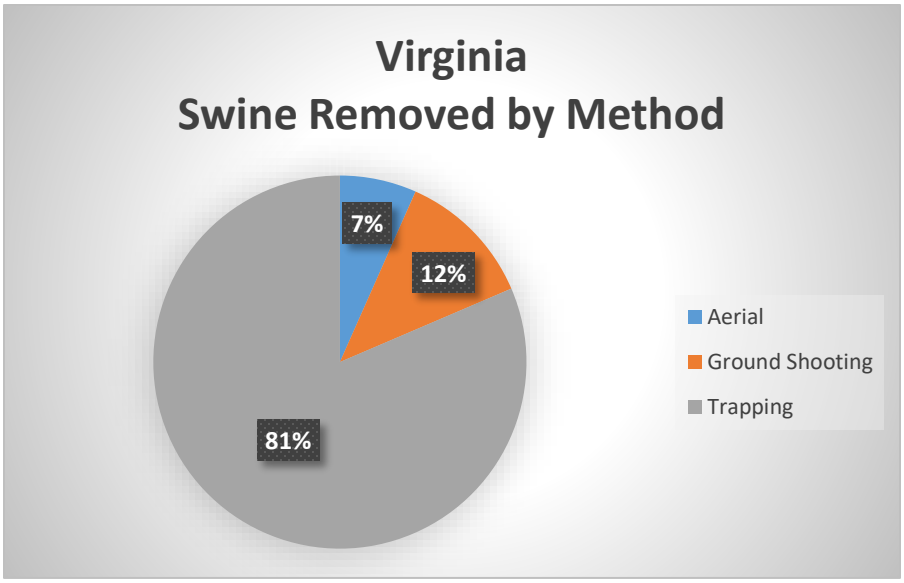
- Objectives:
    - Develop a better understanding of feral swine distribution in Virginia, reduce damage, and work towards reducing feral swine presence in the Commonwealth.
    - Locate and map feral swine populations.
    - Solicit reports of feral swine from the public, cooperators, interest groups, and other agencies through outreach activities.
    - Identify, isolate, and eliminate small populations and break up larger populations.
    - Collect samples for disease surveillance.
    - Coordinate activities and management goals with the Virginia Department of Game and Inland Fisheries.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Feral swine locations identified and mapped throughout Virginia – counties classified according to feral swine presence and aerial surveys completed.
        - Outreach materials developed (business cards, flyers) and widely distributed, attended industry conferences (pork and grain producers); established cooperative relationship with USDA Forest Service for swine management; spoke to the Virginia Bear Hunters Association at the quarterly meeting.
        - Established cooperative relationship with Virginia Department of Agriculture and Consumer Services for disposal of feral swine carcasses using incinerators at regional labs.
    - 2015
        - Met regularly with the Virginia Department of Game and Inland Fisheries (VDGIF) Feral Swine Committee to coordinate activities.
        - Contacted many landowners in several counties with established feral swine populations and obtained permission to access properties for feral swine management.

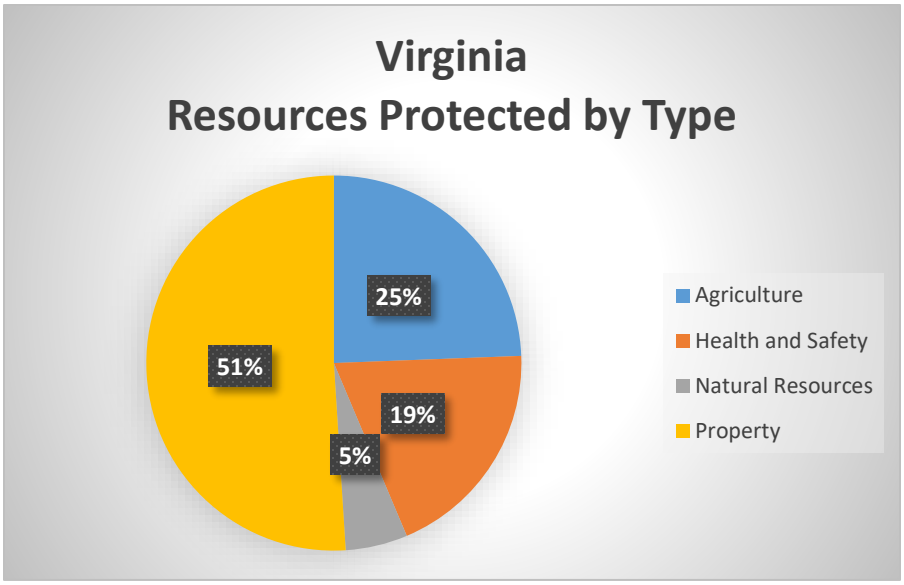
- 2016
  - Aerial removal operations for feral swine at Back Bay National Wildlife Refuge and False Cape State Park was approved by the Virginia legislature.
  - Coordination with the Tennessee WS program on the Virginia/Tennessee/Kentucky Tri-State project (aerial surveys of project area completed).
  - Distributed over 55,000 "Report Feral Swine" postcards through direct mailing to 11 counties.
  - Two additional wildlife specialists were hired to work locally funded projects in Southeastern and Southwestern Virginia.
- 2017
  - Aerial removal operations were performed as part of the Coastal Barrier Islands local project.
  - Experimented using trained dogs to locate feral swine in remote areas of the George Washington and Jefferson National Forests.
  - "Report Feral Swine" advertisements were placed in several weekly newspapers, feral swine outreach materials were widely distributed, and industry conferences and trade shows were attended.
  - Established new feral swine project areas in King William County and the city of Suffolk.
- 2018
  - Identified a new population of feral swine and established a new project area in Wise County.
  - Aerial survey/removal operations were completed as part of the Coastal Barrier Islands local project; no were swine observed and no damage was reported.
  - Staffed an exhibit with the TN/KY WS program at the Cumberland Gap Cattle Conference.
  - Organized two coordination/review meetings with regional VDGIF staff to discuss feral swine management program.
  - Purchased three UAS for detection of feral swine in difficult terrain.
  - Removed last known feral swine from Bland/Giles project area.

- Future directions and goals related to feral swine management over the next five years:
  - Elimination of Culpeper and Coastal Barrier Island feral swine populations.
  - Move Virginia to Level 2 funding.
  - Establish long-term feral swine monitoring program in Eastern Virginia.
  - Shift program focus to population suppression in western areas of Virginia.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$235,000	$0	$61,094	$296,094
2015	$235,000	$0	$80,000	$315,000
2016	$235,000	$234,166	$120,000	$589,166
2017	$242,050	$138,286	$120,000	$500,336
2018	$242,050	$142,339	$110,000	$494,389
Total	**$1,189,100**	**$514,791**	**$491,094**	**$2,194,985**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	17.7	0
Fixed-wing	15.1	0	0	0	0

- Major cooperators:
    - Virginia Department of Game and Inland Fisheries
    - U.S. Fish and Wildlife Service
    - U.S. Forest Service
    - Virginia Department of Agriculture and Consumer Services
    - Virginia Department of Conservation and Recreation
    - Local farm association

Washington

- FY18 funding level: Detection phase
- Point of Contact: State Director
    - Address: 720 O'Leary Street NW
    - City/State/Zip: Olympia, WA 98502
    - Phone: 360-753-9884

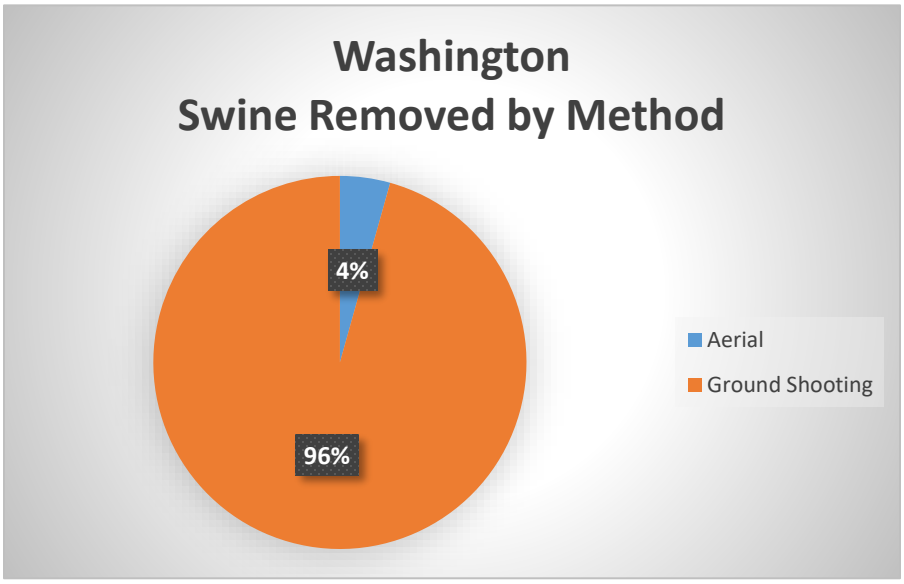
- State task force: Washington Invasive Species Council
    - Member organizations:
        - Washington Invasive Species Council
        - USDA APHIS Wildlife Services
        - Washington State Department of Agriculture
        - U.S. Fish and Wildlife Service

- Objectives:
    - Develop and participate in interagency feral swine coordination efforts.
    - Obtain monitoring and response equipment for feral swine reports.
    - Investigate reports of feral swine.
    - Develop GIS database for reports, investigations, disease samples, and results.
    - Remove confirmed feral swine.
    - Collect disease samples.

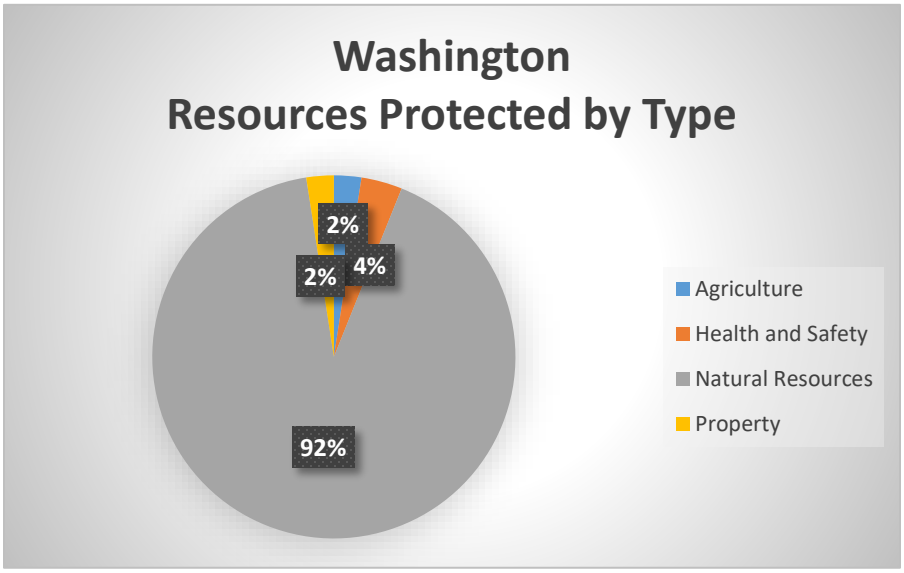
- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Participated in the Washington Invasive Species Council meeting, apprising the interagency personnel of WS' ability to respond to feral swine reports.
        - Developed coordination with the Washington Department of Fish and Wildlife to receive feral swine reports through the state's online Invasive Species Sighting Report Form.
        - Reviewed the U.S. Forest Service feral swine management plan.
        - Investigated a report of a possible feral swine sighting in southwest Washington.
    - 2015
        - Developed a draft Washington State Feral Swine Response Plan.
    - 2016
        - Nearly eradicated the last feral swine in Washington, one animal remaining.
    - 2017
        - Received nine new reports of feral swine and investigated each report, removed the swine when discovered.
        - Presented at the annual Washington State Pork Producers meeting and the Invasive Species Workshop (involve both Washington and Oregon).
    - 2018
        - Received and responded to 11 separate reports of feral swine in Washington from calls to the "Squeal on a Pig" hotline administered by the Invasive Species Council. WS also investigated reports submitted to the U.S. Forest Service.
        - Twelve free-ranging pigs removed in three separate incidents.
        - Presentations given at the Washington Farm Bureau meeting, the Washington Sheep Producers meeting, and the Washington Cattlemen's Convention, and the Washington State Zoonotic Disease working group.

- Future directions and goals related to feral swine management over the next five years:
    - Enhance community awareness and outreach, additional monitoring on Forest Service lands, and involve additional partners in detection efforts.

- Feral swine removed by method:



- Resources protected:



- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$0	$68,000
2015	$68,000	$0	$0	$68,000
2016	$42,000	$0	$0	$42,000
2017	$42,000	$0	$0	$42,000
2018	$42,000	$0	$0	$42,000
Total	**$262,000**	**$0**	**$0**	**$262,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	9.2	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
    - Washington Department of Fish and Wildlife
    - Washington Invasive Species Council
    - U.S. Forest Service
    - Local farm association
    - Local livestock associations
    - Washington State Zoonotic Disease Working Group (comprised of federal, state, county/municipal agencies)

West Virginia

- FY18 funding level: 2
- Point of Contact: State Director
    - Address: 730 Yokum Street
    - City/State/Zip: Elkins, WV 26241
    - Phone: 304-636-1785

- State task force: West Virginia Feral Swine Working Group
    - Member organizations:
        - USDA APHIS Wildlife Services
        - West Virginia Division of Natural Resources
        - West Virginia Department of Agriculture
        - West Virginia University Extension Service
        - USDA APHIS Veterinary Services

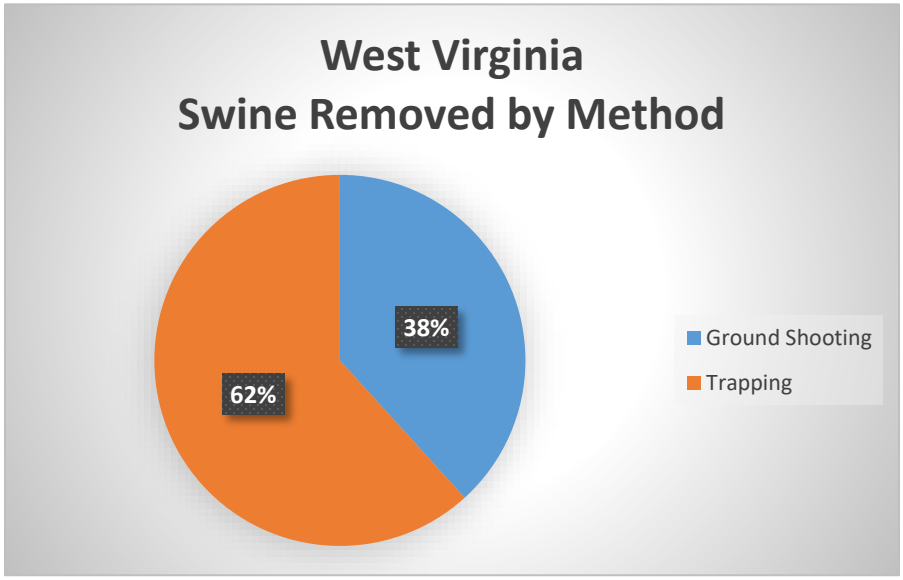
- Objectives:
    - Sponsor legislation to prevent the transportation of feral swine into West Virginia for the purposes of hunting.
    - Utilize West Virginia University Extension Service expertise and network to create and distribute information on feral swine damage.
    - Enhance feral swine damage/sighting reporting system to determine locations within the state.
    - Conduct an annual stakeholder meeting to discuss current feral swine issues.
    - Use genetic testing to determine if the state game species of wild boar have been hybridized with feral swine.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Purchased firearms, night vision, sampling supplies, traps, and other equipment.
        - Conducted direct control using a variety of methods and traps, developing expertise in capturing feral swine.
        - Convened with the Feral Swine Working Group to provide program updates and a strategic plan.
        - Conducted aerial surveys of known populations.
        - Placed trail cameras in reported areas to verify presence, updated the feral swine locations map.
        - Drafted a strategic plan for feral swine damage management.
    - 2015
        - Obtained genetic samples from hunter harvested wild boar to determine the possibility of hybridization through cooperation from West Virginia Department of Natural Resources.
        - Chaired the Feral Swine Working Group that included key state and federal cooperators.
        - Presented information on the NFSP at a West Virginia Department of Natural Resources biologist meeting.
        - Met with state cooperators to create a feral swine reporting protocol to better identify and respond to emerging populations.

- 2016
  - Removed all known feral swine from Jackson and Mason counties and continued to monitor the area.
  - Removed feral swine in Fayette County and observed a significant decrease in damage and signs from pigs within the area.
  - Obtained tissue samples from hunter harvested wild boar from Logan and Boone counties for genetic testing.
  - Increased outreach activities by giving presentations at stakeholder meetings, distributing materials, and using cooperative contacts to broaden awareness.
  - Received a significant increase in cooperation from state and federal park services to report sightings, allow access, and contribute time and resources.
- 2017
  - Continued monitoring sites with known or suspected feral swine populations within the past two years to confirm eradication in Summers, Monroe, Nicholas, Mason, Jackson, and Fayette counties – no confirmed reports occurred in these counties.
  - Expanded genetic sampling of the state wild game species of wild boar and increased surveillance for feral swine in the wild boar area to identify a potential hybridization threat.
  - Worked with a researcher from West Virginia University to investigate the role of feral swine in northward expansion of lone star and gulf coast ticks.
  - Worked with the private timber industry to include language in hunting leases to prevent the transportation and release of feral swine on their lands in 16 states, totaling one million acres.
- 2018
  - Monitored Jackson, Mason, and Fayette counties; no feral swine found.
  - Responded to a report of a dozen escaped domestic pigs in Monongalia County. Through cooperation with West Virginia Department of Agriculture (WVDA) the issue was resolved using technical assistance to a farmer to improve fencing.
  - Responded to isolated reports of pigs in Harrison and Barbour counties.
  - Worked with WVDA to conduct surveillance at a closed high fence facility in Nicholas County to confirm if any pigs remained inside or escaped into the surrounding forest.
  - Obtained 16 genetic samples from hunter harvested wild boar in southern WV through a collaborative effort with WVDNR.
  - Investigated a report of escaped domestic pigs in Upshur County. Local animal control assisted with capturing pigs to return to the owner.
  - Responded to a report from the Director of WVDNR of pigs crossing the interstate in Braxton County. Upon investigation it was discovered a local farmer was experiencing feral swine damage and had already removed a pig. WS removed two more feral swine and is monitoring the area.
  - Held a WV Feral Swine Working Group meeting to provide program updates, discuss needed legislation, and agreed to begin working on feral pigs in the restricted wild boar counties.
  - Conducted aerial surveys with a helicopter over southern WV to document feral swine populations in the wild boar area.
  - Responded to a report in Gilmer County of feral swine damage. Trail cameras confirmed two pigs that were rooting up a farmer's pasture. When no owners could be located, both pigs were removed and sampled for diseases.
  - Enrolled 195,000 acres of previously inaccessible property that is known to contain feral swine.

- Future directions and goals related to feral swine management over the next five years:
    - Continue collection of genetic samples from wild boar and feral swine in WV. These genetic samples will help the state wildlife agency with management decisions regarding interaction between wild boar and feral swine.
    - Currently there are no laws in WV preventing the release of domestic swine onto the landscape. WS will continue to participate in discussions with WVDNR and West Virginia Department of Administration about passing legislation to prohibit release of swine in WV.
    - Known populations of feral swine in most of the state have been eliminated. WS will monitor and eliminate remaining suspected feral swine populations in Boone, Fayette, Kanawha, Mingo, and Wayne counties.
    - WS will respond to all reports of feral swine to identify and remove emerging populations.
    - WS will sample wild boar and feral swine to determine status of diseases capable of negatively impacting recently reintroduced elk.

- Feral swine removed by method:



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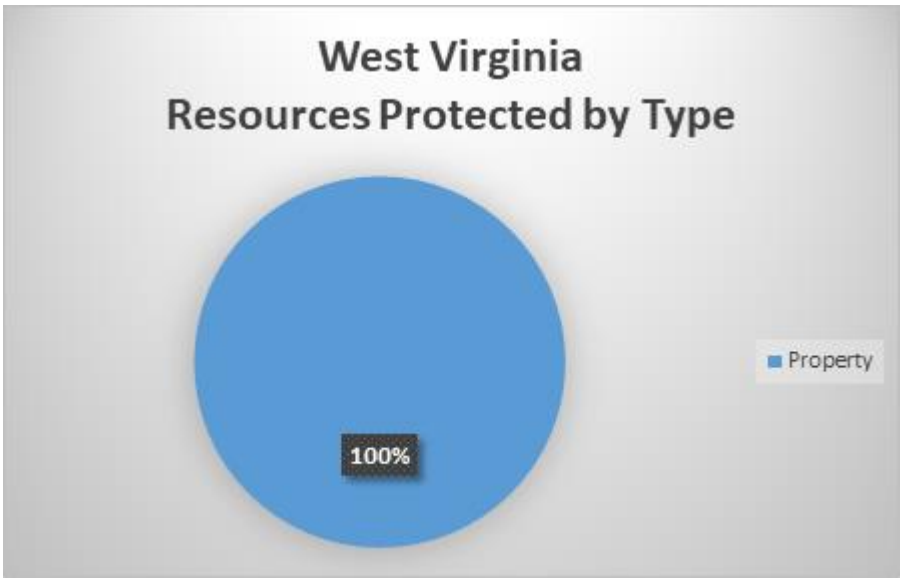


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$165,000	$80,000	$10,000	$255,000
2015	$165,000	$80,000	$10,000	$255,000
2016	$165,000	$80,000	$10,000	$255,000
2017	$165,000	$80,000	$10,000	$255,000
2018	$165,000	$80,000	$10,000	$255,000
Total	**$825,000**	**$400,000**	**$50,000**	**$1,275,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	8
Fixed-wing	16.2	0	0	0	0

- Major cooperators:
  - West Virginia Division of Natural Resources
  - West Virginia Department of Agriculture
  - USDA APHIS Veterinary Services
  - West Virginia University Extension
  - National Park Service

Wisconsin

- FY18 funding level: Detection phase
- Point of Contact: State Director
    - Address: 732 Lois Drive
    - City/State/Zip: Sun Prairie, WI 53590
    - Phone: 608-837-2727

- State task force: Wisconsin Feral Swine Task Force
    - Member organizations:
        - Wisconsin Department of Agriculture – Animal Health
        - Department of Natural Resources, Wildlife
        - Department of Natural Resources, Health
        - Department of Natural Resources, Law Enforcement
        - Local commodity association
        - Wisconsin Conservation Congress
        - USDA APHIS Wildlife Services

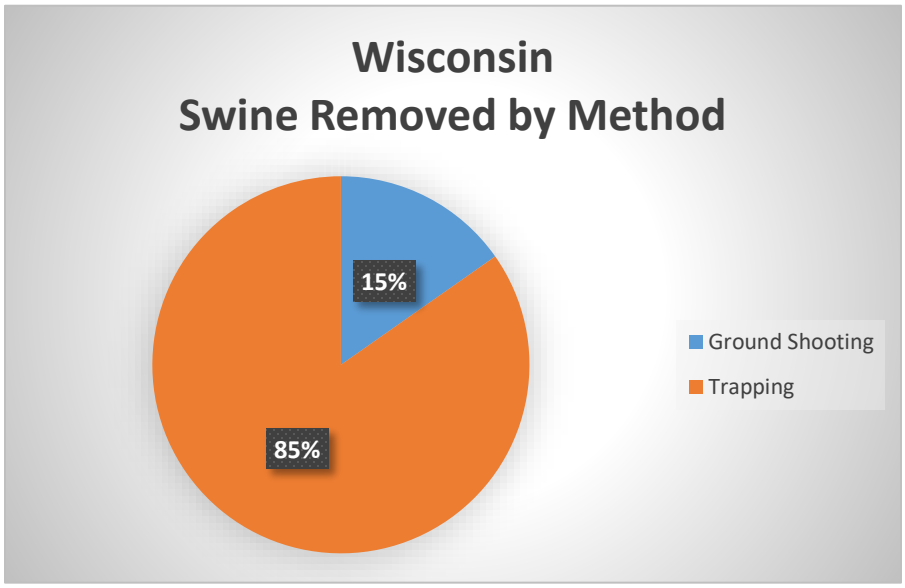
- Objectives:
    - Education.
    - Prevention of reintroduction.
    - Early detection and rapid response.
    - Statewide elimination.

- Highlighted accomplishments of feral swine damage management in the state within the last five years:
    - 2014
        - Educated the public on the negative impacts feral swine have on various resources.
        - Created an active surveillance and outreach system to detect feral swine on the landscape.
        - Worked collaboratively between government agencies, producer groups, and other interest groups to accomplish goals.
    - 2015
        - Killed the only pig detected in the area of the last known population of reproducing feral pigs.
        - Worked with local law enforcement to organize a solution to a domestic pig operation that had unrestrained pigs.
        - Investigated all reports of sightings made to the DNR or other sources.
        - No reports of feral swine shot by hunters were recorded during the fall season.
    - 2016
        - Performed outreach and educational efforts at the Midwest Invasive Species Conference and other fairs.
        - Removed a pig that, based on genetic data, led to a discovery of a re-introduction effort.
    - 2017
        - Contacted landowners after deer season in the area of last known feral swine population, no observations were reported.
        - Depopulation of the only known captive feral swine farm in Wisconsin.
        - Conducted public outreach at county fairs to increase observational reporting.

- 2018
  - Assisted Department of Natural Resources Law Enforcement with the collection of DNA from potential feral swine that were held illegally. A depopulation agreement with the landowner is underway after confirmation that the captive swine contained wild boar genetics.
  - Investigated/responded to all reports of sightings made to the DNR or other sources.
  - Assisted local law enforcement and county officials with determining legal status of escaped domestic swine.

- Future directions and goals related to feral swine management over the next five years:
  - Continue to respond quickly to reports of feral swine and conduct surveillance if needed.
  - Continue to submit samples of suspected feral swine for DNA analysis.
  - Expand outreach through increased participation in educational opportunities and agricultural related events/extension centers.

- Feral swine removed by method:



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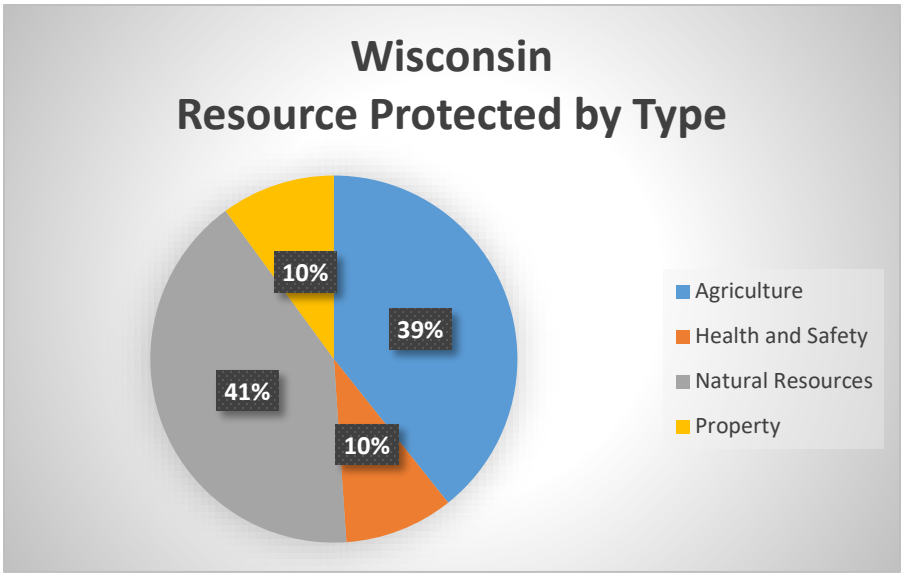


- Funding for feral swine activities – Wildlife Services (Baseline and Project) and Cooperator (both in kind and cost share):

Year	Baseline	Project	Cooperator	Total
2014	$68,000	$0	$25,000	$93,000
2015	$68,000	$0	$25,000	$93,000
2016	$68,000	$0	$25,000	$93,000
2017	$42,000	$26,000	$25,000	$93,000
2018	$42,000	$0	$25,000	$67,000
Total	**$288,000**	**$26,000**	**$125,000**	**$439,000**

- Aerial support (hours flown):

Aerial	2014	2015	2016	2017	2018
Helicopter	0	0	0	0	0
Fixed-wing	0	0	0	0	0

- Major cooperators:
  - Wisconsin Department of Agriculture, Trade, and Consumer Protection
  - Wisconsin Department of Natural Resources
  - Local farm association
  - Local livestock association
  - Wisconsin Conservation Congress
  - Great Lakes Restoration Initiative

Aerial Program

The NFSP relies heavily on the use of helicopters and fixed-wing airplanes to perform operational duties, such as damage assessments and feral swine removals. The aerial program is organized at the regional level.

Eastern Region

Historical Perspective: FY04 – FY13

The majority of aviation projects in the Eastern Region (ER) associated with the NFSP are coordinated and managed by the TN/KY WS Program. The TN/KY Program first conducted feral swine damage management operations utilizing aircraft in FY04 at Fort Campbell Army Base along the TN/KY border. This effort was in collaboration with the ATOC and the Oklahoma WS program. This 2004 project was the first aerial removal project ever conducted in the ER. It resulted in the removal of 13 feral swine and a population survey covering over 30,000 acres in approximately six hours from the unexploded ordnance range. TN/KY WS conducted similar aerial projects at Fort Campbell in FY08 and FY09. Additionally, in FY11/12, feral swine removal projects were conducted utilizing a helicopter in Hickman County, KY and in Fentress, Overton, and Stewart counties, TN. All of these projects were cooperatively funded. These early efforts demonstrated that aircraft could be efficiently, effectively, and safely utilized for aerial removal projects in the ER. Through collaboration with the ATOC and GSA surplus, the TN/KY Program acquired the following aircraft at no ($0) cost:

2012	N5187Y	OH-6 Helicopter
2012	N6230D	Cessna 172 Fixed Wing
2013	N6186U	OH-6 Helicopter

Since that time, aerial projects to manage feral swine damage have steadily increased in the ER. The increase in awareness of feral swine damages accompanied by the initiation of the NFSP and congressional funding to support the aviation program have been the driving forces creating the current aviation program directed at managing feral swine damages through population reduction in the ER.

Current Program: FY14 – FY18

As requests for services continued to grow, the program acquired more aircrafts. In FY15/18 WS acquired two additional OH-6 aircraft at no ($0) cost through a combination of ATOC support and GSA surplus. WS purchased two new H120 aircraft in FY17:

2015	N58479	OH-6 Helicopter
2017	N250WH	Airbus H120 Helicopter
2017	N260WH	Airbus H120 Helicopter
2018	N332AB	OH-6 Helicopter

During the last five fiscal years, the program has flown more than 3,565 hours and worked more than 25,880,350 acres of private and public land, resulting in the removal of more than 19,000 feral swine from the landscape in 20 states. These activities are funded through assigned allotments from the NFSP to the TN/KY Program. While most flights are purposed for direct removal of feral swine, numerous flights are conducted each year to assess feral swine damages, densities, and populations. All of these flights contribute to the overall program objective of reducing feral swine damage.

The current ER aviation program utilizes seven regional aircraft whereby the aircraft, pilots, funding and additional aviation resources are utilized throughout the ER and managed and coordinated directly by the TN/KY Program. The program is a collaborative effort between the NFSP, ATOC, TN/KY Program, and the Eastern Region State Programs. The NFSP provides funding and recommendations on mission priorities, while the ATOC provides guidance and services on technical issues related to aviation and flight safety. The ATOC provides training and instruction of our Certified Flight Instructors, Annual Pilot Certification, initial crewmember training, and support facilities for the majority of aviation safety training. The state requesting services is responsible for obtaining land access and the associated WID for the properties in their state; providing GIS information delineating legal property boundaries and requesting project dates.

The TN/KY Program manages all fiscal related responsibilities associated with the management and operations of the ER Aviation program. Additionally, the TN/KY Program coordinates the following:

Aircraft Maintenance Contracts (AMCs) / Scheduled Maintenance and Repair / Aircraft Inspection: The TN/KY Program works with USDA APHIS Contracting to secure new AMCs, renew existing AMCs, and oversee all fiscal responsibilities with associated Purchase Orders (POs) connected to AMCs. The program currently has four AMCs and four associated POs that provide for routine scheduled maintenance and repair on all seven aircraft. With the exception of emergency repairs and very minor issues, all scheduled/unscheduled maintenance and repair on aircraft must be accomplished through the AMC. This involves daily/weekly communication with contractors to coordinate scheduled/unscheduled maintenance and repairs on all 7 aircraft. Currently scheduled maintenance requirements are as follows: H120- 15 hour, 100 hour, 300 hour; OH-6- 100 hour, 300 hour; Cessna 172 – 50 hour, 100 hour. Program staff also manage unscheduled repairs/emergency issues on a regular basis. These issues usually require numerous communications after hours and on weekends to maintain safety, coordinate repairs, and arrange for logistical issues involving WS personnel, Contractor personnel, and aircraft. These events quite often are in rural/remote areas and involve emergency landing aircraft on private property. Additionally, program staff schedule and coordinate logistical issues on all aircraft annual inspections with the ATOC.

Flight Monitoring: As required by WS policy, all flights are monitored on a continuous basis seven days a week. Flight monitoring is accomplished primarily with the Outerlink System and with SPOT Units. Electronic messages via text and email are monitored at 15-minute intervals throughout the duration of each and every flight. In addition to Outerlink, program staff utilize the Map Plus app on an iPad to record flight tracks. Upon project completion, flight records and flight tracks are provided to the respective state for MIS and project data. Outerlink and Map Plus records are utilized to show/track the flight path on all flights accounting for location of each flight and ensuring aerial projects are only conducted on WS permissible properties and locations.

Staffing: We currently have eight Helicopter Pilots, two Fixed-Wing Pilots, one Certified Flight Instructor, 10 Certified Aerial Crewmembers, two Staff Wildlife Biologists, and one Certified Crewmember/Firearm Training Instructor in the TN/KY program that support the aviation program in the ER. An additional 20 crewmembers from other ER states are also involved in providing operational services. A newly initiated Aviation Coordinator position will be filled in FY19, along with two new Aviation Liaison Staff Biologist positions. All operations are overseen by the TN/KY State Office.

Operations Scheduling: All flight scheduling is conducted and coordinated with various entities, including pilots, aircraft, landowners, maintenance contractor, crewmembers, and requesting parties. This is required due to a variety of factors, including flight hour restrictions on pilots and aircraft; scheduled maintenance and unscheduled repairs; contractor and crewmember availability; landowner and regulatory entity issues all coupled with weather, unexpected mechanical issues, and requesting parties' requirements. Scheduling remains a complex, multi-faceted challenge that requires vast amounts of staff time in communication and collaborative efforts. In the southeast U.S., where the majority of aviation projects are conducted, tree canopy coverage and heat extremes cause additional scheduling conflicts. Tree canopy coverage in place over much of the eastern U.S. plays a significant role in restricting flight hours to a (3-4) month winter season, which results in a the majority of states competing for limited flight resources (e.g., pilot/aircraft/crewmember). While conversely summer temperature extremes greatly limit daily flight hours that impact weekly flight times and further cascade scheduling complications.

Summary

The success of the ER aviation program is a result of collaborative efforts between the ATOC, NFSP, Eastern Regional Office, and numerous ER WS State Programs. While the program is directly managed and coordinated by the TN/KY Program, all entities work cooperatively while directing their specific resources (e.g., funds, training, technical support, personnel) towards the overall accomplishment of NFSP programmatic objectives. The numerous accomplishments and success of the current ER aviation program is due to these continued combined cooperative efforts, along with a tremendous amount of hard work, long hours, and dedicated service by numerous personnel. Each state that participates in the program is to be commended for their efforts.

Major Accomplishments: FY14 – FY18

- Acquired and rebuilt helicopter N58479 for no additional funding
- Acquired and rebuilt helicopter N332AB for no additional funding
- Implemented a successful aerial removal program in the ER
- Awarded the 2016 WS Aviation Safety and Accident Prevention Award
- Demonstrated aerial removal as an effective method in non-winter months in coastal areas
- Implemented two certified flight instructors in the ER – one fixed-wing/one rotary wing
- Implemented one certified crewmember instructor in the ER
- Initiated rifle utilization for aerial removal in helicopters
- Flew over 3,565 hours in the past five years with no accidents/incidents
- Flew over 8.6 million acres of private/public land for aerial removal in the ER
- Provided aerial services to 20 states

Western Region

The Western Region has traditionally utilized aviation for predation management and disease responses and most states have aviation assets or contracts in place. Feral swine aviation began well before the creation of the NFSP in states where feral swine were located. Notably, Texas and Oklahoma provided significant aerial operations as part of cooperative programs well before the creation of the NFSP. Kansas cooperated with the DOD on aerial operations on military lands utilizing contract aircraft.

With the advent of the National program, one aircraft, a surplus OH-6 helicopter was rebuilt in Texas for use within the Region. States needing aerial support can request the aircraft through the Texas State Director or Assistant State Director and out-of-Texas flying has received priority for this aircraft. Still, the demand for aerial services often exceeds the ability of one aircraft and the Texas program has made all four helicopters stationed within the state available for aerial removal of feral swine.

Most states wish to schedule the aircraft outside of fall hunting seasons but before leaves appear on deciduous vegetation, resulting in a bottleneck of requests from January through March.

Because individual western states have aviation assets and personnel available within the state, often the first response is with agency aircraft. Oregon, North Dakota, Nevada, Colorado, Utah, and Montana all have responded to feral swine sightings with reconnaissance flights. Arizona, Washington, New Mexico, and Kansas have used agency and contract aircraft to remove feral swine and search for potential new populations. As noted above, Texas and Oklahoma have continued to use their in-state aircraft to support feral swine removals during this period.

The "Regional Helicopter" provides service to western region states and to Louisiana, which is adjacent to Texas and in easy operational range. During the five years FY14-FY18, helicopters from Texas, including the regional helicopter, provided 450.4 hours of aerial removal time in Louisiana removing 4,773 pigs. That helicopter has also provided 199.7 hours of aerial support to Kansas, removing 1,182 pigs. The pilot assigned to NFSP funding has flown 1,844.6 total hours, removing 29,979 feral swine.

Due to scheduling conflicts, Texas in-state helicopters have been used to provide assistance to other states as well. In California, a Texas helicopter was used for 23 hours of reconnaissance in an effort to find the last two known pigs in San Diego County. The same helicopter has been used on three separate occasions (a total of 88.9 hours of aerial hunting time) at Havasu National Wildlife Refuge in Arizona and California to remove 161 feral swine. That project appears to have eliminated swine along the Colorado River and is now concentrating on the Topoc Marsh in an effort to eradicate all feral swine there.

In total, Western Region states, cooperating with funding from the NFSP, have flown well over 6,000 hours in FY14-FY18, covering in excess of 15,000,000 acres in 14 states. More than 89,000 feral swine have been removed with aerial operations in the Western Region and an additional 4,773 in the Eastern Region with assets from the WR.

Training

While aviation programs have been in place for almost 50 years in the Western Region, the increase in feral swine has shifted some of the priorities among the states. Predator flying usually requires a crew of two people (a pilot and a single firearms expert) for a full day of operations. In contrast, high volume feral swine removal often requires multiple firearms experts per day due to the stress of high recoil and hundreds of shots in a single flight. With the review and approval of the National Aviation Coordinator, an aerial removal school has been conducted in Texas for the past several years specifically to address feral swine aerial operations. This is an approved ATOC school and students receive WS accreditation upon successful completion. While the main focus is safety and situational awareness, students also receive specialized training in reloading quickly and hitting multiple targets in succession; skills necessary in feral swine removal. Students from seven different states and two state wildlife agencies have attended the school for high quality safety training.

Maintenance

With numerous aviation assets across the Western Region, maintenance is conducted by each state for the assets within that state. The "Regional Helicopter" is added to the Texas WS Maintenance Contract and maintenance is conducted as part of the contract. The Texas program is responsible for four helicopters (including the Regional Helicopter) but has three pilots on staff. Ordinarily, a state-managed OH-6 helicopter is available for the pilot to use when the Regional Helicopter is in for service.

In FY18, a significant effort was made to acquire parts necessary to prevent downtime due to unscheduled part replacement. Every part on a helicopter is time- or wear-limited and must be inspected every 100 hours. While scheduled maintenance can anticipate time-limited part replacement, unscheduled part failure will ground the helicopter until a replacement part can be obtained. Some parts, such as rotor-heads, must be sent to the factory for rebuild. Rebuilds can take months, depending on the availability of parts on the shelf and demand. In an effort to limit vulnerability to maintenance downtime, WS procured several of the parts needed for power plant and transmission replacement/rebuild. In doing so, the agency not only reduced its risk of downtime but enhanced aerial safety by eliminating the need to fly with parts of uncertain life. Now, if a specific part appears to be losing power, we can quickly replace it and have the part inspected and certified or replaced.

Summary

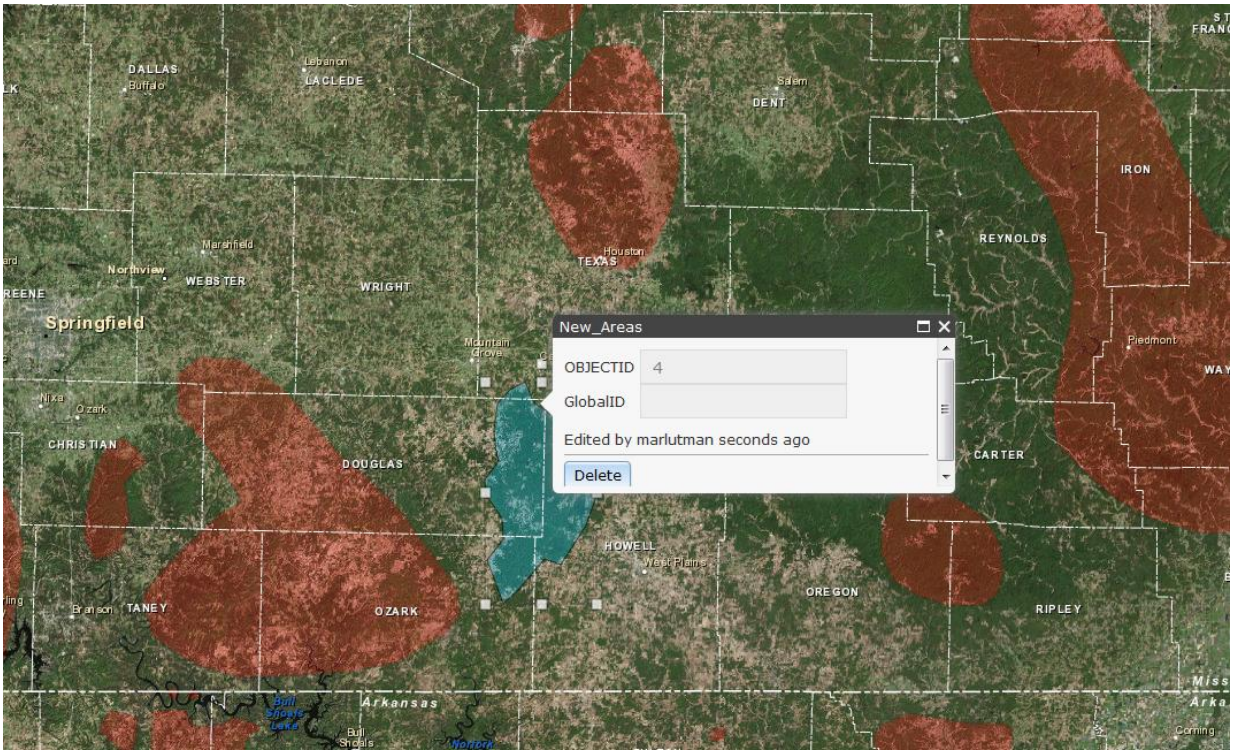
Aerial removal of feral swine is an effective method of removal where cover permits. Bodenchuk (2014) reported that aerial operations in Texas were the least costly method per feral swine removed- less costly than trapping, snaring, or night shooting from the ground. In part, this is because the Texas aircraft are used in high-density areas where the number removed per hour is usually high. Aircraft have also been proven effective in low-density areas, such as the Topoc Marsh in Arizona, because ground access is limited. Aerial assets are a quick method to utilize to respond to potential sightings and many western region states use agency aircraft to quickly meet our partners' needs to prevent the establishment of feral swine populations.

Expanded aerial operations will likely be necessary within the WS Western Region. As states move towards eradication (e.g., Nevada, Oregon) aerial reconnaissance and removal will be needed to support the agency's goals. The aircraft available today are suitable for the mission and are available as needed.

Geographic Information Systems:

The use of geospatial data is an ever-growing field. WS has been collecting geospatial data for well over 20 years, and with the use of current technology, this data has been made easier to collect. New web-based applications like ESRI's ArcGIS Online (AGOL), have provided WS with several tools to collect field data and showcase information in a variety of map or mapping applications. One application is the updating of the feral swine populations map using AGOL. APHIS has been partnering with the Southeastern Cooperative Wildlife Disease Study (SCWDS) since 2007 to identify and track all the known breeding populations of feral swine across the country. This data is updated every year and was managed by SCWDS until 2017. WS was the primary contributor to this map and with the retirement of senior SCWDS staff members, the map and all the data was turned over to the NFSP to maintain and share with cooperators and stakeholder groups. WS will continue to work with all stakeholders in updating this map using AGOL. This mapping application provides a web-based map interface that allows users to make edits to maps in real time that can be viewed by all with access. Right now, WS is reaching out to its cooperators to solicit updates for the map. Until the agency has the ability to allow cooperators to access and update the map independently, all map changes will be channeled through the local WS state programs.

In 2016, the NFSP worked with several state programs to develop an app, ESRI's Collector app, that could help field personnel track various feral swine activities. This is a great tool to help track resources as well as identify where equipment is located in the field. In Missouri, the feral swine task force has been using the Collector app to track the location of their traps; this app has allowed the task force to share the responsibility of checking and maintaining traps, ultimately allowing for greater success in trapping efforts by all involved. This shared responsibility has resulted in an increase in the number of trap nights, and thus increase the number of feral swine removed from the landscape.

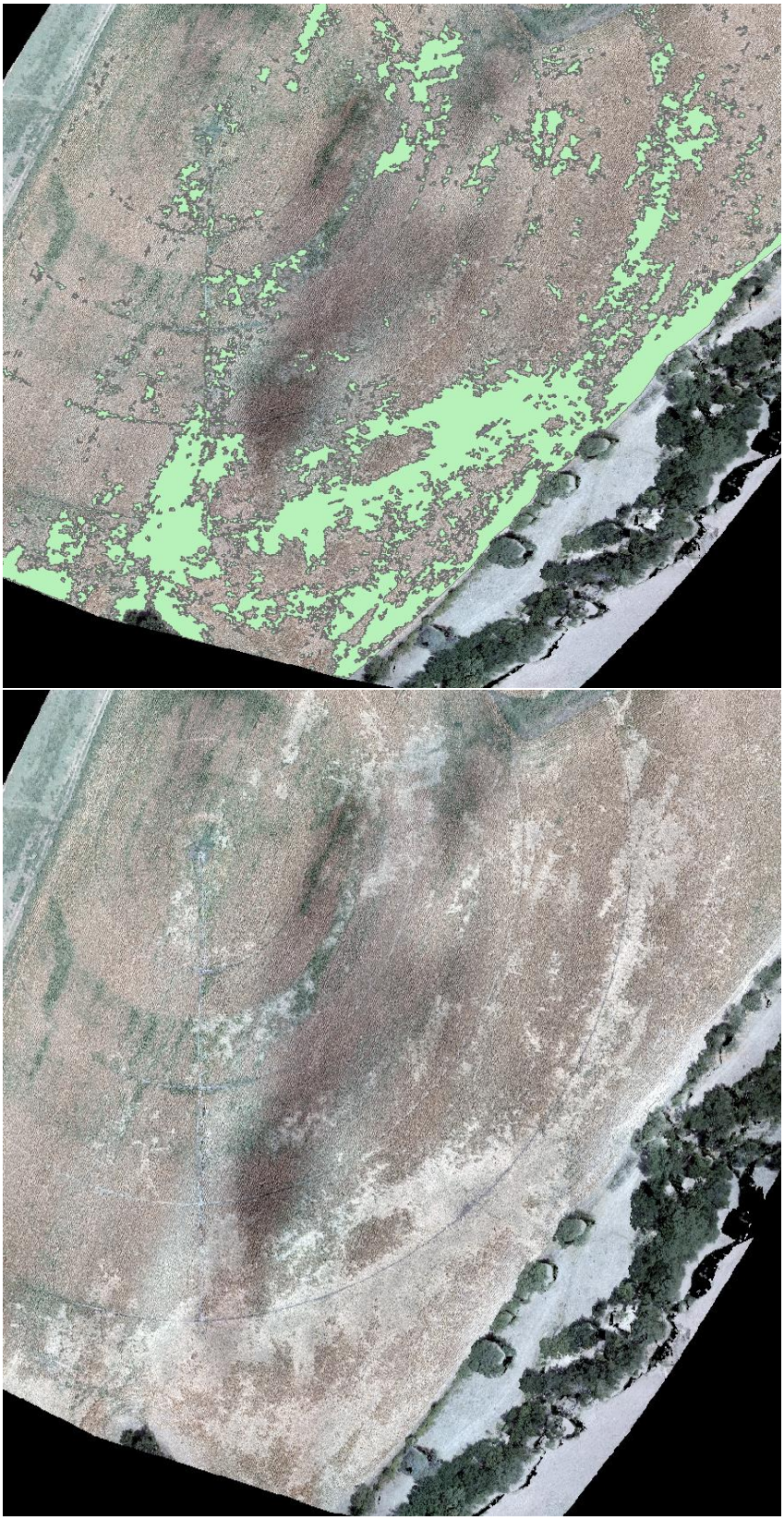


An image of feral swine population maps using ArcGIS online (AGOL).

Unmanned Aircraft Systems (UAS):

The UAS field is relatively new for WS. In 2014, WS began to investigate various platforms that would fit the agency's operational and research needs. At that time, the selection of platforms and ground control stations were limited with only a few commercial fixed-wing and homemade platforms to choose from. In April 2016, WS ATOC applied for, and received, a nation-wide certificate of authorization (COA) which allowed trained WS employees to fly in Class G airspace within the U.S. The initial training was held in Cedar City, UT and the basic training was one week, with an advanced training taking two weeks. After a review of the training along with the advancement of the UAS technology, the training was made mobile and the classroom was expanded from four students up to 20 students. All potential pilots had to complete and pass the FAA Part 107 certification exam and complete the three-and-a-half-day training provided by the WS National Training Academy. The training focused on using commercial off the shelf (COTS) platforms which were developed with several safety features and had better reliability as compared to homemade platforms. By using COTS platforms, all pilots can assemble and fly autonomous missions to aid in their fieldwork. The NFSP is mostly using these applications for measuring feral swine damage to various crops across the U.S. An alternative application includes scouting for feral swine both during the day and at night with a night waiver from the Federal Aviation Administration.

Data (images) collected from drones is currently being stitched together with Pix4D software. Once all the images are stitched to make the orthomosaic, it is pulled into ArcMap where Feature Analyst is being used to detect and quantify all the damage within the field. After the damage is calculated/identified, an accuracy assessment is performed on the field in question to ensure the software is detecting true damage. Accuracy assessments above 80% are necessary, but optimal accuracy exceeds 90%.



Orthomosaic images from drone work in Texas demonstrating feral swine damage to a milo field. The areas in light green depict feral swine damage detected by image analysis software.

A still image captured from a drone showing interior damage caused by feral swine to a cornfield in Missouri.

Mark Lutman operating a drone to capture images of damage over rice fields in Louisiana.

Disease and Population Monitoring Component

The NFSP in conjunction with the National Wildlife Disease Program (NWDP) works with USDA APHIS Veterinary Services to identify the diseases of national concern in feral swine. Originally porcine reproductive and respiratory syndrome (PRRS), influenza A virus in swine (IAV-S), classical swine fever (CSF), swine brucellosis (SB), and pseudorabies (PRV) were identified as the national diseases of concern with which to survey feral swine. Subsequently, surveillance for PRRS and IAV-S were discontinued and the current disease surveillance program includes only CSF, SB, and PRV.

Surveillance for diseases of national concern is conducted using an adaptive risk-based surveillance strategy. Annually, counties of priority for feral swine surveillance are identified based on previous sampling results, risk factors associated with introduction of foreign animal diseases, and presence of animal agriculture. The objective of this adaptive approach is to improve knowledge over time of pathogen prevalence while also improving the distribution of sampling.

The disease data collected through current surveillance and monitoring is important for conducting risk assessments, identifying areas of importance for implementing risk mitigations, and is used for reporting to stakeholders and trading partners. VS provides annual reports summarizing the disease surveillance conducted for identified pathogens of interest in feral swine and domestic swine to the swine industry and stakeholders as well as informs congressional committees and executive-level decision makers.

Classical swine fever is a foreign animal disease and current surveillance serves to reassure trade partners that the U.S. is CSF-free in feral swine populations. Both SB and PRV have been eradicated from U.S. commercial swine operations; however, as they are endemic diseases in feral swine populations, monitoring of feral swine for SB and PRV was deemed important to inform the swine industry as well as other livestock entities. Additionally, SB is a zoonotic pathogen which can cause severe disease in humans. WS routinely removes feral swine and collects serum (~2,800 samples annually) to conduct serologic tests for these three diseases. Sampling is distributed over both space and time and is undertaken in much of the U.S. with counties being ranked high, medium, and low priority based upon such criteria as: 1) existing feral swine populations, 2) domestic hog production, and 3) presence of landfills.

Testing for CSF occurs in series. An enzyme-linked immunosorbent assay (ELISA) is the initial test, if that test is negative, testing is complete for the sample. If the ELISA is positive, the sample is then tested using an immunoperoxidase test. If that test is negative, the sample is considered negative; however, a positive sample is then tested via virus neutralization. This testing occurs at the Foreign Animal Disease Diagnostic Laboratory in Plum Island, New York. To date, no positives for CSF have been identified. Testing for SB occurs at the Kentucky Federal Brucellosis Laboratory and the fluorescence polarization assay (FPA) is used. The average apparent seroprevalence for SB in the U.S. between FY13 and FY17 is 7%, ranging between 4.6 and 10.1%. Testing for PRV occurs at the Kentucky Federal Brucellosis Laboratory and the gB enzyme-linked immunosorbent assay is used. The average apparent seroprevalence for PRV in the U.S. between FY14 and FY18 is 18.4%.

In addition to the three diseases of national concern, there were a number of other diseases that feral swine were surveilled for between FY14 and 18, including blue tongue (BTV), bovine tuberculosis (bTB), influenza A viruses in swine (IAV-S), Japanese encephalitis (JEV), leptospirosis, Neospora, porcine epidemic diarrhea (PED), porcine reproductive and respiratory syndrome (PRRS), Sarcocystis, Seneca Valley virus (SVV), toxoplasmosis, and trichenellosis. See **Table 3** below for apparent seroprevalence in U.S. feral swine between FY14 and 18.

Table 3: Apparent antibody prevalence for each disease that was tested for in feral swine between FY14 and 18.

Disease	Total samples positive	Total samples tested	Percent positive
CSF*	0	14,976	0
PRV*	2,749	14,936	18.4
SB*	949	14,892	6.4
BTV	136	930	14.6
bTB	1	2,257	0
IAV-S	704	11,970	58.8
JEV	5	600	0.8
Leptospirosis	3,293	5,886	55.9
Neospora	16	90	17.8
PED	8	5,699	0.14
PRRS	70	5,609	1.2
Sarcocystis	9	16	56.3
SVV	6	1,404	0.42
Toxoplasmosis	227	2,487	9.1
Trichenellosis	648	5,602	11.6

*denotes a disease of national concern

Additionally, the NFSP conducts a number of pilot projects to address disease issues that arise at a local level. In close collaboration with NWDP, WS field personnel, and others on the ground, the NFSP is able to quickly and robustly respond to pathogens of zoonotic, domestic livestock, or companion animal concern. These projects are often multi-agency collaborative efforts. See the below list of target projects currently ongoing within the NFSP.

1) Evaluation of feral swine for chronic wasting disease (CWD) prions.

Objective and study design:
An experimental infection of swine with chronic wasting disease (CWD) found that pigs are susceptible to this prion infection via multiple routes of exposure and as such, the potential for natural infection via scavenging of cervid carcasses or environmental contamination is a possibility. The prevalence of CWD in Newton County, Arkansas is believed to be ~25% in cervids and a large number of feral swine cohabit this same region. This study aims to evaluate the potential for inter-species transmission of CWD in a natural setting.

Collaborators:
- Wildlife Services Arkansas State Program
- Wildlife Services Oklahoma State Program
- Iowa State University
- University of Texas Health
- Arkansas Game & Fish
- Arkansas Livestock and Poultry Commission
- National Park Service
- U.S. Forest Service
- USDA Veterinary Services

- National Veterinary Services Laboratory
- Colorado State University

Progress: To date, 102 feral swine have been sampled for this study from Newton County, AR and 27 feral swine have been sampled from a CWD-free region of Oklahoma; a number of tissues were taken from feral swine removed in both locations to evaluate for the presence of CWD prions. The samples from OK serve to help elucidate results as no research of this nature has been undertaken in swine. Testing is currently ongoing.

2) Evaluation of SB and tuberculosis (bTB) in feral swine along the Texas-Mexico border.

Objective and study design:
Feral swine are believed to cross back and forth along the U.S.-Mexico border and Mexico is known to have SB as well as bTB, caused by *Brucella suis* and *Mycobacterium bovis*, respectively. Both of these bacterium can be readily carried by feral swine who interact frequently with domestic livestock. A total of 150 adult animals will be culled from counties along the Texas-Mexico border and submandibular lymph nodes and serum will be collected for culture and serology, respectively.

Collaborators:
- Wildlife Services Texas State Program
- National Veterinary Services Laboratory
- Colorado State University

Progress: To date, 114 feral swine have been sampled for this study. Results pending.

3) Experimental infection of swine with *Brucella suis (B. suis)*

Objective and study design:
A robust understanding of disease biology and immune response is fundamental to derive meaningful information from the feral swine disease surveillance program. A number of assays are currently employed and the serologic assay used to determine the prevalence of exposure to *B. suis* has been found to underestimate true exposure when compared to direct bacterial culture. Currently it is unknown if the diagnostic capacity of the assay is poor or if the immune response in swine is atypical or unexpected. More controlled experiments are necessary to determine the root of the inconsistencies, as such, swine were experimentally inoculated with *B. suis* and the pathogenesis, and immune response is being evaluated. Both feral swine proxies and domestic swine will be infected in order to compare the immune response in a side-by-side experiment.

Collaborators:
- Colorado State University
- National Veterinary Services Laboratory

Progress: The experimental infection in Ossabaw pigs (used as a proxy for feral swine) is complete. The following tissues were collected and cultured on *Brucella*-selective media: blood, vaginal swab, endometrium, mandibular lymph node (LN), retropharyngeal LN, parotid LN, mediastinal LN, mesenteric LN, mammary/inguinal LN, spleen, liver, and lung. For every pig, colonies were picked from a culture-positive sample and PCR was performed, thus confirming *B. suis* colonization of at least one tissue. Tissue burden varied greatly between animals and at various time points. Generally, the lymph nodes and spleen had the highest concentration of bacteria, but statistics will need to be performed to confirm if any of the tissue burdens were significantly different. *B. suis* was rarely isolated from the endometrium in females and was never confirmed on vaginal swabs. Interestingly,

bacteremia was present at the time of necropsy in 9/24 (38%) pigs. The number of positive tissues per pig was highest between 2-8 weeks post infection, but even 4 months out, all animals had at least one positive tissue. Domestic swine will be challenged in July to compare the results of the two swine types. Serology diagnostics are currently running.

4) Evaluation of bTB and hepatitis E virus exposure in feral swine abattoir samples.

Objective and study design:
Feral swine have been known to carry a number of pathogens of public health concern. Samples were collected from abattoirs in Texas in 2015 and tested for antibodies against a number of pathogens, including *B. suis*, influenza, *Trichinella spiralis*, *Toxoplasma gondii*, and *Leptospira.* The samples were stored in the Feral Swine Serum Archive after testing in 2015, and will now be tested for antibodies against *M. bovis* and hepatitis E virus. The ELISA kits for hepatitis E antibody detection have been obtained and sample screening is underway.

Collaborators:
- USDA Food Safety and Inspection Service
- Colorado State University

Progress: A total of 369 samples were tested from feral swine and 58 came back positive for antibodies to hepatitis E virus, 15.7% positive. Results are pending for the *M. bovis* antibody testing.

5) Evaluation of feral swine for *Mycobacterium bovis* and *Brucella suis* on the Hawaiian Island of Molokai.

Objective and study design:
Currently cattle from the eastern portion of the island of Molokai are quarantined for bTB and historical sampling indicated wildlife, including feral swine, were infected with *M. bovis*. This study is designed to determine if bTB persists in feral swine and if so, at what level. This information will be very be useful in making management decisions for domestic cattle. Additionally, determining the apparent prevalence of *B. suis* in feral swine is of interest.

Collaborators:
- Hawaii Department of Agriculture
- National Veterinary Services Laboratory
- USDA Veterinary Services

Progress: Two samples have been collected to date. Both had negative results for SB serology and both *M. bovis* and *B. suis* culture results are outstanding.

In addition to pilot projects that serve to target specific diseases in areas of concern, a number of modelling projects are ongoing that serve to help predict disease patterns in feral swine. The primary researcher leading these efforts is Dr. Ryan Miller from USDA APHIS VS CEAH.

1) Develop analytical tools to predict spatio-temporal disease prevalence in feral swine.

Objective and study design:
The primary objective of this project was to develop analytical tools that allow for prediction of feral swine disease seroprevalence at local, regional, and national scales to inform risk analysis, risk mitigations, targeted surveillance, and provide long-term measures of program success. There are many challenges associated with feral swine surveillance including diagnostic test errors, unbalanced

sampling, detection biases, and other factors that can bias prevalence predictions. This analytical tool accounts for all sources of bias and predicts 'true sero-prevalence' after adjusting for these sources of error.

Collaborators:
- Colorado State University
- Center for Epidemiology and Animal Health

Progress: Version 1.0 tools developed. A final analytical tool is available to predict seroprevalence for PRRS virus, PRV virus, IAV-S, hepatitis E virus, and SB at the national scale. Additionally a tool is developed for PRV and SB to predict regional seroprevalence at the watershed scale. The results of this analytical tool are currently being used to support risk-based targeted surveillance. A modified version of the tool has been applied to national surveillance of bTB in feral swine. Two manuscripts are in submission describing the tool and results.

2) Risk assessment of pathogens shared between feral swine, livestock, poultry, and humans.

Objective and study design:
This project conducted a structured evaluation of 84 World Organisation for Animal Health (OIE) pathogens that can be shared between feral swine, livestock, poultry, and humans. Additionally, the existing knowledge of pathogen presence in North American feral swine populations was evaluated. An assessment of the species groups most affected was conducted. The potential risk to agricultural and human health and potential economic impact was also determined by evaluating the status of these pathogens and the co-occurrence of feral swine, agriculture, and humans. However a limitation of the initial study was that it did not include the evaluation of host susceptibility in a quantitative framework or the potential for the host to contribute to maintenance or spillover.

Collaborators:
- Colorado State University
- National Wildlife Research Center
- Center for Epidemiology and Animal Health

Progress: Initial study completed identifying 34 (87%) OIE listed swine pathogens that cause clinical disease in livestock, poultry, wildlife, and humans. Only 49% of currently listed OIE domestic swine diseases had published feral swine surveillance studies. The study is being expanded to develop data describing the maintenance or spillover capacity of the host. Statistical models will be developed and linked to the data describing the co-occurrence of feral swine and livestock to better characterize areas of risk for disease transmission.

3) Analytical tools to predict changes in disease risks due to feral swine control efforts.

Objective and study design:
A primary objective of feral swine control is to mitigate disease risks to domestic animals and humans. However, currently there is no method for evaluating changes in disease risks resulting from control of feral swine populations. This project intends to integrate analytical tools that have been developed to predict disease prevalence with tools to predict changes in population size. Integrating disease surveillance activities and Management Information System (MIS) reported effort and take will allow this tool to determine the changes (reductions) in risk resulting from APHIS program activities to reduce feral swine populations. The resulting analytical tool can be used as a program metric of success identifying regions where disease risks have been mitigated by program activities.

Collaborators:

- National Wildlife Research Center
- Center for Epidemiology and Animal Health

Progress: Project is being initiated in FY19 and builds upon preliminary analytical tools to predict county level disease prevalence and population size.

4) Estimating feral swine-livestock contact and the potential for disease transmission.

Objective and study design:
Understanding the contact and transmission of pathogens from feral swine to domestic animals is central to conducting risk assessments for foreign animal diseases and endemic diseases. However, data describing the contact rates among feral swine and livestock and how those contacts change with feral swine control are currently unavailable. To address this, feral swine at the MacArthur Agro-Ecology Program at Buck Island were marked with GPS collars and contact loggers. Concurrently, cattle, cattle feed, and nutrient resources were also monitored with contact loggers. Both feral swine and cattle were tested for various pathogens across the study. Contacts were measured pre- and post-two treatments using a crossover before-after-control-impact (BACI) design.

Collaborators:

- University of Florida
- University of Georgia, Savannah River Ecological Laboratory
- Arizona State University
- National Wildlife Research Center
- Center for Epidemiology and Animal Health

Progress: The field portion of the study is entering its final year of data collection. It is anticipated that preliminary analyses will be conducted using data from the first part of the study in FY19.

5) Development of adaptive risk-based surveillance strategies for feral swine diseases of concern.

Objective and study design:
Surveillance and monitoring of feral swine for diseases of concern is central to the APHIS program. However, conducting national scale surveillance for endemic and foreign animal disease pathogens of concern is not trivial and requires targeting to efficiently allocate limited sampling resources. To improve targeting, an adaptive risk-based approach was previously developed for CSF, PRV, and SB. However, initial guidance developed targeting for all three pathogens in aggregate. To improve targeting and also allow for inclusion of new pathogens of concern, such as African swine fever, the existing risk-based approach will be revised to develop guidance for each pathogen independently.

Collaborators:

- National Feral Swine Program
- National Wildlife Research Center/National Wildlife Disease Program
- Center for Epidemiology and Animal Health

Progress: Project is slated for FY19.

The disease-monitoring component of the NFSP works in close conjunction with the National Wildlife Disease Program (NWDP) to identify pathogens and areas of concern and to appropriately develop study

designs and implement projects. These efforts are a crucial element of the NFSP as protecting domestic livestock is an essential component of the core mission of the program. The surveillance for pathogens of national concern, in conjunction with pilot projects, serve to enhance the understanding of the role feral swine play in disease maintenance and transmission on the landscape.

Communication and Outreach Component

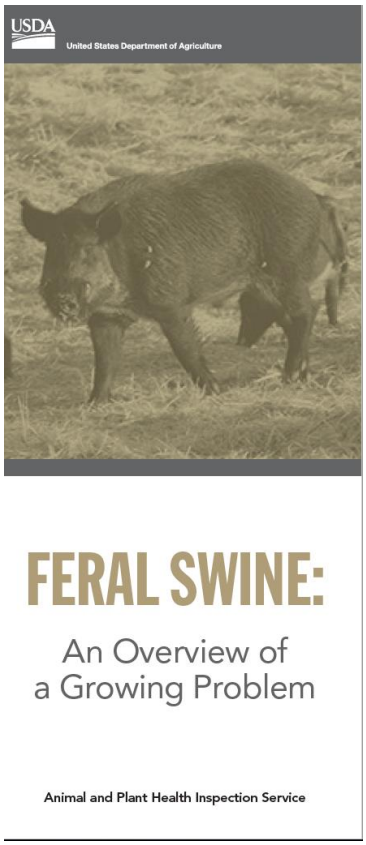
Public awareness campaigns are a crucial component of the role of the National Feral Swine Program, as anthropogenic factors (e.g., baiting, hunting, and translocation) are all instrumental in the range expansion of feral swine. The outreach component of the NFSP involves printed material, such as brochures and fact sheets, as well as a website and other online media. A number of different issues are addressed in these media releases, including requests not to move feral swine; information about diseases carried by feral swine that can affect humans, domestic livestock, or companion animals; and the damage incurred to crops, riparian areas, and threatened and endangered species as a result of feral swine. Outlined below is the outreach component of the NFSP as well as the types of media used in the public awareness campaigns.

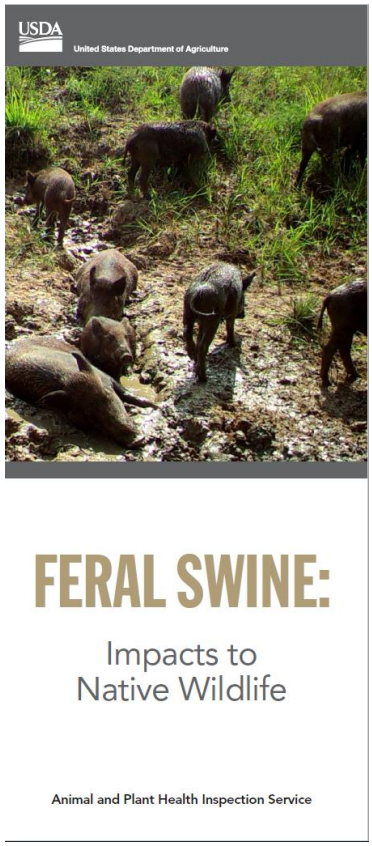
Brochures

Brochures are a traditional way to provide an audience with information and can be used in a variety of ways. Brochures fit nicely into the glove box of a field vehicle allowing wildlife biologists and specialists to provide landowners with information quickly and easily. Brochures are also great for booths at fairs and events, or to hand out during community meetings. The feral swine program has created four brochures, available in both English and Spanish.

The brochures currently available in print include:

- **Feral Swine: An Overview of a Growing Problem**
- **Feral Swine: Impacts to Native Wildlife**
- **Diseases of Feral Swine**



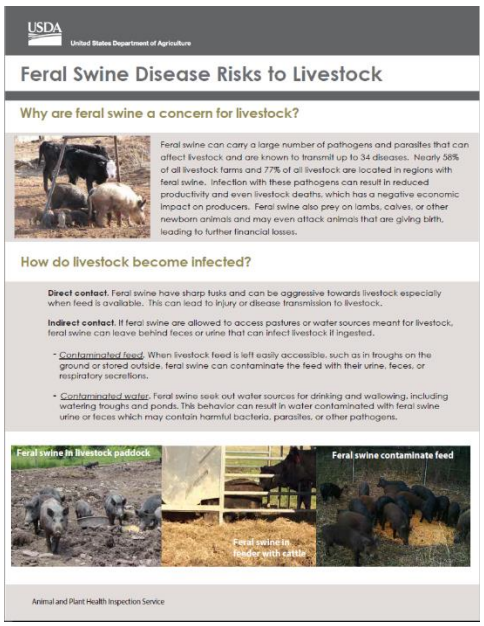


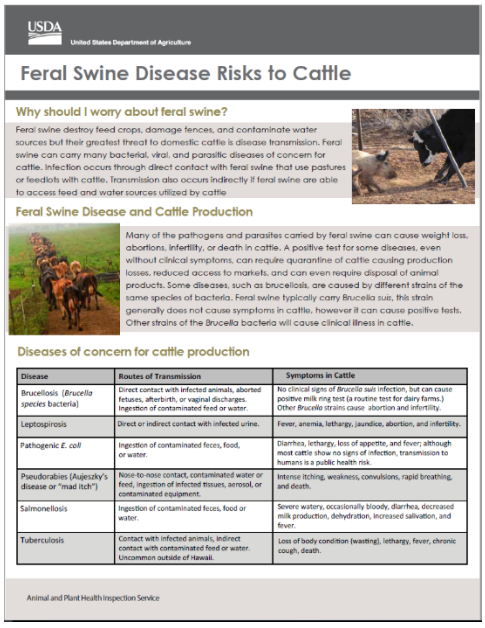
Fact Sheets

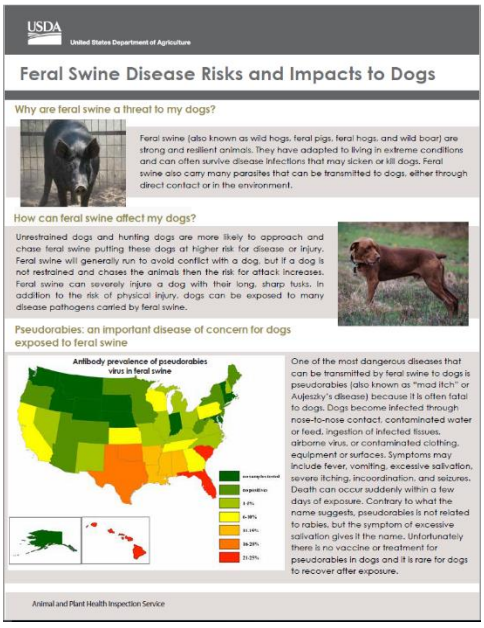
Factsheets are handouts with a narrower topic focus than brochures, but are useful in many of the same venues, such as being distributed at landowner visits, community meetings, fairs, or other events. The program has created nine factsheets available in print or electronically. These fact sheets help target specific audiences by providing focused information.

Factsheets currently available include:

- **Feral Swine Disease Risks to Livestock**
- **Feral Swine Disease Risks to Cattle**
- **Feral Swine Disease Risks to Dogs**
- **Feral Swine Disease Risks to Domestic Swine**
- **Feral Swine Disease Risks to Sheep and Goats**
- **Feral Swine: Impacts on Game Species**
- **Feral Swine: Impacts on Threatened and Endangered Species**
- **Feral Swine: Damage, Disease Threats, and Other Risks**
- **Identifying and Reporting Feral Swine**







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Feral Swine Disease Risks to Domestic Swine

Why should I worry about feral swine?

Feral swine and domestic swine are both the same species (Sus scrofa) meaning they can be infected with the same diseases. Pasture-raised pigs, non-confined domestic swine, and other outdoor swine practices can increase the risk of feral swine transmitting pathogens and parasites. Since feral swine roam freely, they can also contaminate accessible feed and water sources meant for domestic pigs.

Disease impacts to domestic swine production

Swine are social animals: domestic swine may interact with feral swine in pastures or through fences. Feral boar will even breed with domestic sows if they can access them. These interactions can result in transmission of pathogens not usually found in domestic swine. Infections can result in reduced productivity, abortions, reduced number of piglets, or even death. Pasture-raised pigs are also susceptible to acquiring parasites from feral swine, which can result in consumer health concerns and market losses.

Diseases of concern for domestic swine production

Disease	Routes of Transmission	Symptoms
Brucellosis (*Brucella species* bacteria)	Direct contact with aborted fetuses, afterbirth, or vaginal discharges. Ingestion of contaminated feed, water, or tissues.	Infertility, abortion, vaginal discharge, lameness, and swollen testicles.
Pseudorabies (Aujeszky's disease or "mad itch")	Nose-to-nose or sexual contact. Ingestion of contaminated water, feed, or infected tissues. Through contaminated equipment or clothing or by airborne virus.	Abortions, infertility, fever, sneezing, coughing, pneumonia, incoordination; stillbirth, abortion, piglet mortality.
Porcine Reproductive and Respiratory Syndrome	Direct contact with nasal discharge, feces, urine, saliva or through sexual contact. Contaminated feed, water, or equipment or by airborne virus.	Lack of appetite, lethargy, coughing, pneumonia, skin discoloration, stillbirth, weak piglets, and reduced milk production.
Porcine Circovirus Type 2	Direct contact with infected animals, through nasal discharge, feces, urine, or saliva.	Weight loss, jaundice, diarrhea, respiratory distress, and swollen lymph nodes.
Giant Kidney Worm	Ingestion of larvae, penetration through the skin, or through infected earthworms.	Loss of appetite, weight loss, blood in urine.
Porcine Epidemic Diarrhea Virus	Contact with infected feces directly or through contaminated, feed, water, soil, or surfaces.	Acute watery diarrhea and vomiting.
Trichinellosis	Ingestion of muscle tissue infected with the encysted larval stage of the parasite.	Vomiting and diarrhea, larvae may migrate and form cysts in muscle tissue.
Toxoplasmosis	Ingestion of tissue cysts in undercooked or raw meat, or of food and water contaminated with oocysts. Also, the consumption of rodents.	Clinical signs are uncommon in adults but may cause an increase in stillbirths or premature, weak piglets. Diarrhea may occur.
Salmonellosis	Ingestion of contaminated feces, food or water.	Fever, lethargy, lack of appetite, and rancid, watery or bloody diarrhea.

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Feral Swine Disease Risks to Sheep & Goats

Why should I worry about feral swine?

In addition to damaging agricultural crops and destroying farm equipment and fences, feral swine also carry pathogens and parasites that can infect sheep and goats. Feral swine are known to carry and transmit nearly 80% of the diseases of concern for sheep and goats. This may occur either through direct contact or by ingestion of water or feed contaminated with feral swine feces, urine or respiratory secretions. Feral swine also pose a predatory threat to small livestock. Feral swine are omnivores, and although their diet consists primarily of plant material, they may opportunistically prey on newborn sheep and goats. It can be challenging to identify a lamb or kid killed by feral swine, because they consume their entire prey.

Diseases of Feral Swine that Can Affect Sheep and Goats

Disease	Routes of Transmission	Symptoms
Toxoplasmosis	Ingestion of contaminated water or feed.	Abortion, stillbirths, and birth defects.
Salmonellosis	Ingestion of contaminated feces or food or water that is contaminated with the bacteria.	Fever, lethargy, dehydration, diarrhea, stillbirths, and abortions.
Pathogenic *E. coli* infection	Ingestion of contaminated feces or food or water that is contaminated with the bacteria.	Diarrhea, lethargy, and excessive salivation in lambs.
Tuberculosis	Contact with infected animals or indirect contact with contaminated feed or water. Uncommon outside of Hawaii.	Weight loss, lack of appetite, low grade fever, cough, diarrhea, and constipation.
Brucellosis (*Brucella species*)	Direct contact with infected animals, aborted fetuses, afterbirth, or vaginal discharges.	Abortion, fever, swollen udders, and swollen testicles.
Q. Fever (*Coxiella burnetii*)	Ingestion, inhalation, or direct contact with birthing fluids, aborted material, milk, urine, or feces.	Anorexia, spontaneous abortion.
Leptospirosis	Direct or indirect contact with infected urine.	Abortion, reduced milk production, and death.
Pseudorabies (Aujeszky's disease or "mad itch")	Nose-to-nose contact, contaminated water or feed, ingestion of infected tissues, aerosol, or contaminated equipment.	Intense itching, weakness, convulsions, rapid breathing, and death.

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FERAL SWINE: Impacts on Game Species

What Are Feral Swine?

Feral swine (also called wild pigs, boar, feral hogs, and many others) are a destructive, invasive species. They vary in color from black to brown and even patchwork colors, and range in size from 75 to 250 pounds. Feral swine belong to the family Suidae and were introduced into the United States in the 1500s by early explorers and settlers as a source of food. Over centuries, domestic pigs, Eurasian boar, and their hybrids have escaped, been released, and been reintroduced, setting the scene for the rapidly expanding populations we have today.

Why Are They Considered an Invasive Species?

Invasive species are defined as plants or animals that are non-native to an ecosystem and often have broad negative impacts on the environment into which they are introduced. With feral swine populations over 6 million and distributed across more than 35 States, the damage they cause is significant to the environment, economy, and human health. Feral swine damage to habitats, predation on wildlife, and disease transmission can be linked to the decline of nearly 300 native plants and animals in the United States, many of which are threatened or endangered species.

What Is Their Impact?

Feral swine directly impact native game species by preying on the nests, eggs, and young of ground-nesting birds and the young of larger animals such as deer. They compete with native wildlife for important food sources, displace other animals through aggression and competition, and can spread diseases and parasites. The most far-reaching impact feral swine have on game species and other wildlife is habitat change and destruction through their rooting, wallowing, trampling, and feeding behaviors. Feral swine are ecosystem engineers, which means they can change their environment by altering water quality and runoff in wetland environments, shifting plant composition and distribution in grasslands, and decreasing tree diversity in a forest. Feral swine are a risk to native game species such as deer, quail, grouse, turkey, and many others, as well as to the economic stability of businesses that depend on these game species to succeed.

What Can I Do?

Feral swine cause problems by damaging native ecosystems, preying on or competing with native wildlife, and spreading diseases.

- **Do not relocate feral swine** to new areas or transport them to other States.
- **Share the knowledge**; discourage transportation and spread of feral swine.
- If you live in a State with no or low levels of feral swine, **report any sightings, sign, or damage** to wildlife or agriculture officials in your State.

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FERAL SWINE: Impacts on Threatened and Endangered Species

What Are Feral Swine?

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What Is Their Impact?

Feral swine directly impact threatened and endangered species by preying on the nests, eggs, and young of ground-nesting birds and reptiles. They actively hunt and consume small mammals, reptiles, amphibians, and insects. They compete for important resources such as food, water, and habitat, often displacing other wildlife. Additionally, wildlife are vulnerable to many of the diseases and parasites feral swine carry. The most far-reaching impact feral swine have on native wildlife is habitat change and destruction through their rooting, wallowing, trampling, and feeding behaviors. Feral swine are ecosystem engineers, which means they can change their environment by altering water quality and runoff in wetlands, shifting plant composition and distribution in grasslands, and decreasing tree diversity in forests. Feral swine have played a role in the decline of nearly 300 native plants and animals in the United States; over 250 of these species are threatened or endangered.

What Can I Do?

Feral swine cause problems by damaging native ecosystems, preying on or competing with native wildlife, and spreading diseases.

- **Do not relocate feral swine** to new areas or transport them to other States.
- **Share the knowledge**; discourage transportation and spread of feral swine.
- If you live in a State with no or low levels of feral swine, **report any sightings, sign, or damage** to wildlife or agriculture officials in your State.

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FERAL SWINE: Damages, Disease Threats, and Other Risks

What Are Feral Swine?

Feral swine (also called wild pigs, Eurasian boar, or feral hogs) are a harmful and destructive invasive species. They are not native to North America. Early explorers and settlers first brought feral swine into the United States in the 1500s as a source of food. The number of feral swine grew further after that; they were introduced repeatedly in different areas of the country and also started crossbreeding with escaped domestic pigs. Today, their geographic range is quickly expanding as their populations continue increasing nationwide. Over 6 million feral swine can now be found across more than 35 States.

Why Are They a Problem?

The damage feral swine cause is wide-ranging and far-reaching. With populations spreading throughout the United States, this invasive animal—with few natural predators—negatively impacts everything from agriculture and the environment to human health and public safety. Feral swine can multiply faster than any other large mammal; females begin breeding at about 8 months and can produce 2 litters of 4–12 piglets every 12–15 months. The main reasons for their expanding range include accidental escapes or intentional releases from fenced facilities and people moving them illegally to new areas. Damages, costs, and risks from feral swine will only keep rising as their populations continue to expand across the country.

Agriculture

Feral swine damage crops and destroy fields (reducing crop yields) with their feeding, rooting, trampling, and wallowing behaviors. They usually target sugar cane, corn, grain sorghum, wheat, oats, peanuts, and rice, among others. Vegetable and fruit crops, such as lettuce, spinach, melons, and pumpkins, are also attractive to them. Feral swine can also impact the regeneration of forests. By consuming seeds, nuts, and seedlings and damaging land, they keep new trees from growing and can stunt the growth of existing trees.

Feral swine can spread diseases to livestock. This causes economic losses such as decreased production, reduced feed efficiency (less food intake affects animal growth and overall health), lower reproductive success and increased mortality in the herd, and higher costs for veterinary care. Feral swine are omnivorous, meaning they eat just about anything. They can kill calves and lambs, and adult livestock are vulnerable to predation while giving birth.

In addition, feral swine degrade pasture grasses; eat, contaminate, and destroy livestock feed; and damage farm property, such as fences, water systems, irrigation ditches, troughs, and levees.

Health and Public Safety

Feral swine can carry at least 30 diseases and nearly 40 types of parasites that may affect people, pets, livestock, and wildlife. Some diseases, such as pseudorabies, are fatal to cats and dogs that may be exposed from direct contact with a feral swine carcass. Feral swine can also transmit foodborne illnesses, such as *E. coli*, toxoplasmosis, and trichinosis. In some areas, feral swine have been the cause of elevated waterborne bacteria levels in streams and irrigation canals, which is another risk for human health.

When in roadways or at airports, feral swine can collide with vehicles and aircraft, putting the safety of drivers, pilots, and passengers at risk. Other public safety risks arise when feral swine are in urban and suburban areas. As they become less afraid of people over time, they have shown aggression toward golfers, picnickers, and others. This behavior is more of a problem when they associate people with food because of handouts and improper waste disposal. In addition, feral swine may be aggressive to dogs and other pets.

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Identifying and Reporting FERAL SWINE

What Are Feral Swine?

Feral swine (also called wild pigs, Eurasian boar, or feral hogs) are a harmful and destructive invasive species. They are not native to North America. Early explorers and settlers first brought feral swine into the United States in the 1500s as a source of food. The number of feral swine grew further after that; they were introduced repeatedly in different areas of the country and also started crossbreeding with escaped domestic pigs. Today, their geographic range is quickly expanding as their populations continue increasing nationwide. Over 6 million feral swine can now be found across more than 35 States.

Why Are They a Problem?

This invasive species:

- Contaminates water supplies
- Destroys crops, pastures, and timber resources by consuming, rooting, and trampling
- Threatens domestic livestock, with major economic losses for producers
- Disrupts, displaces, and preys on wildlife, including threatened or endangered animals
- Degrades wildlife habitat and other environmentally and culturally valuable areas
- Displaces native wildlife, including game animals, and competes with them for food and other resources
- Poses many risks for public safety and human and animal health

What Do They Look Like?

Feral swine come in many different sizes and colors because of their extensive crossbreeding. Some look like pure Russian or Eurasian wild boars, while others look more like domestic pigs. Adults weigh from 75 to 250 pounds on average, but can get twice as large as that. They may grow to be 3 feet tall and 5 feet long. They generally have a thick coat of coarse, bristly hair. Male feral swine typically have larger heads and tusks than females.

Feral swine reproduce rapidly. Females, or sows, begin breeding at about 8 months and can produce 2 litters of 4–12 piglets every 12–15 months. Sows and their young travel in family groups, called sounders. Sounders can include a few to as many as 30 pigs. The adult males (boars) eventually split off from the sounder and become solitary. Feral swine are usually active at night and are rarely seen during daylight hours.

The best way to identify whether feral swine are active in your area is to look for signs of damage.

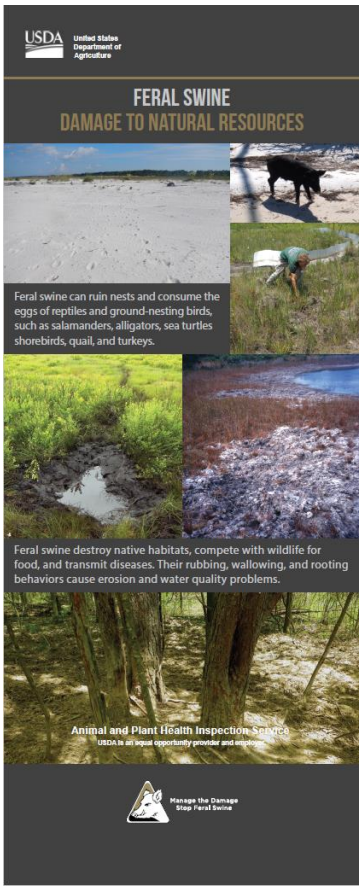
Animal and Plant Health Inspection Service

Display Shades

The program has created a set of five informational display shades, with sets of these distributed to all states the program operates within. These displays are used at fairs, meetings, and other events to provide visuals and information to an audience. Displays are available in both English and Spanish.

Display topics include:

- Damage to Agriculture
- Damage to Cultural Sites
- Damage to Urban Areas
- Damage to Natural Resources
- Human Health and Safety Risks



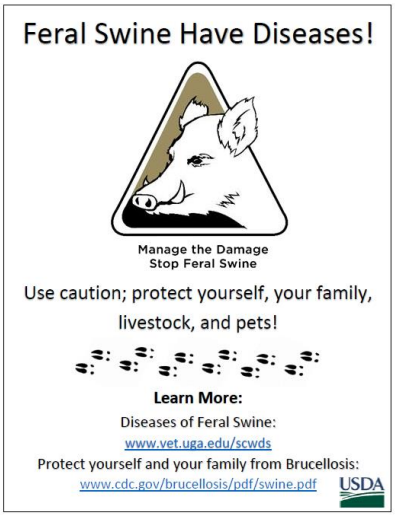
Advertisements

The program has placed advertisements in outlets such as state hunting regulation guides, farm bureau magazines, and event programs.

Examples of these advertisements:

- Sunbelt Ag Expo

- Hunting advertisements



- Farm bureau advertisements

Blogs

Blogs are a great way to connect with a fast paced, modern audience, as they are short, tell a story, and have a call to action that can hook a reader into deeper engagement. Some blogs done by the program over the years include:

Feral Swine Eradication in Havasu National Wildlife Refuge: Protecting Endangered Species from Feral Swine Damage

Posted by Jeanine Neskey, Extension Specialist, USDA, APHIS in Animals
Apr 17, 2018

Feral swine walking on path in Havasu National Wildlife Refuge. The refuge is a vital nesting ground for many species of birds, many of which are federally threatened or endangered. U.S. Fish Wildlife Service photo

Havasu National Wildlife Refuge was established by Franklin D. Roosevelt in 1941, as a refuge and breeding ground for migratory birds and other wildlife. The refuge encompasses 37,515 acres of riverine, riparian, wetland, and desert upland habitats protecting one of the last remaining natural stretches of the lower Colorado River along the Arizona and California borders. The refuge is an important breeding ground and migratory flyway stopover for over 300 species of birds.

The refuge conducts land management and restoration activities intended to improve habitat for federally threatened and endangered species, including southwestern willow flycatchers, western yellow-billed cuckoos, and Yuma Ridgway's rails, as well as other migratory and resident birds, waterfowl and terrestrial wildlife. In addition to habitat protection, the refuge provides extensive wildlife-oriented recreational activities, such as hunting, fishing, wildlife observation and photography,

Unleashing a New Tool to Stop an Unexpected Invader

Posted by Jeanine Neskey, APHIS Feral Swine Program, and Pam Manns, APHIS Public Affairs in Animals
Jul 07, 2017

Canine handlers Lisa Buhr (left) and Marnie Pepper (right) stand with training specialist James Mason (center) and the two APHIS detector dogs that traveled to California to detect feral swine.

The National Feral Swine Damage Management Program, within the USDA's Animal and Plant Health Inspection Service's Wildlife Services (WS) program, has unleashed detector dogs as a new tool to help stop the spread of feral swine, one of the United States' most destructive and ravenous invasive creatures.

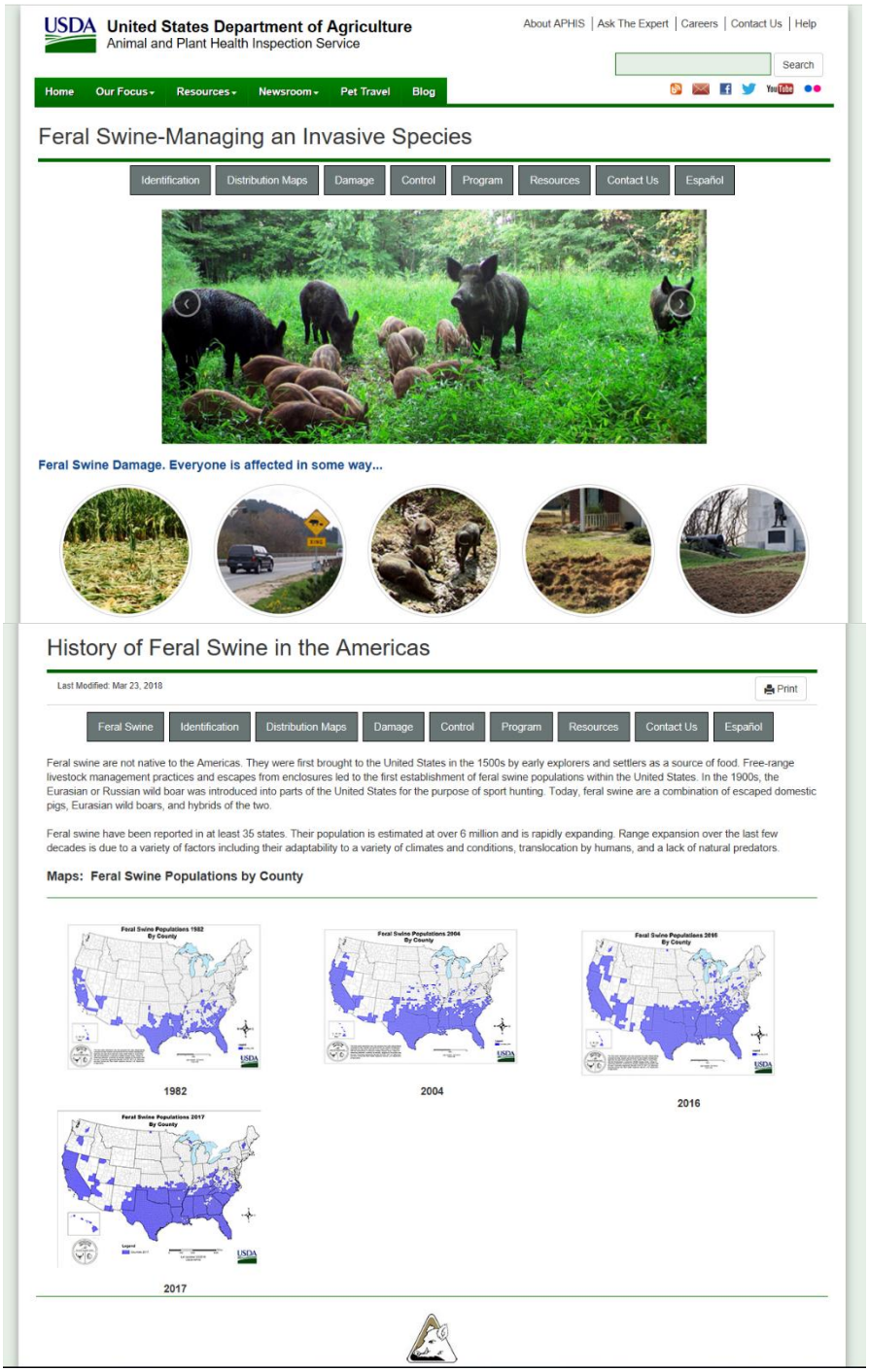
WS first used detector dogs in 2013, to successfully sniff out the scat or droppings of invasive Nutria on Maryland's Lower Eastern Shore as part of the Chesapeake Bay Nutria Eradication Program (CBNEP), a multifaceted effort to rid the area of the damaging animal. Applying the same training techniques, the dog handlers from the Nutria program were able to cross train the canines to locate and detect feral swine scat. WS field staff from across the country sent in samples of feral swine scat so the dogs could be trained to detect it.

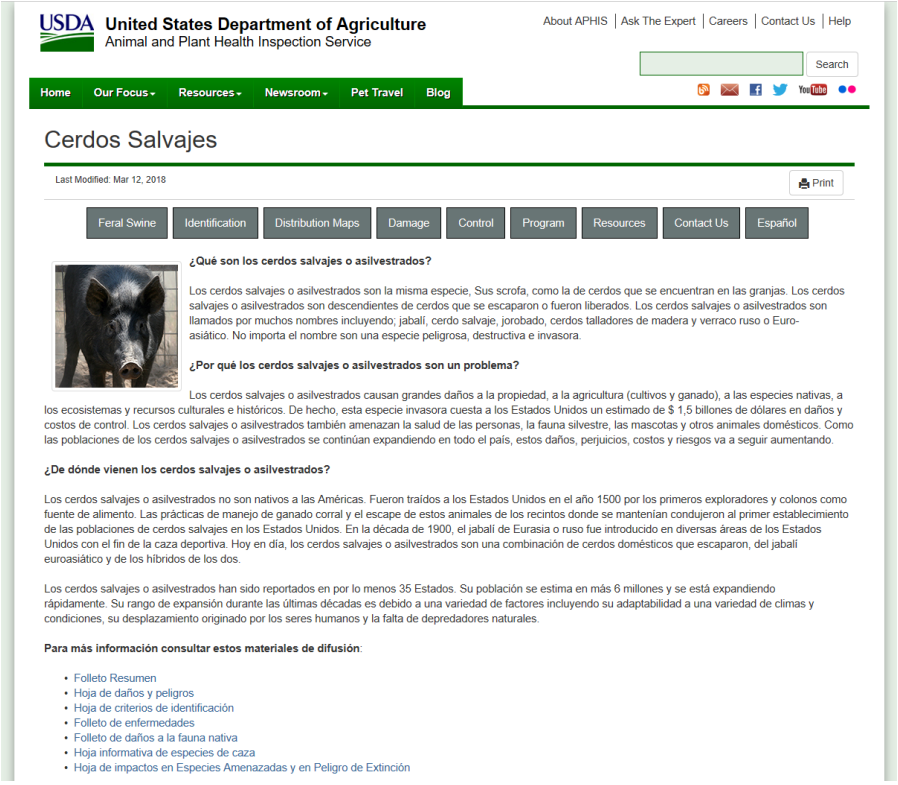
Recently, two dogs, along with their handlers, had the opportunity to put this new training into action when they were flown to the San Diego area. Experts believed feral swine were eradicated in the area, but needed to dogs' help to help prove the animal's absence.

"The dogs did not have any confirmed detections," said Marnie Pepper, a certified biologist and WS project leader for the Chesapeake Bay Nutria Eradication Project/Nutria Detector Dog Program. "One dog, Keeva, did respond and that sample was collected. But the DNA was so compromised that they

Website

The program website is a useful tool for providing a significant amount of information in one place. Stakeholders can be directed to the site to learn about the history of feral swine, identification, damages, control efforts, the program itself, access additional resources, and gain contact information. The site also has a page with additional resources in Spanish.





USDA United States Department of Agriculture
Animal and Plant Health Inspection Service

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Cerdos Salvajes

Last Modified: Mar 12, 2018

Print

Feral Swine | Identification | Distribution Maps | Damage | Control | Program | Resources | Contact Us | Español

¿Qué son los cerdos salvajes o asilvestrados?

Los cerdos salvajes o asilvestrados son la misma especie, Sus scrofa, como la de cerdos que se encuentran en las granjas. Los cerdos salvajes o asilvestrados son descendientes de cerdos que se escaparon o fueron liberados. Los cerdos salvajes o asilvestrados son llamados por muchos nombres incluyendo; jabalí, cerdo salvaje, jorobado, cerdos talladores de madera y verraco ruso o Euro-asiático. No importa el nombre son una especie peligrosa, destructiva e invasora.

¿Por qué los cerdos salvajes o asilvestrados son un problema?

Los cerdos salvajes o asilvestrados causan grandes daños a la propiedad, a la agricultura (cultivos y ganado), a las especies nativas, a los ecosistemas y recursos culturales e históricos. De hecho, esta especie invasora cuesta a los Estados Unidos un estimado de $ 1,5 billones de dólares en daños y costos de control. Los cerdos salvajes o asilvestrados también amenazan la salud de las personas, la fauna silvestre, las mascotas y otros animales domésticos. Como las poblaciones de los cerdos salvajes o asilvestrados se continúan expandiendo en todo el país, estos daños, perjuicios, costos y riesgos va a seguir aumentando.

¿De dónde vienen los cerdos salvajes o asilvestrados?

Los cerdos salvajes o asilvestrados no son nativos a las Américas. Fueron traídos a los Estados Unidos en el año 1500 por los primeros exploradores y colonos como fuente de alimento. Las prácticas de manejo de ganado corral y el escape de estos animales de los recintos donde se mantenían condujeron al primer establecimiento de las poblaciones de cerdos salvajes en los Estados Unidos. En la década de 1900, el jabalí de Eurasia o ruso fue introducido en diversas áreas de los Estados Unidos con el fin de la caza deportiva. Hoy en día, los cerdos salvajes o asilvestrados son una combinación de cerdos domésticos que escaparon, del jabalí euroasiático y de los híbridos de los dos.

Los cerdos salvajes o asilvestrados han sido reportados en por lo menos 35 Estados. Su población se estima en más 6 millones y se está expandiendo rápidamente. Su rango de expansión durante las últimas décadas es debido a una variedad de factores incluyendo su adaptabilidad a una variedad de climas y condiciones, su desplazamiento originado por los seres humanos y la falta de depredadores naturales.

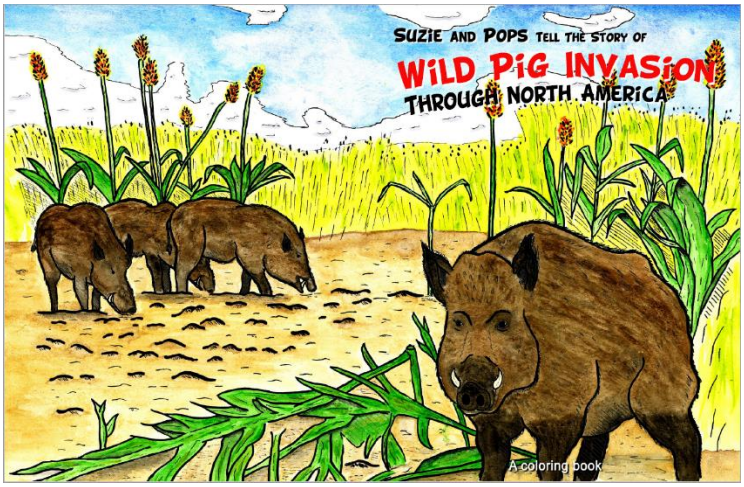
Para más información consultar estos materiales de difusión:

- Folleto Resumen
- Hoja de daños y peligros
- Hoja de criterios de identificación
- Folleto de enfermedades
- Folleto de daños a la fauna nativa
- Hoja informativa de especies de caza
- Hoja de impactos en Especies Amenazadas y en Peligro de Extinción

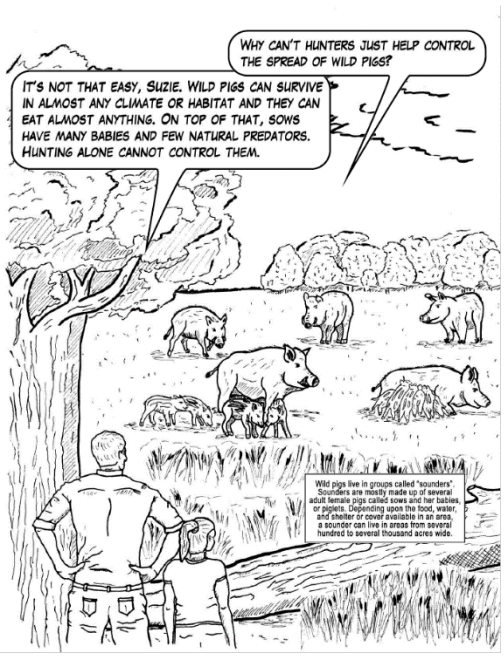
Youth Outreach

The program has developed tools in cooperation with Mississippi State University to engage with youth audiences. An educational coloring book was created which outlines where feral swine came from, the damage they cause, and how people can help. Youth temporary tattoos were also created and eagerly utilized by field staff when hosting booths or events where children may be present. Additionally, engaging with youth is an excellent way to engage with parents.

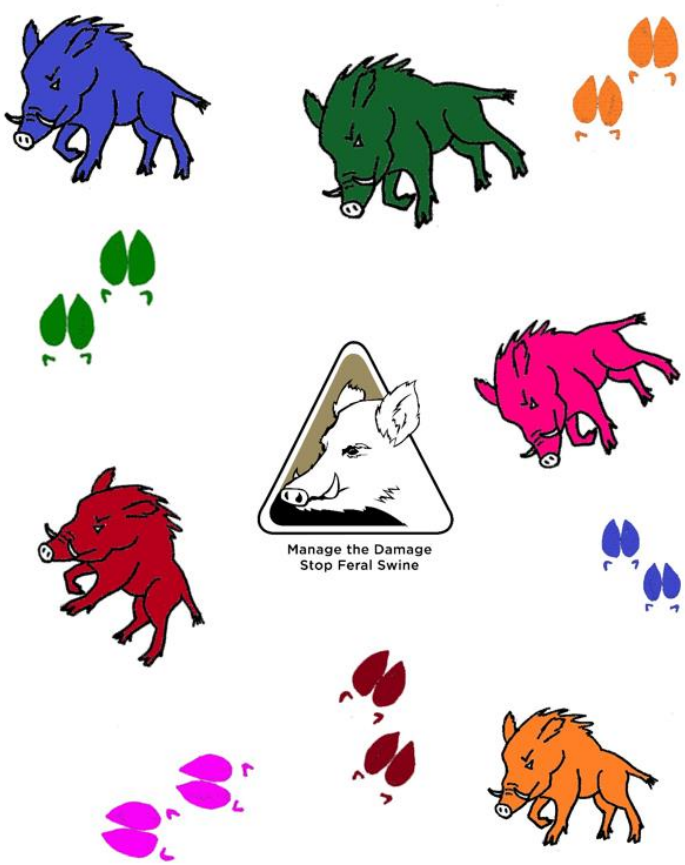
- Coloring book




DEAR READER,
THIS BOOK IS TO HELP YOU LEARN AND UNDERSTAND ABOUT HOW WILD PIGS WERE BROUGHT INTO NORTH AMERICA AND THE DAMAGE THAT THEY CAUSE TO AGRICULTURAL CROPS, THE ENVIRONMENT, OTHER ANIMALS, AND EVEN HUMAN SAFETY.
THERE IS MUCH MORE BEYOND THIS BOOK TO LEARN ABOUT WILD PIGS. WITH YOUR PARENT'S PERMISSION, PLEASE VISIT THE FOLLOWING WEBSITES TO SEE REAL-LIFE DEVASTATION CAUSED BY THESE INVASIVE ANIMALS:
WWW.WILDPIGINFO.COM
WWW.APHIS.USDA.GOV/APHIS/RESOURCES/PESTS-DISEASES/FERAL-SWINE
ENJOY COLORING AND LEARNING!
SUZIE AND POPS
Art and story by Florent Bled
Text by Jessica Tegt


WHY CAN'T HUNTERS JUST HELP CONTROL THE SPREAD OF WILD PIGS?
IT'S NOT THAT EASY, SUZIE. WILD PIGS CAN SURVIVE IN ALMOST ANY CLIMATE OR HABITAT AND THEY CAN EAT ALMOST ANYTHING. ON TOP OF THAT, SOWS HAVE MANY BABIES AND FEW NATURAL PREDATORS. HUNTING ALONE CANNOT CONTROL THEM.
Wild pigs live in groups called "sounders". Sounders are mostly made up of several adult female pigs called sows and her babies, or piglets. Depending upon the food, water, and shelter or cover available in an area, a sounder can live in areas from several hundred to several thousand acres wide.

- Tattoos


Manage the Damage
Stop Feral Swine

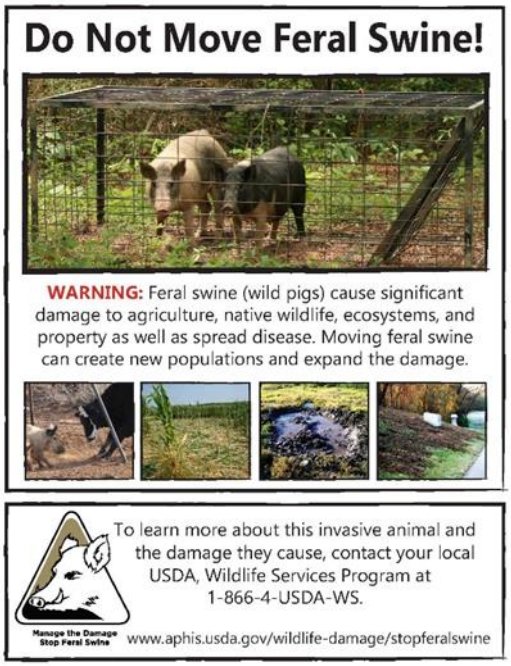
Other Materials

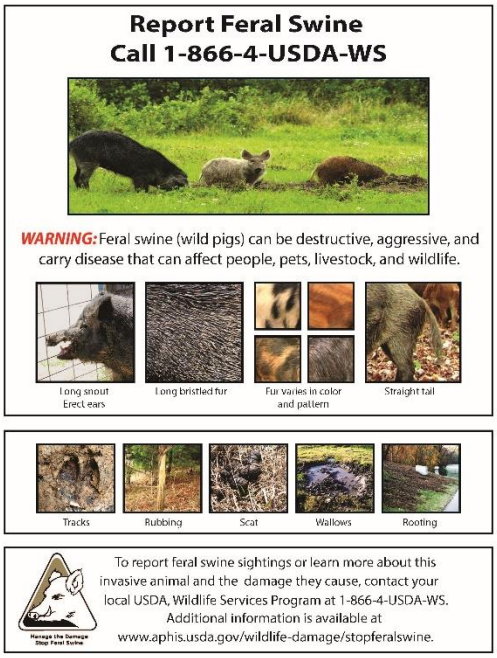
Other materials created to aid in the Program's outreach efforts include magnets, signage, and decals. These items have messaging related to identifying and reporting feral swine, advising people not to move feral swine, and the dangers of feral swine. Signs are often placed at trailheads and parking areas on public lands and the magnets and decals are useful aids at booths or events.

- Decals

- Magnets

- Signs


Do Not Move Feral Swine!
WARNING: Feral swine (wild pigs) cause significant damage to agriculture, native wildlife, ecosystems, and property as well as spread disease. Moving feral swine can create new populations and expand the damage.
To learn more about this invasive animal and the damage they cause, contact your local USDA, Wildlife Services Program at 1-866-4-USDA-WS.
Manage the Damage Stop Feral Swine
www.aphis.usda.gov/wildlife-damage/stopferalswine


Report Feral Swine
Call 1-866-4-USDA-WS
WARNING: Feral swine (wild pigs) can be destructive, aggressive, and carry disease that can affect people, pets, livestock, and wildlife.
Long snout
Erect ears
Long bristled fur
Fur varies in color and pattern
Straight tail
Tracks
Rubbing
Scat
Wallows
Rooting
To report feral swine sightings or learn more about this invasive animal and the damage they cause, contact your local USDA, Wildlife Services Program at 1-866-4-USDA-WS.
Additional information is available at www.aphis.usda.gov/wildlife-damage/stopferalswine.

Research Component

A number of the goals and objectives of the NFSP closely align with those of several research projects housed within the National Wildlife Research Center (NWRC), specifically the Feral Swine Research Project, the Economics and Human Dimensions of Natural Resources Project, and the Genetics Project led by Drs. Kurt VerCauteren, Stephanie Shwiff, and Toni Piaggio, respectively. Outlined below is a project summary relative to feral swine for each of the aforementioned projects and a list of scientific publications and conference presentations can be found in Appendix A.

Feral Swine Research Project

Introduction:

The estimated current population of feral swine in the United States exceeds 6 million. Research accounting for population growth, available habitat, and the likelihood of expansion has modeled potential populations exceeding 20 million swine, with the majority of this growth predicted to occur in Midwestern states. Though the NFSP was initiated in 2014, the NWRC had already initiated research on impacts of feral swine at the Kingsville Field Station (Texas). Following the creation of the NFSP, formal goals were established for the NWRC to serve the program's research needs. As with the Wildlife Services Operations programs, NWRC research serves to improve efficiency of current control methods and develop new strategies to ensure the agency uses safe, acceptable, and science-based management tools. Specifically these goals include the development of a feral swine toxicant, quantitative means for optimizing control methods, monitoring populations, assessing damage to agriculture, and investigating the role of feral swine in disease transmission to humans and livestock.

This summary is designed to highlight tangible results and implications from studies performed within the NWRC project titled "Strategies for Reducing Impacts of Feral Swine and Other Ungulates", herein referred to as the Feral Swine Research Project. Objectives and products have been categorized and grouped into the five goals introduced above. Technical descriptions and results can be found by reading the accompanied list of peer-reviewed scientific publications (Appendix A).

GOAL 1: DEVELOPMENT OF FERAL SWINE TOXICANT AND TOXICANT DELIVERY SYSTEMS

Objective 1.1: Identify a suitable acute toxicant which causes humane death in feral swine, while posing reasonably low risks to non-target species.

Progress

- Determined sodium nitrite is a suitable acute toxicant because it is readily available, safe to handle, degrades quickly in the environment, and overdosing via ingestion is considered a humane death by the Australian Institute of Medical and Veterinary Science (methemoglobinemia).
- Results from our pen and laboratory studies have shown sodium nitrite breaks down rapidly within feral swine once consumed. Residual sodium nitrite in swine muscle tissues were well below the U.S. Food and Drug Administration human safety threshold. Therefore, the potential risk of secondary toxicity to humans and predators/scavengers from consuming feral swine that ingest the toxicant is low.
- No adverse impacts to coyotes or turkey vultures were observed after feeding on carcasses of feral swine that ingested the toxicant in pen studies.

- From a 2-choice pen study, we found that 53 of 56 (95%) animals succumbed to the toxic bait within 3 hours of consumption. These results exceeded U.S. Environmental Protection Agency goals of 90% lethality in pens.
- From a field study conducted under an Experimental Use Permit, we found 109 dead feral swine from 14 bait sites, representing ~66% mortality from feral swine that visited the bait sites. We identified potential palatability issues with free-ranging feral swine, which lead to lower than expected consumption of the toxic bait and spilling of the toxic bait outside the bait station. Spilled bait lead to 179 non-target deaths, comprised of passerine birds (167), raccoons (8), and wild turkeys (4).
- Efforts are currently underway to increase palatability and reduce toxicant spillage by modifying the bait formulation and delivery methods.

Objective 1.2: Identify a suitable bait matrix to conceal the toxicant, and is readily consumed in sufficient (lethal) doses by feral swine.

Progress
- In order to stabilize sodium nitrite and prevent detection by feral swine, the sodium nitrite must be microencapsulated. We examined multiple formulations of microencapsulation material and selected the best relative to lethality and quickest time-until-death for feral swine.
- Identified that a black colored peanut paste was as attractive to feral swine as whole-kernel corn, therefore the paste serves as a suitable oil-based bait matrix.
- Determined that a 10% loading of sodium nitrite in the peanut paste was an adequate concentration to cause death in feral swine after a single feeding bout (i.e. 300-400 grams of consumption).

Objective 1.3: Identify a suitable bait delivery device to deploy toxicant on the landscape, facilitating access by feral swine while prohibiting access by non-target species.

Progress
- In order to safely deploy a feral swine toxicant on the landscape, we developed a durable, lightweight, mobile bait station. An overhanging lid prevents moisture, debris, and non-target species from coming into contact with the bait, yet allows feral swine to access by using their rooting behavior to lift the lid.
- In order to prevent raccoons from accessing our bait stations, we measured their strength and ability to lift lids. We discovered that 26lbs. of resistance was the threshold at which raccoons could no longer lift. Additionally, we found that most pigs can lift 30-40lb lids. From these observations we concluded that 30lbs of magnetic resistance was appropriate to exclude raccoons while still allowing feral swine access to toxic bait.
- Ensured the design of the bait station allowed access to as many pigs as possible in a group feeding situation. We tested several designs and concluded that double-sided bait stations approximately 4 feet long allowed group feeding and reduced aggressive behaviors by dominant feral swine.

Objective 1.4: Identify and describe suitable delivery methods to optimize toxicant exposure to feral swine populations.

Progress

- Using field studies, we determined the best strategy for accustoming feral swine to using the bait stations took 14–20 days. The strategy consisted of: 1) locating feral swine with bait on the ground, 2) introducing the bait station, 3) slowly closing the lid of the bait station, and 4) locking the lid of the bait station with 30lbs of magnetic resistance.
- Using GPS collars, we determined that bait stations should be placed 0.75-1.5 km apart to maximize exposure of a population of feral swine to toxic bait.
- Using a biomarker bait deployment (i.e., simulated toxic bait), we established that the above strategies were capable of delivering toxic bait to 90% of a population of feral swine within 0.75 km of the bait stations.

GOAL 2: OPTIMIZATION OF FERAL SWINE CONTROL METHODS

Objective 2.1: Understand how swine move across different habitats to inform capture methods and strategies.

Progress

- Developed a method for predicting how far feral swine are likely to move in a specific time frame in different regions of the country.

Objective 2.2: Predict habitat utilization of newly established feral swine populations to inform management and control operations.

Progress

- Identified differences in movement behavior in feral swine populations that are near and away from agriculture. Our methodology can be used as a proxy for identifying which crops feral swine prefer to use and for predicting levels of feral swine damage to crops.

Objective 2.3: Deliver ecologically sound recommendations for planning control strategies.

Progress

- Developed dynamic population modeling tools, finding that feral swine control is more efficient (i.e., more swine removed, elimination achieved in a shorter time frame) when spatial and temporal prioritization of resources is used. For example, concentrating resources in a focal area and conducting elimination as a wave front is much more efficient than spreading resources over a larger spatial area. Additionally, concentrating removals during low-birthing periods was more efficient than high-birthing periods.
- Currently extending this methodology to identify cost-effective strategies for distributing toxicant bait stations on the landscape to optimize toxicant delivery.
- Developing optimal strategies for allocating resources for elimination in spatially structured feral swine populations (i.e. Missouri).

Objective 2.4: Provide justification for developing non-lethal control tools for feral swine and recommend when they may provide the most benefit.

Progress

- Population modeling tools have revealed that incorporating fertility control into typical feral swine removal programs was only beneficial over a narrow range of population conditions, including when a population's growth rate was too high to be controlled by removal rates. Fertility control was especially beneficial in areas where immigration from surrounding populations cannot be prevented. Integrating fertility tools cost-effectively however, may require accurate monitoring of population dynamics.

Objective 2.5: Provide methods for evaluating control impacts.

Progress

- Developed a method to quantify changes in the rate of feral swine expansion since the NFSP was initiated. This methodology can be linked with damage and crop distribution data to predict damage prevented by slowing the rate of expansion.

GOAL 3: FERAL SWINE MONITORING METHODS

Objective 3.1: Provide science-based evaluations of management actions.

Progress

- Developed a factsheet demonstrating how additional information such as percent population reduction and return on investment are better criteria than body counts for evaluating management impacts.

- Developed an excel-based app that can be used to assess population reduction on properties following repeated aerial removal. We have delivered the app to two aerial removal programs that work in multiple states.

- Extending this method to use multiple types of management data (aerial removal, trapping, ground removal) combined with population models to assess property-level management impacts alongside management actions.

Objective 3.2: Develop a suite of feral swine monitoring tools that can be used efficiently for management and research.

Progress

- Developed multiple field-based and analytical monitoring methods for feral swine based on mark-recapture/resight concepts and tools such as cameras, traps, and biomarking. Protocols for the methods are described in detail and advantages/disadvantages are summarized contextually.

- Developed a method for evaluating the cost-effectiveness of different monitoring strategies to provide science-based recommendations for choosing the most cost-effective monitoring method.

- Developed analytical methods for determining the certainty of elimination using monitoring tools such as camera traps or environmental DNA.

- Combined methods using unmanned aircraft systems and thermal cameras to detect and count feral swine.

Objective 3.3: Evaluate current quantitative monitoring methods for feral swine and provide input, if needed, to increase the quality and practicality of such methods.

Progress

- Validated the use of standard normal theory statistics on indices following a widely applicable paradigm developed at NWRC (track plots and motion-activated cameras).
- Developed methods and procedures to evaluate and validate population abundance monitoring methods in situations when known populations are not available.
- Documented the universality for using primitive road/track based observation stations for monitoring feral swine abundance.
- Documented the fragility of mark-recapture abundance estimations and that in certain circumstances mark-recapture estimates make poor benchmarks for assessing other population monitoring methods.
- Compared two methods for detecting and monitoring feral swine abundance (motion-activated cameras and tracking plots), and provided guidance for managers regarding when to use these methods.

Objective 3.4: Develop a repeatable relative density index for feral swine (DIFS) to compare populations pre- and post-removal.

Progress

- Developed a method using camera grids and bait sites to implement a relative density estimate and index for feral swine to quickly evaluate relative changes in populations from pre- to post-control operations.
- Preliminary data have been analyzed and validated, further analysis and evaluation will be conducted to optimize the accuracy of estimates.
- Additional replicates to further validate and determine DIFS accuracy and sensitivity to changes in feral swine populations, including varying habitats and density levels, will be conducted.

GOAL 4: DEVELOPMENT OF DAMAGE ASSESSMENT METHODS

Objective 4.1: Damage assessment involved theory and method development as well as damage assessment applications.

Progress

- Line-intercept sampling and estimation was optimized for practical application to sensitive habitats and row crops.
- An “exact” GPS damage measurement method was developed for valuable resources.
- Strip transect sampling was developed for sensitive habitats that avoids impacts from the sampling process.
- A simple method was developed for estimating damage to row crops at planting.
- A method to measure and estimate damage from photographs was developed.

- Methods are being developed to photograph crop fields, via manned and unmanned aircraft, create high-resolution maps, and then use geographic, object-based image analysis for computer identification/classification of feral swine damage.

Objective 4.2: Damage assessments and quantification with economic assessments.

Progress

- First ever assessment of damage at planting was conducted on three crops, with peanuts being much more vulnerable than corn or cotton.
- Damage to globally imperiled steephead ravines in one of North America's top biodiversity hotspots was assessed relative to control effort, climate, recreational hunting, and land use.
- Damage to seepage slopes and other rare and sensitive wetland plant communities was assessed in Florida.
- Harvest-time damage to peanuts in Georgia and Alabama was measured and are now being analyzed.
- First ever scientifically quantified U.S assessments of predation to insular sea turtle nests were conducted during eradications in Florida and South Carolina, with conditioning to turtle nests as food shown to be an important factor in damage levels.
- Feral swine were documented as a new threat to the remaining breeding wetlands of endangered reticulated flatwoods salamanders.
- The first two quantitative assessments on the prevalence and severity (non-recoverable) of feral swine damage to important archaeological sites were conducted in Florida and showed in both cases that nearly half of all sites were disturbed within the past 18 months.

GOAL 5: DISEASE DETECTION, TRANSMISSION, AND PREVENTION

Objective 5.1: Understand factors that drive disease transmission to inform risk assessment, control, and surveillance design.

Progress

- Determined that disease transmission by direct contact among feral swine is unlikely beyond 2 km.
- Acute infections with short infectious periods are unlikely to persist in many feral swine populations due to their group structure and fragmented distribution.
- Models predicted that if foot-and-mouth disease (FMD) were detected in feral swine, removal of feral swine around the detection site would not provide much advantage over doing nothing. In contrast, pre-emptive removal (before emergence) to reduce feral swine population connectivity and density would be highly effective. Both pre-emptive and reactive removal would provide an advantage for control of pathogens with longer infectious periods such as CSF.

Objective 5.2: Provide knowledge for science-based risk assessment and management of diseases at the wildlife-livestock interface.

Progress

- Developed a method for assessing disease risk at the wildlife-livestock interface using prevalence of disease in wildlife populations and livestock producer connections. Data from both sectors (wildlife and livestock) are important for assessing risk accurately.

- Developed statistical methods for assessing spatial expansion risk of diseases that are surveyed by convenience sampling.
- Developed a new method for assessing seasonal disease risk using serology data collected by convenience sampling. This method can disentangle underlying disease dynamics from the sampling design and antibody data (such as that collected for feral swine) to estimate when and where true peaks in disease transmission are occurring.
- Developed a method for estimating contact structure for multiple species by both direct and indirect transmission modes. Framework is currently being applied to quantify contact structure among feral swine and between feral swine and cattle, and to examine the effects of management (baiting and feral swine removals) on decreased disease risk (in progress).

Objective 5.3: Provide disease risk assessments for policy decisions.

Progress

- Developed a model of African swine fever (ASF) using surveillance data from Poland; implications of results are: 1) policies that rapidly remove dead carcasses are important because carcass-based transmission comprises > 50% of all transmission, 2) reducing host density below 1 feral swine/km^2 can help to eliminate persistence in feral swine, 3) ASF transmission is likely not self-sustaining in Poland – targeted surveillance near the border could improve detection and control, and 4) policies to reduce long-distance transmission are important because the rates of spread cannot be explained by natural feral swine movement alone.

Economics and Human Dimensions of Natural Resources Project

Economics Introduction:

The Economics Project has been involved in efforts to estimate the economic damage imposed by feral swine. Economic damage estimation is an important component of a management program for several reasons. First, initial damage estimates serve as a baseline against which management progress can be measured and valued. As estimates are repeated over time, the benefits of management actions are revealed by the reduction in damages. Second, crop-specific and region-specific damage estimates assist managers in allocating resources. There is considerable geographic heterogeneity in feral swine damage, and efficient management strategies require an understanding of where damage is most severe.

To date, the Economics Project has completed two major surveys of producers to assess current damage levels. In a paper published in the journal *Crop Protection* in 2016, we reported the results of one of the most comprehensive surveys on feral swine damage and control in 11 U.S. states (Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, and Texas). The survey was distributed by the USDA National Agricultural Statistical Service in the summer of 2015 to a sample of producers of corn, soybeans, wheat, rice, peanuts, and sorghum in the 11-state region. Findings indicate that feral swine damage can be substantial. The highest yield loss estimates occur in peanut and corn production in the southeast and Texas. Extrapolating crop damage estimates to the state-level in 10 states with reportable damage yields an estimated crop loss of $190 million.

More recently, we completed a survey of livestock producers in 13 U.S. states (Alabama, Arkansas, California, Florida, Georgia, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas). The survey was distributed by the USDA National Agricultural Statistical Service in the summer of 2017 to a sample of livestock producers in the 13-state region. Findings indicate that damage to cattle operations in Texas and Arkansas was substantially higher than

damage in other states and types of livestock operations. When extrapolated to livestock producers across the entire 13-state region, we estimated that damages sum to an annual cost of about $40 million.

Human Dimensions of Natural Resources Introduction:

In 2015, the Economics Project added a human dimensions of wildlife component to complement the economics research that it performs for the NFSP. Broadly, the field of human dimensions of wildlife is concerned with humans' values and attitudes relating to wildlife, and the ways in which humans affect, and are affected by, wildlife. Among other things, insights gleaned from human dimensions research help resource managers and policy makers identify and understand human-wildlife conflicts and the preferences of affected communities for dealing with those conflicts.

In terms of contributions to the NFSP, human dimensions researchers at the NWRC have used surveys to better understand the perceptions of the general public and targeted populations (e.g., farmers and livestock ranchers in selected states) of feral swine and their preferences for controlling the species. This research reveals that a majority of the U.S. public holds a generally unfavorable view of feral swine and would support legal restrictions on the transport of feral swine and most methods of lethal control. A significant exception with important implications is that a majority of the public, including in those states where feral swine are present, oppose the use of toxicants for this purpose. Data collected by human dimensions researchers reveal that possible impacts on non-target species is by far the greatest concern cited by survey respondents, followed by the potential for pain and suffering by feral swine, environmental (e.g., water and soil) impacts, and the tainting of meat intended for human consumption. Given the NFSP's investment in a sodium nitrite-based toxicant, these insights can be extremely useful in developing a toxicant delivery system that addresses these concerns and in shaping public education and outreach efforts.

Genetics Project

Introduction:

The Genetic Methods to Manage Livestock-Wildlife Interactions project (hereafter referred to as the Genetics Project) was formed in 2014 at the NWRC and focuses on the development and application of novel genetic techniques and statistical analyses to infer evolutionary relationships, population dynamics, and molecular ecology of wildlife involved in damage issues as well as national and international wildlife diseases. Over the past five years, this project has assisted the NFSP in realizing its overarching goal of managing the damages caused by feral swine through the use of genomics in analyzing the diet of feral pigs, assessing feral swine genetic ancestry in North America, detecting movements of wild pigs through human-mediated transport, as well as defining management units. The Genetics Project has also developed and implemented novel eDNA sampling to inform local managers of swine presence on the landscape before and after control efforts.

Many of the impacts of feral swine can be easily seen and documented, while others such as impacts to plant communities and other animals through consumption are more difficult to quantify. Traditional diet analysis from inspection of feral swine stomach contents has revealed impacts to rodents, amphibians, and young cervids. However, impacts to easily digested things such as eggs of ground nesting birds is difficult with traditional analyses. The emerging field of genomics can simultaneously sequence and identify multiple items from a mixed stomach or fecal sample. In collaboration with University of Florida, Colorado State University, University of Texas, Tejon Ranch Conservancy, and WS Operations, the Genetics Project tested the ability of this method to distinguish differences in feral swine diets across distinct ecosystems and sampling approaches. We demonstrated a successful proof-of-concept of this

method for detecting feral swine diet items and uncovered the consumption of quail in Texas, imperiled kangaroo rats in California, and impacts to wetland plant communities in Florida. The Genetics Project, in collaboration with University of Florida, also collected fecal samples for a year in Florida to document changes in diet items across seasons and found that this method greatly reduces the time required to identify diet items relative to traditional stomach content analyses. Further, we found alligator and gopher tortoise DNA in feral swine diets. Documenting threats such as these to native wildlife populations and species of conservation concern is vital for the management and recovery of these species, as well as justifies the need for intense management or eradication efforts of feral swine in areas where their distribution overlaps with other wildlife.

Additional information gained through genomics include reasons for swine movements across the landscape through the analysis of DNA present in fecal samples. To better understand these movements, the genetics team successfully led a collaboration with the Savannah River Ecology Laboratory to identify a suite of highly polymorphic markers that are robust in low quality/quantity DNA, and assessed persistence of this DNA in fecal samples in humid areas. Identifying the environments that feral swine are utilizing through fecal sampling provides invaluable information to managers seeking to conserve threatened, endangered, and native wildlife with habitats being utilized by invasive swine.

An additional contribution of the Genetics Project to the NFSP was the development of environmental eDNA sampling techniques to detect the presence of feral swine on the landscape. Sampling eDNA is the ability to sample shed DNA from a target wildlife species from the environment (e.g., water). The Genetics Project was the first to develop methods to apply this to a terrestrial species as previously it has only been used to detect aquatic species and it was unknown if it could work for non-aquatic species. There were many issues to resolve to make this a reliable surveillance tool for terrestrial species (e.g., rapid degradation of DNA, inhibition, dilution, and ease of collection and preservation in the field). A series of studies were thus designed to understand and resolve such issues so that mammalian species of interest could be detected from the water sources they visit. Ultimately, the completion of this work provided a new tool for detecting invasive species such as feral swine, which may be cryptic or exist in low numbers on an invasion front or after eradication efforts.

The NFSP leads an extensive effort across the country to reduce feral swine populations and some states have the goal of elimination. After eradication, it is important to monitor for new invaders. Further, in areas of the country still free of feral swine a report of a feral swine must be considered and checked as the best chance of successful elimination is early in the invasion process when numbers are low. Water sources used by feral swine are often turbid and contain many inhibitors for successful DNA analysis. To develop a method to detect feral swine eDNA in turbid waters required complex trials in the lab and extensive experimentation to develop a process to find equilibrium between eliminating inhibitors and maintaining the low quantity DNA. The development of an assay that removes inhibitors and detects low copies of DNA from turbid waters is a major contribution to the field of eDNA and now can be applied for the detection of other terrestrial species including endangered species, which also occur in low numbers.

The next goal of the Project's development of an eDNA sampling and analysis scheme was to make eDNA field collection easy. In the past, the collection of eDNA has relied on filtering of water samples in the field and required the transport and use of pumps, filters, and a cold chain system. This extensive use of equipment is often cumbersome and unrealistic for use in the field, where personnel may be sampling in remote locations or may be under time constraints. Thus, eliminating the cold chain and filtering equipment needed could greatly increase the chance that this method would be viable in the field. Through experimentation, Genetics Project personnel identified a buffer and the minimal concentrations required to successfully preserve eDNA in raw water samples at ambient temperatures for two weeks equivalent to freezing, a method never before seen for this type of field sampling. The next step in this

technology transfer to the field was to establish a high throughput lab space dedicated to eDNA processing of water samples so that sample processing was as efficient as possible. The resulting eDNA method developed out of the NWRC has directly aided WS with control efforts for feral swine since its inception. For example, in 2016 WS in New Mexico used eDNA detection to triangulate an area and strategically place a helicopter and firearms crew in the air to find a group of feral swine and subsequently eliminate them.

The application of an eDNA sampling scheme to the field has meant that we need to account for uncertainty in detection when using a method for detection after the animal is no longer present. We conducted a field trial at Camp Bullis in Texas to evaluate the probability of detection of feral swine from water bodies using an occupancy modeling approach. We learned that pH of waters, time of year, and water body type all influenced the probability of detection. We also learned that our method of pooling multiple samples from a single water body was not the best approach, rather we needed to test each sample independently for the best probability of detection. This modeling approach also allowed us to estimate the best number of samples to take from each site and replicate required in the laboratory. This detailed field study has led us to be able to develop a robust field collection and laboratory processing protocol that optimized our probability of detection of feral swine eDNA in water.

Furthermore, the Feral Swine Genetic Archive was formed with the inception of the NFSP to complement other monitoring efforts conducted by the Program. The overarching objectives of the Archive were two-fold: 1) to serve as a physical archive for the long-term preservation of voucher samples, as such a tool will allow managers to examine shifts in genetic attributes over time so that they may identify ongoing invasion pressures as well as the genetic effects of control efforts. Toward this objective, we have catalogued over 13,000 samples from across the entirety of the invaded range within the U.S. The Archive also; 2) serves as a data-driven decision support tool, translating physical samples into genetic data (genotypes). Toward this second objective, we have genotyped over 8,000 samples submitted to the Archive and will have genotyped over 10,000 by the end of the 2018 calendar year. By applying cutting-edge molecular tools developed in the agricultural genomics field, we have amassed an unprecedented dataset for the study of an invasive species. As an example of some of the management tools produced from this dataset, we have developed an algorithm that allows us to identify the genetic ancestry of feral swine. This has revealed that feral swine overwhelmingly represent hybrids between heritage (historic) breeds of pig and wild boar. Additionally, we have identified limited direct releases of domestic pigs among contemporary feral swine populations. This has allowed managers to differentiate circumstances where they may have local producers with insecure fencing versus other scenarios where there has been a deliberate collection and release of feral swine from other parts of the invaded range.

We have also been able to evaluate whether the reappearance of feral swine in a location previously assumed to have been cleared of feral swine represented a reinvasion or a failed elimination. In this case, elevated levels of diversity among new individuals clearly demonstrated that feral swine had been re-released as opposed to a rebound of remnant individuals. Finally, we have also begun to map the movement of feral swine among populations. We are finding high rates of movement from population to population within states, the movement of feral swine across state lines, and introductions from captive populations to wild populations. Building on this type of analysis, we were able to identify the source population from which a feral swine was introduced when an animal was sampled in a location that was not previously invaded by feral swine. As the database continues to grow, our goal is to map the movement of feral swine throughout the U.S. and to identify sources of new populations so that managers can use this information to help shut down those introduction pathways.

The Genetics Project has also helped describe management units for feral swine. Working with partners from other federal agencies (National Park Service, U.S. Fish and Wildlife Service), universities (University of North Dakota, University of South Dakota), and NGOs (The Great Basin Institute), we examined genetic structure throughout the invaded range within the U.S. We found multiple distinct

populations of feral swine (Hawaii, Indiana, and Arizona) along with other genetic groups that spanned broad spatial areas. This analysis further supported the conclusion that human-aided introduction has contributed to the rapid expansion of feral swine, but provided little understanding of the processes by which populations are established or what makes populations distinct.

In response to the lingering questions of 'where do feral swine come from?' and 'what are the drivers of range expansion?' the Genetics Project led a highly collaborative effort to describe the ancestry (genetic origins) of feral swine. In sum, this analysis revealed that the rapid expansion of feral swine over the past 30 years has been driven by the geographic expansion of established feral swine populations as opposed to novel introductions of domestic pigs, wild boar, or companion animals (i.e., pot-bellied pigs). Further, the spatial pattern of the expanding invasion, characterized by the emergence of isolated populations at considerable distances from established populations as opposed to the expansion of a continuous invasion front, unequivocally demonstrates the influence of human-aided introduction in the establishment of new populations.

While leveraging the full resources of the Feral Swine Genetic Archive elucidated the overarching driver of range expansion, the Genetics Project has led or facilitated the examination of specific patterns of feral swine movement at local scales. In Tabak et al. (2017), we identified patterns of connectivity among feral swine populations throughout California and a number of sociological predictors of pig introduction. Conducting similar analyses in Florida (Hernandez et al. 2018), we identified feral swine holding facilities (facilities that temporarily hold feral swine prior to being sold for meat or released at private hunting facilities) as foci for pig releases. Finally, we have been leading efforts to map patterns of movement of feral swine both among populations in Missouri and into the state. These efforts are revealing levels and variation in introduction pressure among populations. Further, by evaluating sociological predictors, as with Tabak et al. (2017), we are developing a risk map for the future introduction of feral swine into uninvaded portions of the state.

As the NFSP continues to manage the damages and human-wildlife conflicts caused by feral swine, the Genetics Project will remain an invaluable partner and will continue working to develop the best scientific methods to accomplish these goals.

Regulatory Actions Component

VS and WS collaborate to assess the effectiveness of existing regulations (9 CFR 78.30(c)) that restrict the movement of feral swine. VS and WS also evaluate issues associated with the illegal state-to-state translocation of feral swine. While APHIS has no immediate plans to seek a regulatory solution, it will focus on outreach with stakeholders to clearly explain the existing movement restrictions for feral swine and the risks associated with feral swine and their transplantation.

Additionally, there is a diversity of public attitudes toward feral swine in the United States depending on if the animals are seen as pests, commodity, source of income, or recreational resource. This diversity is also represented in State statues regulating hunting, capture, sale, and transport of feral swine. Feral swine classification within States ranges from wildlife and game animal to prohibited invasive species and escaped private property. As such the primary regulatory authority for feral swine is also different in each state, either residing with the State game and fish agency, State department of agriculture, or in some cases shared authorities. State regulations can broadly be divided into those pertaining to hunting of feral swine and those governing sale and transport of live feral swine. Currently at least 28 states allow some form of public hunting of feral swine and at least four states (Oregon, Kansas, New York, Nebraska) explicitly prohibit all forms of public hunting. Specific to sale and transport of feral swine, at least seven states allow live capture and sale of feral swine. Regulations vary greatly on transport of feral swine but most allow some form of transport with approved animal health certifications. Eighteen federally inspected slaughter plants accepting feral swine currently operate in the U.S. with most slaughter capacity present in three states – Texas, Oklahoma, and Florida.

Planning and Evaluation Component

WS is the primary lead for environmental planning and performance evaluation. PPD and the USDA Office of the General Council provide support to WS to ensure requirements of NEPA and other applicable environmental compliance statues are met. APHIS also ensures federal decision making regarding the NFSP is conducted in a manner that is transparent and accountable to the public. The program reflects information gathered during NEPA analysis prior to implementing feral swine damage management activities.

APHIS evaluated a range of alternatives for a nationally coordinated feral swine damage management program and selected the Integrated NFSP, a nationally coordinated response to reduce and, in some areas, eliminate the risks and damage inflicted by feral swine to agriculture, property, natural and cultural resources, and human health. APHIS serves as the lead federal agency in a cooperative effort with other agency partners, tribes, organizations, and local entities that share a common interest in reducing or eliminating problems caused by feral swine. The program is implemented according to applicable federal, state, tribal, and local laws, and in accordance with local management objectives for feral swine. The selected alternative is also the environmentally preferable alternative.

Multiple alternatives were compared by assessing their effects on a number of potentially affected environmental resources and issues:

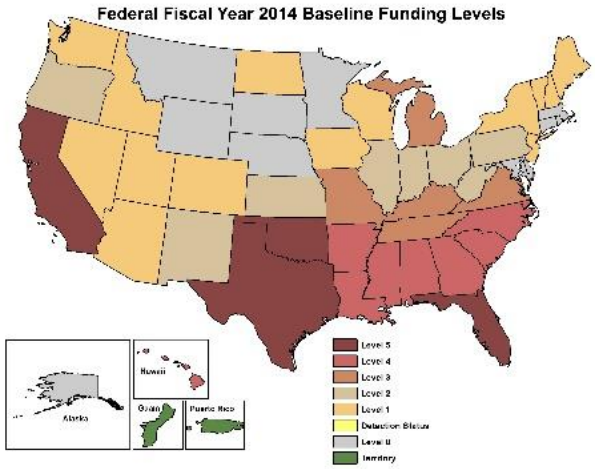
1. Effects on threatened and endangered animals and plants and critical habitats.
2. Effects on other non-target animals.
3. Effects on soils, vegetation, and water quality.
4. Odor/air quality impacts.
5. Effects on recreation including opportunities for hunting feral swine as well as other game species, effects on the aesthetic enjoyment of the nature, and disturbance to recreationists.
6. Climate change impacts.
7. Effects on human health and safety.
8. Socio-cultural impacts including cultural/historic resources, effects on tribes, traditional cultures, and ceremonial values, and humaneness and ethical perspectives.
9. Economic effects.

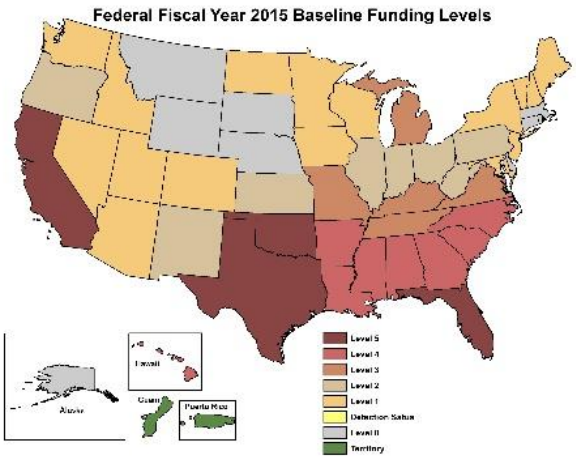
For a thorough review of the environmental planning undertaken on behalf of the NFSP, please see the Final Environmental Impact Statement and/or state relevant NEPA documents.

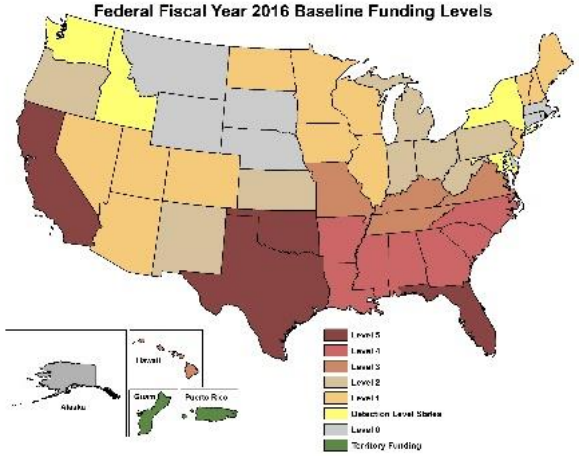
Conclusion

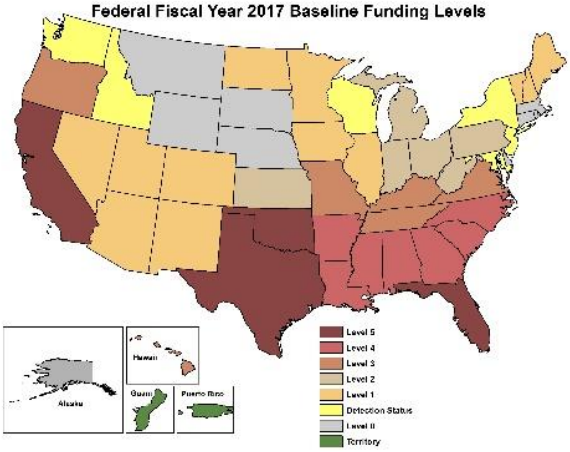
The efforts of the NFSP have been instrumental in reducing the number of feral swine on the landscape which has subsequently, reduced damage to crops, livestock, natural and historic sites, and threatened and endangered species. In addition to testimonial evidence of the positive impact of Wildlife Services from a number of farmers and ranchers, modelling efforts indicate that feral swine populations and landscape inhabitation has been reduced since the inception of the NFSP.

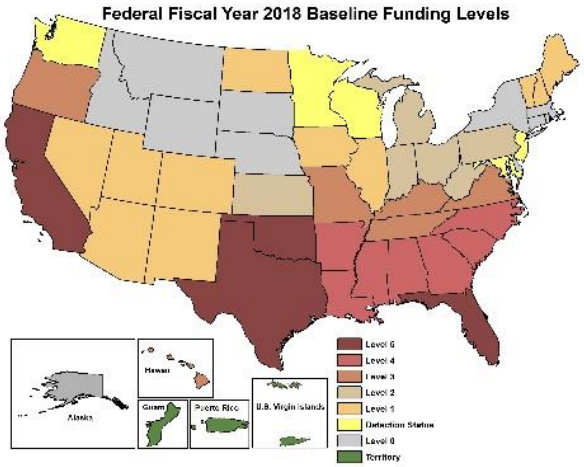
The baseline funding levels are determined by the number of feral swine in each state. The below series of maps illustrate the changes over time in feral swine populations which can be depicted by a change in funding level. Between FY14 and 18, there were 10 states that transitioned, two of which accomplished elimination status and are no longer funded by the NFSP.











In addition to reducing feral swine numbers on the landscape (10 state transitions and 2 eliminations between FY14 and FY18), the NFSP is working closely with collaborators to quantify damage caused by feral swine. The economic estimates of feral swine damage across the United States have been predominantly based on an early study that estimated annual damages and control costs at $1.5 billion (Pimentel *et al*., 2005). The Economics Project at the NWRC has been conducting surveys of producers of agricultural commodities in states impacted by feral swine to better understand the full impact feral swine have on these resources and the American economy. The survey estimates focus on agriculture (crops and livestock) and do not account for the cost of feral swine damage to a myriad of other resources including things like watersheds, natural areas, ecosystem services, native wildlife, or endangered species. The long term goal of the Economics Project is to update and improve the estimate of damage by Pimentel and colleagues (2005) with a more accurate and comprehensive estimate of feral swine impacts that incorporate not only the direct value of agricultural commodities lost but the downstream value of these losses to the macroeconomy as well as the value of impacted resources that are not in the agricultural sector. Furthermore, the Economics Project also worked with Tuskegee University and 12 other 1890s land-grant universities on two survey studies related to feral swine damage. The first focused on limited-resource crop producers in the Southeast (2015) and the second on limited-resource livestock producers in the Southeast (2017). In addition to providing data about damages to crops, livestock and property, the surveys shed light on how this vulnerable demographic is impacted by feral swine.

Additional damage assessment has been identified as a priority moving forward and the NFSP will seek personnel to focus solely on developing a strategy to quantitatively determine the damage caused by feral swine as well as the damage mitigated through feral swine operational control. This would facilitate the NFSP to put a dollar value to the costs associated with feral swine on the landscape which ultimately affords us the opportunity to evaluate the cost/benefit and the overall success of the headquarters program.

With the program having completed its first five years, the headquarter staff have fleshed out their roles relative to the needs of the larger operational mission. Relationships and collaborations with NWRC scientists and researchers in academia and beyond, have been developed and a bright future of fruitful collaboration is imminent. A close interface with states, VS, and the public has allowed the NFSP to respond quickly and appropriately when new issues arise.

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Appendix A.

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Johnson EM, Nagamori Y, Duncan-Decocq, RA, Whitley PN, Ramachandran A, Reichard MV. 2017. Prevalence of Alaria infection in companion animals in north central Oklahoma from 2006 through 2015 and detection in wildlife. *Journal of the American Veterinary Medical Association*, 250, 881-886.

Martin BE, Sun H, Carrel M, Cunningham FL, Baroch JA, Hanson-Dorr K, Young SG, Schmit B, Nolting JM, Yoon KJ, Lutman MW, Pedersen K, Lager K, Bowman AS, Slemons RD, Smith DR, DeLiberto TJ, Wan XF. 2017. US feral swine were exposed to both avian and swine influenza A viruses. *Applied and Environmental Microbiology*, AEM-01346.

Pedersen K, Anderson TD, Bevins SN, Pabilonia KL, Whitley PN, Virchow DR, Gidlewski T. 2017. Evidence of leptospirosis in the kidneys and serum of feral swine (*Sus scrofa*) in the United States. *Epidemiology & Infection*, 145, 87-94.

Pedersen K, Bauer NE, Olsen S, Arenas-Gamboa AM, Henry AC, Sibley TD, Gidlewski T. 2017. Identification of *Brucella spp*. in feral swine (*Sus scrofa*) at abattoirs in Texas, USA. *Zoonoses and Public Health*, 64, 647-654.

Pedersen K, Bauer NE, Rodgers S, Bazan LR, Mesenbrink BT, Gidlewski T. 2017. Antibodies to various zoonotic pathogens detected in feral swine (*Sus scrofa*) at abattoirs in Texas, USA. *Journal of Food Protection*, 80, 1239-1242.

Pedersen K, Miller RS, Anderson TD, Pabilonia KL, Lewis JR, Mihalco RL, Gortázar C, Gidlewski T. 2017. Limited antibody evidence of exposure to *Mycobacterium bovis* in feral swine (*Sus scrofa*) in the USA. *Journal of Wildlife Diseases*, 53, 30-36.

2018

Bevins SN, Lutman M, Pedersen K, Barrett N, Gidlewski T, Deliberto TJ, Franklin AB. 2018. Spillover of swine coronaviruses, United States. *Emerging Infectious Diseases*, 24, 1390-1392.

Burdett CL, Tabak MA, Miller RS. 2018. Geospatial data depicting the relative density and species richness of mast-producing trees in the Northern Hemisphere. *Global Ecology and Biogeography*, Submitted.

Brown VR, Bevins SN. 2018. A review of African swine fever and the potential for introduction into the United States and the possibility of subsequent establishment in feral swine and native ticks. *Frontiers in Veterinary Science*, 5, 1-18.

Brown VR, Bevins SN. 2018. A review of classical swine fever virus and routes of introduction into the United States and the potential for virus establishment. *Frontiers in Veterinary Science*, 5, 31.

Brown VR, Bowen RA, Bosco-Lauth AM. 2018. Zoonotic pathogens from feral swine that pose a significant threat to public health. *Transboundary and Emerging Diseases*, 65, 649-659.

Franckowiak GA, Poché RM. 2018. Short-term home range and habitat selection by feral hogs in Northern Texas. *The American Midland Naturalist*, 179, 28-37.*

Franckowiak GA, Torres-Poché Z, Poché, RM. 2018. Activity patterns by feral hogs in the Texas Panhandle. *The American Midland Naturalist*, 180, 233-245.*

Ferguson L, Luo K, Olivier AK, Cunningham FL, Blackmon S, Hanson-Dorr K, Sun H, Baroch J, Lutman MW, Quade B, Epperson W. 2018. Influenza D Virus Infection in Feral Swine Populations, United States. *Emerging Infectious Diseases*, 24, 1020.

Hernández FA, Parker BM, Pylant CL, Smyser TJ, Piaggio AJ, Lance SL, Milleson MP, Austin JD, Wisely SM. 2018. Invasion ecology of wild pigs (*Sus scrofa*) in Florida, USA: the role of humans in the expansion and colonization of an invasive wild ungulate. *Biological Invasions*, 20, 1865-1880.

Hernández FA, Sayler KA, Bounds C, Milleson MP, Carr AN, Wisely SM. 2018. Evidence of pseudorabies virus shedding in feral swine (*Sus scrofa*) populations of Florida, USA. *Journal of Wildlife Diseases*, 54, 45-53.

Hosier MA, Di Salvo PA, Nol P, Boughton RK, Tabak MA, Miller RS, Kinsey JC, Snow NP, Sweeney SJ. 2018. Tolerance of feral swine to simulated GPS ear tag transmitters. *Wildlife Research*, Submitted.

Linares M, Hicks C, Bowman AS, Hoet A, Stull JW. 2018. Infectious agents in feral swine in Ohio, USA (2009-2015): A low but evolving risk to agriculture and public health. *Veterinary and Animal Science*.

McClure ML, Burdett CL, Farnsworth ML, Sweeney SJ, Miller RS. 2018. A globally-distributed alien invasive species poses risks to United States imperiled species. *Scientific Reports*, 8, 5331.

Miller RS. 2018. Interaction among societal and biological drivers of policy at the wildlife-agricultural interface. *Doctoral dissertation*, Colorado State University.

Miller RS, Opp SM, Webb CT. 2018. Determinants of invasive species policy: Print media and agriculture determine United States invasive wild pig policy. *bioRxiv*, 364372.

Neskey J, VerCauteren K. 2018. A new tool in feral swine management: Sodium nitrite. *Alabama Wildlife* Spring 2018 Edition, In press.

Pedersen K, Miller RS, Mustante AR, White TS, Freye II, James D, Gidlewski T. 2018. Antibody evidence of porcine reproductive and respiratory syndrome virus detected in sera collected from feral swine (*Sus scrofa*) across the United States. *Journal of Swine Health and Production*, 26, 41-44.

Pepin KM, Wolfson DW, Miller RS, Tabak MA, Snow NP, VerCauteren KC, Davis AJ. 2018. Measuring success of national-scale invasive species control programs: insights from 4 years of enhanced feral swine control in continental USA. *Conservation Biology*. Submitted.

Smith JB, Keiter DA, Sweeney SJ, Miller RS, Schlichting PE, Beasley JC. 2018. The movement ecology of establishment: How a long-lived, invasive mammal explores and exploits resources in novel environments. *Journal of Wildlife Management*, Submitted.

Tabak MA, Norouzzadeh MS, Wolfson DW, Sweeney SJ, VerCauteren KC, Snow NP, Halseth JM, Di Salvo PA, Lewis JS, White MD, Teton B, Beasley JC, Schlichting PE, Boughton RK, Wight B, Newkirk ES, Ivan JS, Odell EA, Brook RK, Lukacs PM, Moeller AK, Mandeville EG, Clune J, Miller RS. 2018. Machine Learning Wildlife Classification (MLWIM): An R package for automated camera trap (Version v0.1). DOI: 10.5281/zenodo.1445736.

Tabak MA, Norouzzadeh MS, Wolfson DW, Sweeney SJ, VerCauteren KC, Snow NP, Halseth JM, Di Salvo PA, Lewis JS, White MD, Teton B, Beasley JC, Schlichting PE, Boughton RK, Wight B, Newkirk ES, Ivan JS, Odell EA, Brook RK, Lukacs PM, Moeller AK, Mandeville EG, Clune J, Miller RS. 2018. Machine learning to classify animal species in camera trap images: applications in ecology. *Methods in Ecology and Evolution*, In press.

Tabak MA, Pedersen K, Miller RS. 2018. Predicted time varying seroprevalence and associated demographic risk factors of five pathogens in a widespread wildlife host. *Journal of Applied Ecology*, Submitted.

White MD, Kauffman KM, Lewis JS, Miller RS. 2018. Wild pigs breach farm fence through harvest time in southern San Joaquin Valley. *California Agriculture*, 72, 120-126.

National Program Office Presentations, Trainings, and Meeting Presence FY14-FY18:

2014

Lutman M. 2014. DART, MIS, disease, and disease surveillance update. National Wildlife Disease Program and National Feral Swine Damage Management Program Biologist Annual Meeting. Fort Collins, CO, USA. (06/2014).

Lutman M. 2014. MIS Committee Meeting. Fort Collins, CO, USA. (08/2014).

Lutman M. 2014. Veterinary Services Swine Health Meeting. Fort Collins, CO, USA. (08/2014).

Nolte D. 2014. Feral Swine Steering Committee Meeting. Brentwood, TN, USA. (10/2014).

Nolte D. 2014. Legislative and Public Affairs Meeting. Riverdale, MD, USA. (11/2014).

Nolte D. 2014. SEAFWA Annual Conference. Destin, FL, USA. (10/2014).

Nolte D. 2014. Tuskegee, NASS and Gene Rhodes Meetings. Auburn, AL, USA; Aiken, SC, USA. (12/2014).

Nolte D. 2014. USAHA Meeting and AAVLD Annual Meeting. Kansas City, MO, USA. (10/2014).

Nolte D. 2014. WS Management Team Meeting. Kansas City, MO, USA. (10/2014).

Pedersen K. 2014. The Wildlife Society Annual Conference. Pittsburgh, PA, USA. (10/2014).

2015

Anderson W. 2015. APHIS Feral Swine Meeting. Riverdale, MD, USA. (12/2015).

Anderson W. 2015. Feral Swine Technical Meeting. Vicksburg, MS, USA. (04/2015).

Anderson W. 2015. Michigan, Program Visit. Okemos and Detroit, MI, USA. (12/2015).

Anderson W. 2015. Midwest Fish and Wildlife Conference. Indianapolis, IN, USA. (02/2015).

Anderson W. 2015. North Carolina Program Visit. Raleigh, Kill Devil Hills, Clinton, and Morrisville, NC, USA. (11/2015).

Anderson W. 2015. Review of Florida's Feral Swine Program. Gainesville, Port St. Joe, and Kissimmee, FL, USA. (04/2015).

Anderson W. 2015. Review of Hawaii's Feral Swine Program. Oahu, HI, USA. (05/2015).

Anderson W. 2015. Wildlife Damage Management Conference. Gatlinburg, TN, USA. (03/2015).

Anderson W. 2015. WS State Meeting (Presenter). Red Lodge, MT, USA. (08/2015).

Lutman M. 2015. ESRI Federal Users Conference. Washington, DC, USA. (02/2015).

Lutman M. 2015. MIS Committee Meeting. Fort Collins, CO, USA. (02/2015 and 08/2015).

Lutman M. 2015. Mobile data collection for feral swine. APHIS GIS Summit. Riverdale, MD, USA. (02/2015).

Lutman M. 2015. Veterinary Services Swine Health Meeting. Fort Collins, CO, USA. (08/2015).

Nolte D. 2015. APHIS Administrator Meeting. Washington, DC, USA. (02/2015).

Nolte D. 2015. APHIS Feral Swine Coordinating Meeting. Riverdale, MD. (12/2015).

Nolte D. 2015. APHIS-IS Meeting. Mexico City, Mexico. (11/2015).

Nolte D. 2015. Association of Fish and Wildlife Agencies Annual Meeting. Tucson, AZ, USA. (09/2015).

Nolte D. 2015. Arizona Wildlife Services Meetings. Phoenix, AZ, USA. (06/2015).

Nolte D. 2015. Feral Swine Meeting and Workshop. Torreon, Mexico. (08/2015).

Nolte D. 2015. Feral Swine Program Update to Southeast Cooperative (Presenter). Atlanta, GA, USA. (05/2015).

Nolte D. 2015. Feral Swine Task Force Meeting. Nashville, TN, USA. (03/2015).

Nolte D. 2015. Feral Swine Technical Meeting. Vicksburg MS, USA. (04/2015).

Nolte D. 2015. Headquarters Meetings. Washington, DC, USA. (05/2015).

Nolte D. 2015. Kingsville Research Meetings. Kingsville, TX, USA. (04/2015).

Nolte D. 2015. Mississippi State Research Meeting. Starkville, MS, USA. (04/2015).

Nolte D. 2015. National Wildlife Services Advisory Council. Riverdale, MD, USA. (03/2015).

Nolte D. 2015. North American Wildlife and Natural Resources Conference. Omaha, NE, USA. (03/2015).

Nolte D. 2015. Site Visit and Meetings with Missouri WS Representatives. Columbia and Kansas City, MO, USA. (07/2015).

Nolte D. 2015. The Wildlife Society Annual Conference. Winnipeg, Manitoba, Canada. (10/2015).

Nolte D. 2015. Tuskegee University Meeting. Auburn, AL, USA. (12/2015).

Nolte D. 2015. Wildlife Damage Management Conference. Gatlinburg, TN, USA. (03/2015).

Nolte D. 2015. Wild Pig Policy Forum. Biloxi, MS, USA. (12/2015).

Nolte D. 2015. WS Management Team Meeting. Minneapolis, MN, USA. (09/2015).

Nolte D. 2015. WS Management Team Meeting. Riverdale, MD, USA. (01/2015).

Paraan J. 2015. APHIS Feral Swine Coordinating Meeting. Riverdale, MD, USA. (12/2015).

Pedersen K. 2015. Chinese Academy of Science Meeting; International Symposium of Integrative Zoology. Beijing and Xian, China. (08/2015).

Pedersen K. 2015. Feral Swine Coordinating Meeting. Riverdale, MD, USA. (12/2015).

2016

Anderson W. 2016. APHIS-IS Mexico Feral Swine Planning. Washington, DC, USA. (10/2016).

Anderson W. 2016. Feral Swine Technical Meeting. Walhonding, OH, USA. (09/2016).

Anderson W. 2016. National Assembly of Sportsmen's Caucuses. Biloxi, MS, USA. (12/2016).

Anderson W. 2016. National Training Academy Meeting. Starkville, MS, USA. (06/2016).

Anderson W. 2016. Oklahoma Program Visit. Oklahoma City and Henryetta, OK, USA. (02/2016).

Anderson W. 2016. Oregon Program Visit. Madras and Portland, OR, USA. (08/2016).

Anderson W. 2016. Restore America's Estuaries Summit (Presenter). New Orleans, LA, USA. (12/2016).

Anderson W. 2016. Southeast Region Feral Swine Technical Meeting (Instructor). Columbiana, AL, USA. (03/2016).

Anderson W. 2016. Western Region Feral Swine Technical Meeting. Midway, UT, USA. (05/2016).

Anderson W. 2016. Wild Pig Conference and WS Feral Swine Meeting. Myrtle Beach, SC, USA. (04/2016).

Anderson W, Lutman M, Pedersen K, Lofton K, Ondovchik M, Muer TJ, Lavelle M, Halseth J, Freye JD, Smyser T, Van Natta E. 2016. Technical Training. Alabama, Utah, and Ohio, USA. (03/2016, 06/2016, and 09/2016 respectively).

Cunningham FL, Sun H, Wen F, Baily E, Cooley J, Lutman M, Schmit B, Baroch H, Pedersen K, Deliberto T, Wan X. 2016. Pathogenesis of H1N1 avian origin influenza A viruses in feral swine. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Lutman M. 2016. APHIS GIS Summit. Riverdale, MD, USA. (02/2016).

Lutman M. 2016. ESRI Federal Users Conference. Washington, DC, USA. (02/2016).

Lutman M. 2016. MIS Committee Meeting. Fort Collins, CO, USA. (02/2016 and 08/2016).

Lutman M. 2016. New mapping techniques for tracking feral swine. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Lutman M. 2016. Unmanned Aircraft Systems Training. Cedar City, UT, USA. (04/2016).

Neskey J. National Feral Swine Damage Management Program Outreach and Communications. Wildlife Services Feral Swine Meeting. Myrtle Beach, SC, USA. (04/2016).

Neskey J. National Feral Swine Damage Management Program Outreach and Communications. Wildlife Services Technical Trainings. Midway, UT, USA; Bladensburg, OH, USA. (05/2016 and 09/2016, respectively).

Neskey J, Nolte D. APHIS National Feral Swine Damage Management Program. National Small Farmers Conference. Virginia Beach, VA, USA. (09/2016).

Neskey J, Nolte D. Congressional Workshop. Jackson, MS, USA. (08/2016).

Nolte D. 2016. AFWA Annual Meeting; WS Management Team Meeting. Philadelphia, PA, USA. (09/2016).

Nolte D. 2016. Alabama Farmer Federation Meetings. Auburn, AL, USA. (03/2016).

Nolte D. 2016. FEI Training. Charlottesville, VA, USA. (07/2016).

Nolte D. 2016. Feral Swine and APHIS-IS Meeting. Washington, DC, USA. (10/2016).

Nolte D. 2016. Feral Swine Economics Meetings with USDA and APHIS Officials. Washington, DC, USA. (11/2016).

Nolte D. 2016. Feral Swine Meetings. Auburn, AL, USA. (10/2016).

Nolte D. 2016. Feral Swine Meetings. Raleigh, NC, USA; Virginia Beach, VA, USA; Washington, DC, USA. (09/2016).

Nolte D. 2016. Meeting with Canadian Government and University Officials. Saskatoon, Saskatchewan, Canada. (06/2016).

Nolte D. 2016. NAFWS National Conference (Presenter). Green Bay, WI, USA. (05/2016).

Nolte D. 2016. National Feral Swine Task Force Meeting. Atlanta, GA, USA. (03/2016).

Nolte D. 2016. National Wild Pig Task Force Meeting; Wild Pig Conference; APHIS-WS Feral Swine Meeting. Myrtle Beach, SC, USA. (04/2016).

Nolte D. 2016. North American Wildlife and Natural Resources Conference. Pittsburgh, PA, USA. (03/2016).

Nolte D. 2016. State Meeting; Legislative Field Day; MSU Meeting. Vicksburg and Jackson, MS, USA. (08/2016).

Nolte D. 2016. Tour of Texas Feral Swine Program with Jere Dick. San Antonio, Columbus, and Corpus Christi, TX, USA. (04/2016).

Nolte D. 2016. Tuskegee University Meeting. Auburn, AL, USA. (12/2016).

Nolte D. 2016. USAHA Pork Board Sub-Committee Meeting (Presenter). Greensboro, NC, USA. (10/2016).

Nolte D. 2016. Vertebrate Pest Conference. Newport Beach, CA, USA. (03/2016).

Nolte D. 2016. WS Budget Meeting. Riverdale, MD, USA. (12/2016).

Nolte D. 2016. WS Management Team Meeting. Scottsdale, AZ, USA. (01/2016).

Paraan J. 2016. Feral Swine Program Support and WS Feral Swine Meeting. Myrtle Beach, SC, USA. (04/2016).

Pedersen K. 2016. Feral Swine Technical Meeting. Walhonding, OH, USA. (09/2016).

Pedersen K. 2016. Southeast Region Feral Swine Technical Meeting (Instructor). Columbiana, AL, USA. (03/2016).

Pedersen K. 2016. The Wildlife Society Annual Conference. Raleigh, NC, USA. (10/2016).

Pedersen K. 2016. Western Region Feral Swine Technical Meeting. Midway, UT, USA. (05/2016).

Pedersen K. 2016. Wild Pig Conference and WS Feral Swine Meeting. Myrtle Beach, SC, USA. (04/2016).

Reynolds E. 2016. Budget Meeting (Participant). Minneapolis, MN, USA. (03/2016).

Reynolds E. 2016. Wildlife Services Feral Swine Meeting (Participant). Myrtle Beach, SC, USA. (04/2016).

Reynolds E. 2016. Wildlife Services Meeting (Participant). Riverdale, MD, USA. (12/2016).

2017

Anderson W. 2017. National Association of Conservation Districts Meeting (Presenter). Denver, CO, USA. (01/2017).

Anderson W. 2017. State Meetings. (Presenter, Attendee). Tumon, Guam. (04/2017).

Anderson W. 2017. State Meetings (Presenter, Attendee). Honolulu, HI, USA. (04/2017).

Anderson W. 2017. Wildlife Damage Management Conference. Orange Beach, AL, USA. (02/2017).

Anderson W. 2017. WS State Meeting (Presenter). Dover, TN, USA. (01/2017).

Lutman M. 2017. APHIS GIS Summit. Riverdale, MD, USA. (02/2017).

Lutman M. 2017. How DART and collector information are being used for feral swine needs. MIS Needs Assessment Presentation. Riverdale, MD, USA. (12/2017).

Lutman M. 2017. How Wildlife Services is currently using unmanned aircraft systems to map feral swine damage. USGS Webinar Presentation. (12/2017).

Lutman M. 2017. MIS Committee Meetings. Fort Collins, CO, USA. (02/2017 and 08/2017).

Lutman M. 2017. Unmanned Aircraft Systems Committee Meetings. Fort Collins, CO, USA. (02/2017 and 08/2017).

Lutman M. 2017. Unmanned Aircraft Systems Workshop. Wildlife Services Specialist Meeting. Fort Collins, CO, USA. (08/2017).

Lutman M. 2017. Using GIS to help collect and assess feral swine damage. ESRI Federal Users Conference. Washington, DC, USA. (02/2017).

Marlow M. 2017. Federal Feral Swine Task Force Meeting. Washington, DC, USA. (08/2017).

Marlow M. 2017. Meeting with the state director, assistant state director, and district supervisor on the Oklahoma aerial feral swine program. Oklahoma City, OK, USA. (10/2017).

Marlow M. 2017. OARS high-level meeting to discuss NFSP data needs. Riverdale, MD, USA. (12/2017).

Neskey J. 2017. A national response to reduce damages caused by the expansion of feral swine populations in the United States (Poster). Wildlife Damage Management Conference. Gulf Shores, AL, USA. (02/2017).

Neskey J. 2017. Congressional Field Day (Participant). Auburn University at Southern Sportsman Lodge. Auburn, AL, USA. (05/2017).

Nolte D. 2017. AFWA Conference. Sandy, UT, USA. (09/2017).

Nolte D. 2017. Alabama Farmers Federation Meeting. Washington, DC, USA. (03/2017).

Nolte D. 2017. Arkansas Task Force Meeting. Little Rock, AR, USA. (08/2017).

Nolte D. 2017. Eastern Regional Meeting. Myrtle Beach, SC, USA. (03/2017).

Nolte D. 2017. Federal Agency Task Force Meeting. Washington, DC, USA. (08/2017).

Nolte D. 2017. Feral Swine Damage Management Program Meeting with Mexican Officials. Mexico City, Mexico. (06/2017).

Nolte D. 2017. Havasu National Wildlife Refuge Feral Swine Elimination Project. Needles, CA, USA. (02/2017).

Nolte D. 2017. MDC Director, ER Director, and WS-MO State Director Meeting for Feral Swine Activities. Columbia, MO, USA. (11/2017).

Nolte D. 2017. MIS Discussion with WS Leadership. Washington, DC, USA. (12/2017).

Nolte D. 2017. Mississippi, Alabama, and Louisiana WS-State Directors Meeting to Coordinate Feral Swine Activities. Gulf Shores, AL, USA. (09/2017).

Nolte D. 2017. Missouri-Arkansas Meeting for Cooperative Efforts along State Borders. Little Rock, AR, USA. (12/2017).

Nolte D. 2017. Northeastern States Meeting for Feral Swine and Rabies Issues Discussion. Concord, NH, USA. (11/2017).

Nolte D. 2017. Swine Meetings. Riverdale, MD; Washington, DC, USA. (05/2017).

Nolte D. 2017. Wildlife Damage Management Conference; Feral Swine Meetings. Gulf Shores, AL, USA. (02/2017).

Nolte D. 2017. WS Management Team Meeting. Albuquerque, NM, USA. (09/2017).

Pedersen K. 2017. Diseases in Nature Transmissible to Man (Presenter). Irving, TX, USA. (05/2017).

Reynolds E. 2017. Eastern Region Meeting (Participant). Myrtle Beach, SC, USA. (03/2017).

2018

Anderson W. 2018. Presentation and Providing of Outreach Materials. Nashville, TN, USA. (02/2018).

Anderson W. 2018. Wild Pig Conference and WS Feral Swine Steering Committee Meeting. Oklahoma City, OK, USA. (04/2018).

Brown V, Marlow M. 2018. Feral Swine Workshop (Participants). Fort Collins, CO, USA (01/2018)

Brown V, Marlow M. 2018. International Wild Pig Conference (Participants). Oklahoma City, OK, USA. (04/2018).

Lutman M. 2018. MIS Committee Meeting. Fort Collins, CO, USA. (02/2018 and 08/2018).

Lutman M. 2018. Unmanned Aircraft Systems Trainer and Presenter. 4 Day Training. Fort Collins, CO, USA; Tumon, Guam; Bismarck, ND, USA. (03/2018, 05/2018, and 07/2018 respectively).

Lutman M. 2018. Using drones to map and quantify feral swine damage. Missouri Department of Conservation and Wildlife Services Presentation. Osage, MO, USA. (02/2018).

Lutman M, Fischer J. 2018. Using UAS to measure feral swine damage in corn. International Wild Pig Conference: Science, Management, and Solutions (Poster). Oklahoma City, OK, USA. (04/2018).

Lutman M, Fischer J, Webber B. 2018. Using UAS to identify and measure feral swine crop damage. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Marlow M. 2018. Southeastern Cooperative Wildlife Disease Study Foreign Animal Disease Course (Presenter). Athens, GA, USA (05/2018).

Marlow M. 2018. State Feral Swine Task Force Meeting. Indianapolis, IN, USA. (08/2018).

Neskey J. 2018. Engaging a diverse public in feral swine damage management. Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Neskey J. 2018. Engaging hunting communities. Wildlife Services Feral Swine Meeting. Oklahoma City, OK, USA. (04/2018).

Neskey J. 2018. National Feral Swine Damage Management Program Overview. National Wildlife Research Center hosting Sonny Perdue, Secretary of Agriculture. Fort Collins, CO, USA. (05/2018).

Nolte D. 2018. APHIS Feral Swine Program Overview, Department of Defense Workshop (Presenter). San Antonio, TX, USA. (03/2018).

Nolte D. 2018. Arizona-Texas-Nevada-California WS State Directors and USFWS Meeting. Needles, CA, USA. (02/2018).

Nolte D. 2018. Feral Swine Meetings. Auburn, AL, USA. (06/2018).

Nolte D. 2018. Meeting with WS Deputy Administrator. Washington, DC, USA. (05/2018).

Nolte D. 2018. Savannah River Ecology Lab. Aiken, SC, USA. (06/2018).

Nolte D. 2018. Wild Pig Task Force; WS-Feral Swine Steering Committee; WS-Feral Swine Meetings; Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Nolte D. 2018. WS Management Team Meeting. Washington, DC, USA. (01/2018).

Reynolds E. 2018. Fundamentals of Human Resources Management Training (Participant). Raleigh, NC, USA. (02/2018).

Feral Swine Research Project Publications FY14-FY18:

2014

Engeman RM, Hershberger T, Orzell SL, Felix Jr. RK, Killian G, Woolard J, Cornman J, Romano D, Huddleston C, Zimmerman P, Barre C, Tillman EA, Avery ML. 2014. Impacts from control operations on a recreationally hunted feral swine population at a large military installation in Florida. *Environmental Science and Pollution Research,* 21, 7689-7697.

Felix Jr. RK, Orzell SL, Tillman EA, Engeman RM, Avery ML. 2014. Fine-scale, spatial and temporal assessment methods for feral swine disturbances to sensitive plant communities in south-central Florida. *Environmental Science and Pollution Research,* 21, 10399-10406.

2015

Beasley JC, Webster SC, Rhoades OE Cunningham FL. 2015. Evaluation of Rhodamine B as a biomarker for assessing bait acceptance in feral pigs. *Wildlife Society Bulletin*, 39, 188-192.

Engeman R, Avery M, Shiels A, Berentsen A, VerCauteren K, Sugihara R, Duffiney A, Clark C, Eisemann J. 2015. Some diverse United States examples from the wide, wide world of managing invasive species on islands where people live. Managing wildlife on inhabited islands. CSIRO Publishing, In press.

Jones KC, Rincon BK, Gorman TA, Haas CA, Engeman RM. 2015. Multi-trophic level feeding interactions between two native and two non-native species and implications to the endangered reticulated flatwoods salamander. *Collinsorum,* 4, 6-7.

Keiter D, Cunningham F, Rhodes O, Irwin B, Beasley J. 2015. Evaluating scat detection rates and methods of detection for the estimation of wild pig (*Sus scrofa*) abundance. *Journal of Wildlife Diseases,* In Press.

2016

Blass CR, Snow NP, Kinsey JC, Foster JA, VerCauteren KC. 2016. Evaluation of potential food items as challenge diets in 2-choice tests with feral swine. *Proceedings of the 27th Vertebrate Pest Conference*, 27, 174–177.

Davis AJ, Hooten MB, Miller RS, Farnsworth M, Lewis J, Moxcey M, Pepin KM. 2016. Inferring invasive species abundance using removal data from management actions. *Ecological Applications,* 26, 2339-2346.

Engeman RM, Addison D, Griffin JC. 2016. Defending against disparate sea turtle nest predators: Benefits to nesting success from eradicating invasive feral swine and caging nests from raccoons. *The Oryx,* 50, 289-295.

Engeman R, Cattaruzza R, Cattaruzza M, Fischer J. 2016. Photographic estimation of wild boar damage to alpine grazing pastures in the Carpathian Mountains of central Romania. *Environmental Science and Pollution Research*, 23, 4949-4952.

Engeman RM, Orzell SL, Felix Jr. RK, Tillman EA, Killian G, Avery ML. 2016. Feral swine damage to globally imperiled wetland plant communities in a significant biodiversity hotspot in Florida. *Biodiversity and Conservation,* 25, 1879-1898.

Fischer J, McMurtry D, Blass C, Walter WD, Beringer J, VerCauteren K. 2016. Effects of simulated removal activities on movements and space use of feral swine. *European Journal of Wildlife Research,* DOI 10.1007/s10344-016-1000-6.

Keiter DA, Cunningham FL, Rhodes Jr. OE, Irwin BJ, Beasley JC. 2016. Optimization of scat detection methods for a social ungulate, the wild pig, and experimental evaluation of factors affecting detection of scat. *PLoS ONE*, 11, e0155615. DOI: 10.1371/journal.pone.0155615.

Pepin K, Davis A, Beasely J, Boughton R, Campbell T, Cooper S, Gaston W, Hartley S, Kilgo J, Wisely S, Wyckoff C, VerCauteren K. 2016. Contact heterogeneities in feral swine: implications for disease management and future research. *Ecosphere*, DOI: 10.1002/ecs2.1230.

Pepin K, VerCauteren K. 2016. Disease-emergence dynamics and control in a socially-structured wildlife species. *Nature: Scientific Reports,* DOI: 10.1038/srep25150.

Snow NP, Halseth JM, Lavelle MJ, Hanson TE, Blass CR, Foster JA, Humphrys ST, Staples LD, Hewitt DG, VerCauteren KC. 2016. Bait preference of free-ranging feral swine for delivery of a novel toxicant. *PLoS ONE,* 11, e0146712.

2017

Byrd RW, Edens JO, Dozier J, Engeman RM 2017. Blood on the sand – elimination of feral swine from North Island, SC. Abstracts, 17th Wildlife Damage Management Conference.

Davis AJ, Leland B, Bodenchuk M, VerCauteren KC, Pepin KM. 2017. Estimating population density for disease risk assessment: the importance of understanding the area of influence of traps using wild pigs as an example. *Preventive Veterinary Medicine,* 141, 33-37.

Engeman RM. 2017. Damage assessment series technical publication 1: Estimating damage to row crops just after planting. Wildlife Services Technical Notes. USDA, APHIS, Wildlife Services. Fort Collins, Colorado. In press.

Engeman RM, Meyer JS, Allen JB. 2017. Prevalence of feral swine disturbance at important archaeological sites over a large area in Florida. *Nature: Scientific Reports,* 7, 40287.

Engeman RM, Ondovchik M. 2017. Damage assessment series technical publication 2: Estimating pre-harvest damage to low-growing row crops. Wildlife Services Technical Notes. USDA, APHIS, Wildlife Services. Fort. Collins, Colorado, In press.

Engeman RM, Wilson B, Beckerman S, Fischer J, VerCauteren K, Dufford D, Cobban JB. 2017. Detecting and eliminating feral swine from a large area of mixed forest and agricultural fragmented habitats in north-central USA. *Journal of Environmental Management,* In review.

Jones KC, Gorman TA, Rincon BK, Allen J, Haas CA, Engeman RM. 2017. Feral swine: a new threat to the remaining breeding wetlands of the endangered reticulated flatwoods salamander. Oryx, In press.

Kay S, Fischer J, Monaghan A, Beasley J, Boughton R, Campbell T, Cooper S, Ditchkoff S, Hartley S, Kilgo J, Wisely S, Wykoff A, VerCauteren K, Pepin K. 2017. Quantifying drivers of wild pig movement across multiple spatial and temporal scales. *Movement Ecology,* DOI: 10.1186/s40462-017-0105-1.

Keiter DA, Davis AJ, Rhodes OE, Cunningham FL, Kilgo JC, Pepin KM, Beasley JC. 2017. Impact of animal movement on common methods of estimating population density. *Scientific Reports,* 7, 9446.

Lavelle MJ, Snow NP, Fischer JW, Halseth JM, VanNatta E, VerCauteren KC. 2017. Attractants for wild pigs: current use, availability, needs and future potential. *European Journal of Wildlife Research,* 63, 86.

Lewis JS, Farnsworth ML, Burdett CL, Theobald DM, Gray M, Miller RS. 2017. Biotic and abiotic factors predicting the global distribution and population density of an invasive large mammal. *Nature: Scientific Reports,* 7, 44152.

Pepin KM, Davis AJ, Cunningham FL, VerCauteren KC, Eckery DC. 2017. Potential effects of incorporating fertility control into typical culling regimes in wild pig populations. *PLoS ONE*, 12, e0183441.

Pepin KM, Davis AJ, VerCauteren KC. 2017. Temporal prioritization of population management activities as an efficient strategy to control vertebrate pest populations. *Ecological Modeling,* 365, 106-118.

Sanders HN, Hewitt DG, Humberto P, VerCauteren KC, Snow NP. 2017. Substantial depredation of wild turkey nests by invasive wild pigs. *Journal of Wildlife Management,* In review.

Snow NP, Foster JA, Kinsey JC, Humphrys ST, Staples LD, Hewitt DG, VerCauteren KC. 2017. Development of toxic bait to control invasive wild pigs and reduce damage. *Wildlife Society Bulletin*, 41, 256–263.

Snow NP, Foster JA, VanNatta EH, Horak KE, Humphrys ST, Staples LD, Hewitt DG, VerCauteren KC. 2017. Potential secondary poisoning risks to non-targets from a sodium nitrite toxic bait for invasive wild pigs. *Pest Management Science*, *74*, 181-188.

Snow NP, Jarzyna MA, VerCauteren KC. 2017. Interpreting and predicting the spread of invasive wild pigs. *Journal of Applied Ecology,* DOI: 10.1111/1365-2664.12866.

Snow NP, Lavelle MJ, Halseth JM, Blass CR, Foster JA, VerCauteren KC. 2017. Strength testing of raccoons and feral swine for developing a swine-specific bait station. *Wildlife Society Bulletin,* 41, 264–270.

Tabak MA, Piaggio AJ, Miller RS, Sweitzer R, Ernest HB. 2017. Anthropogenic factors predict movement of an invasive species. *Ecosphere,* 8, e01844.

2018

Allen BL, Fawcett A, Engeman RM, Lisle A, and Leung L K-P. 2018. Environmental effects are stronger than human effects on mammalian predator-prey relationships in arid Australian ecosystems. *Science of the Total Environment,* 610–611, 451-461.

Beasley J, Ditchkoff S, Mayer J, Smith M, VerCauteren KC. 2018. Research priorities for managing invasive wild pigs in North America. *Journal of Wildlife Management,* 82, 674-681.

Boughton RK, Allen BL, Tillman EA, Wisely SM, Engeman RM. 2018. Road hogs: implications for road-based relative abundance observation techniques derived from GPS collared feral swine in pastureland habitat. *Ecological Indicators,* In review.

Davis AJ, Keiter DA, Kierepka EM, Slootmaker C, Piaggio AJ, Beasley J, Pepin KM. 2018. A comparison of cost and quality of three methods for estimating density for wild pig (*Sus scrofa*). *European Journal of Wildlife Research*, Submitted.

Davis AJ, Leland B, Bodenchuk M, VerCauteren KC, Pepin KM. 2018. Costs and effectiveness of damage management of an overabundant species (*Sus scrofa*) using aerial gunning. *Wildlife Research,* In review.

Davis AJ, McCreary R, Psiropoulos J, Brennan G, Cox T, Partin A, Pepin KM. 2018. Quantifying site-level usage and certainty of absence for an invasive species through occupancy analysis of camera-trap data. *Biological Invasions,* 20, 877-890.

Engeman RM, Avery ML, Shiels A, Berentsen A, VerCauteren K, Sugihara R, Duffiney A, Clark C, Eisemann J. 2018. Diverse examples from managing invasive vertebrate species on inhabited islands of the United States. *Australasian Journal of Environmental Management,* 25, 43-61.

Engeman RM, Byrd RW, Dozier J, McAlister MA, Edens JO, Kierepka EM, Smyser TJ, Myers J. 2018. Eliminating feral swine from a barrier island under challenging conditions and the benefits to sea turtle nesting at an important nesting beach. *Acta Oecologia,* In review.

Engeman RM, Preston J, Allen J, Laine E, Pizzolato W, Williams B, Stevens A, Teague D. 2018. Invasive feral swine damage to globally imperiled steephead ravine habitats and influences from changes in population control effort, climate, and land use. *Biodiversity and Conservation*, In review.

Engeman RM, Terry J, Stephens LR, Gruver KS. 2018. Prevalence and amount of feral swine damage to three row crops at planting. *Crop Protection*, 112, 252-256.

Engeman RM, Wilson B, Beckerman S, Fischer J, Dufford D, Cobban JB. 2018. How feral swine were located and eliminated from a large area of fragmented mixed forest and agriculture habitats in north-central USA. *Environmental Science and Pollution Research*, In review.

Fischer JW, Snow NP, Wilson BE, Beckerman SF, Jacques CN, VanNatta EH, Kay SL, VerCauteren KC. 2018. Maximizing usage of bait sites and removal of invasive wild pigs during an elimination program. *European Journal of Wildlife Research*, Submitted.

Hosier MA, DiSalvo PA, Nol P, Boughton RK, Tabak MA, Miller RS, Kinsey JC, Snow NP, Lewis JS, Sweeney SJ. 2018. Viability of ear tag GPS transmitters in wild pigs (*Sus scrofa*). *Wildlife Research*, In review.

Lavelle MJ, Snow NP, Halseth JM, Kinsey JC, Foster JA, VerCauteren KC. 2018. Development and evaluation of a bait station for selectively dispensing bait to invasive wild pigs. *Wildlife Society Bulletin*, 42, 102-110.

Lavelle MJ, Snow NP, Halseth JM, Sanders HN, VanNatta EH, VerCauteren KC. 2018. Evaluation of movement behaviors to inform toxic baiting strategies for invasive wild pigs (*Sus scrofa*). *Pest Management Science*, DOI: 10.1002, 4929.

Lewis J, Corn J, Mayer J, Jordan T, Farnsworth M, Burdett C, VerCauteren K, Sweeney S, Miller R. 2018. Historical, current, and potential population size estimates of invasive wild pigs (*Sus scrofa*) in the United States. *Ecological Modeling*, Submitted.

Long RF, Sellers LA, Jay-Russell MT, Li X, Atwill ER, Engeman RM, Baldwin RA. 2018. Impact of field-edge habitat on mammalian wildlife abundance, distribution, and vectored foodborne pathogens. 28th Vertebrate Pest Conference. Rohnert Park, CA, USA, In press.

Snow NP, Horak KE, Humphrys ST, Staples LD, Hewitt DG, VerCauteren KC. 2018. Assessment of secondary risks for coyotes consuming invasive wild pigs poisoned with sodium nitrite. *Ecotoxicology*, In review.

Snow NP, Lavelle MJ, Halseth JM, Glow MP, VanNatta EH, Davis AJ, Pepin KM, Staples LD, VerCauteren KC. 2018. Exposure of a population of invasive wild pigs to simulated toxic bait containing biomarker: implications for population reduction. *Pest Management Science*, In review.

Snow NP, Miller R, Beasley J, Pepin KM. 2018. Population dynamics of feral swine in North America. In Ecology and management of wild pigs in North America, In review.

Tabak MA, Webb CT, Miller RS. 2018. Propagule size and structure, life history, and environmental conditions affect establishment success of an invasive species. *Scientific Reports*, 8, 10313.

VerCauteren KC, Dolbeer R, Shiels A, Gese E. 2018. Identification and management of wildlife damage. The Wildlife Techniques Manual, 8th edition. The John Hopkins University Press, Baltimore, MD, USA, In press.

Feral Swine Research Project Presentations FY14-FY18:

2014

Cunningham FL. 2014. NWRC Feral swine research overview. WS Eastern Regions Managers Meeting. Myrtle Beach, SC, USA. (03/2014, Invited).

Cunningham FL. 2014. Feral swine damage management and research. United States Senate Agriculture Committee. Starkville, MS, USA. (03/2014, Invited).

Cunningham FL. 2014. Technical Session 3: Disease. 2014 Duration of H3N2 influenza virus shedding and antibody detection in feral swine. International Wild Pig Conference. Montgomery, AL, USA. (04/2014, Invited).

Cunningham FL. 2014. Technical Training. Wild Pig Zoonotic Diseases. International Wild Pig Conference: Science and Management. Montgomery, AL, USA. (04/2014, Invited).

Cunningham FL. 2014. USDA/APHIS/WS Management Team Meeting: Feral swine research project update. Starkville, MS, USA. (05/2014).

Cunningham FL. 2014. Feral swine damage management and research. Mississippi Farm Bureau Board of Directors. Starkville, MS, USA. (05/2014, Invited).

Cunningham FL. 2014. Defining economic impacts and developing control strategies for reducing feral swine damage. Mississippi River Landowners Alliance-Board of Directors Meeting. Vicksburg, MS, USA. (05/2014).

Cunningham FL. 2014. An overview of the United States swine industry. Cochran Fellows-Veterinarians from Bosnia and Herzegovina. (072014).

Cunningham FL. 2014. Feral swine biology and damage management. Cochran Fellows-Veterinarians from Bosnia and Herzegovina. (07/2014).

Cunningham FL. 2014. Defining economic impacts and developing control strategies for reducing feral swine damage: research update. APHIS National Feral Swine Damage Management Program, APHIS Feral Swine Coordinating Committee Meeting. Riverdale, MD, USA. (08/2014).

Cunningham FL. 2014. Feral Swine Research- United States Senator Thad Cochran's Legislative Staff. NWRC Mississippi Field Station. Mississippi State, MS, USA. (10/2014).

Cunningham FL. 2014. Feral Swine Research Update and Facility Tour-Mississippi Extension Conference Planners. MS, USA. (10/2014).

Cunningham FL. 2014. Lecture junior veterinary students in production and epidemiology of domestic and feral swine. Mississippi State University College of Veterinary Medicine. Mississippi State, MS, USA. (8 rotations in calendar year 2014).

Engeman RM. 2014. Practical performance metrics for assessing the need and efficacy of management actions towards wild pigs. Proceedings, Society for Range Management 67th Annual International Meeting. Orlando, FL, USA. (02/2014).

Fischer J, McMurty D, Beringer J, VerCauteren K. 2014. Feral swine movements in response to control in southern Missouri. International Wild Pig Conference: Science and Management. Montgomery, AL, USA. (04/2014).

Foster J, Martin C, Phillips G, Eisemann J, Staples L, Humphrys S, VerCauteren K. 2014. Optimization of formulations of sodium nitrite for the lethal control of feral swine. 26th Vertebrate Pest Conference. Waikoloa, HI, USA. (03/2014).

Lavelle MJ, Campa R, Ryan P, Glow M, LeDoux K, Hygnstrom S, VerCauteren K. 2014. Wildlife-Livestock Interactions and the Role Played by Stored Cattle Feed. Bovine TB Conference. Hillman, MI, USA. (04/2014).

VerCauteren K. 2014. Development of sodium nitrite as a toxicant for the control of feral swine. Wildlife Services Management Team Meeting. Starkville, MS, USA. (05/2014).

VerCauteren K, Eckery D. 2014. Toxicants and contraceptives: Real potential or pie in the sky? Technical Training. International Wild Pig Conference: Science and Management. Montgomery, AL, USA. (04/2014, Invited).

VerCauteren K, Foster J, Phillips G, Eisemann J, Staples L, Humphrys S. 2014. Optimization of formulations of sodium nitrite for the lethal control of feral swine. 16th Australasian Vertebrate Pest Conference. Brisbane, Australia. (05/2014).

VerCauteren K, Foster J, Phillips G, Staples L, Humphrys S. 2014. Development of sodium nitrite as a toxicant for the control of wild pigs. International Wild Pig Conference: Science and Management. Montgomery, AL, USA. (04/2014).

VerCauteren K, Phillips G, Foster J. 2014. Development of a toxicant for feral swine. 74th Midwest Fish and Wildlife Conference. Kansas City, MO, USA. (01/2014, Invited).

2015

Boughton R. 2015. Ecological and economical damage of feral swine in Florida – What we need to know to make a difference. Charlotte Harbor Natural Estuary Program, Conservation Lands Workshop. (09/2015, Invited).

Fischer JW, Walter D, Avery M. 2015. Using GIS to model three-dimensional flight patterns at airfields to reduce avian-aircraft collisions. USDA GIS Day. Washington, DC, USA. (11/2015, Invited).

Franklin AB, Bevins SN, Bisha B, Chandler J, Kunugi A, VerCauteren KC. 2015. Contamination of leafy green crops with foodborne pathogens: Are wildlife a problem? (Poster). Center for Produce Safety Research Symposium. Atlanta, GA, USA. (Invited).

Franklin AB, Shriner SA, Pepin KM. 2015. Potential sources of bias that can arise in common disease metrics. TWS. Winnipeg, Canada. (10/2015).

Pepin KM. 2015. Population and disease models for guiding management of feral swine. Seminar at NWRC. Fort Collins, CO, USA. (05/2015).

Pepin KM. 2015. Disease –dynamic models in disease management: Examples from bottom-up and top-down approaches (Webinar). USDA-APHIS-VS. CO, USA. (06/2015).

Pepin KM. 2015. Contact structure and disease invasion dynamics in feral swine populations. TWS. Winnipeg, Manitoba, Canada. (10/2015).

Pepin KM, Cunningham FL. 2015. Serological dynamics of influenza A in feral swine populations. RAPIDD workshop on interpreting serology data in terms of disease dynamics. NWRC, Fort Collins, CO, USA. (01/2015).

Snow N, VerCauteren K, Lavelle M, Foster J, Kinsey J, Frels D, Hewitt D, Staples L, Humphrys S, MacMorran D, Shapiro L. 2015. Development of a toxicant for the lethal control of feral swine. Department of Defense webinar recording.

Snow N, VerCauteren K, Lavelle M, O'Hare J, Foster J, Kinsey J, Frels D, Hewitt D, Staples L, Humphrys S, MacMorran D, Shapiro L. 2015. Development of a toxicant for the lethal control of feral swine. Caesar Kleberg Wildlife Research Institute. Texas A&M University-Kingsville, TX, USA. (09/2015).

Snow N, VerCauteren K, Lavelle M, O'Hare J, Foster J, Kinsey J, Frels D, Hewitt D, Staples L, Humphrys S, MacMorran D, Shapiro L. 2015. Development of a toxicant for the lethal control of feral swine. The Wild Pig Symposium: The Wildlife Society 22nd annual Conference. Winnipeg, Manitoba, Canada. (10/2015).

VerCauteren K, Foster J, Snow N, O'Hare J, Cunningham F. 2015. Development of a toxicant for the lethal control of feral swine. Invasive Animals Cooperative Research Center. Canberra, Australia. (05/2015).

2016

Bacon M. 2016. Identification of clathrin and dynamin II in porcine oocytes support the presence of clathrin-mediated endocytosis. Graduate Research Day, Colorado State University. Fort Collins, CO, USA. (01/2016).

Bacon M. 2016. Pig Nation: Combating the Wild Pig Invasion Using Biology. Vice President of Research 3-minute Thesis Competition, Colorado State University. Fort Collins, CO, USA. (02/2016).

Bacon M. 2016. Identification of clathrin and dynamin II in the porcine ovary supports the presence of clathrin-mediated endocytosis. Master's thesis defense, Colorado State University. Fort Collins, CO, USA. (06/2016).

Bacon M. 2016. Identification of clathrin and dynamin in the porcine ovary support the presence of clathrin-mediated endocytosis (Poster). Graduate Student Showcase, Colorado State University. Fort Collins, CO, USA. (11/2016).

Bacon M, Eckery D. 2016. Addressing Fertility Control in Feral Swine. Animal Reproduction and Biotechnology Laboratories Seminar Series, Colorado State University. Fort Collins, CO, USA. (02/2016).

Bacon M, Eckery D. 2016. Identification of clathrin and dynamin II in porcine oocytes support the presence of clathrin-mediated endocytosis (Poster). Rocky Mountain Reproductive Symposium. Loveland, CO, USA. (04/2016).

Bacon M, Eckery D. 2016. Towards fertility control in swine: Identification of clathrin and dynamin II in the porcine ovary supports the presence of clathrin-mediated endocytosis. NWRC Seminar. Fort Collins, CO, USA. (06/2016).

Baraoidan S, Boughton R. 2016. Friend, foe, or food? Quantifying Interactions among wildlife and livestock on Florida rangelands. The Wildlife Society, Florida Chapter Spring Meeting. Gainesville, FL, USA. (02/2016).

Beasely J, VerCauteren, KC. 2016. Managing invasive wild pigs in North America. Annual Conference of The Wildlife Society, Invasive Species Symposium. Raleigh, NC, USA. (10/2016, Invited).

Boughton R. 2016. Feral swine biology and impacts. WISE - Wildlife and Invasive Species Education Program. University of Florida. Bushnell, FL, USA. (02/2016, Invited).

Boughton R. 2016. Impacts of feral swine. Everglades Research and Education Center. Belle Glade, FL, USA. (04/2016, Invited).

Boughton R. 2016. Invasive mammal species of Florida. University of Florida Natural Resources IST. The Wildlife Society Florida Chapter Spring Meeting. Gainesville, FL, USA. (04/2016).

Boughton R, Wight B, Anderson W. 2016. Using Drones to assess feral swine rooting damage in wetlands and pasture. Wild pig research and management workshop, The Wildlife Society 23rd Annual Conference. Raleigh NC, USA. (10/2016).

Crank C, Boughton R. 2016. Potential resource competition between feral swine and white-tailed deer on Florida rangelands. International Wild Pig Conference. Myrtle Beach SC, USA. (04/2016).

Davis AJ, Hooten MB, Miller RS, Farnsworth ML, Lewis J, Moxcey M, Pepin KM. 2016. Inferring feral swine abundance using removal data from management actions. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Farnsworth ML, Lewis JS, Miller RS, Grear D, Sweeney SJ, Boughton R, White M, Orthmeyer D, VerCauteren KC. 2016. Development of a comprehensive feral swine field study: population dynamics, response to culling, space-use patterns, and behavioral interactions. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Gray S, Roloff G, Montgomery R, Wegan M, Etter D, VerCauteren K.C. 2016. Feral swine movement in Michigan, USA. Annual Conference of The Wildlife Society. Raleigh, NC, USA. (10/2016).

Griffin JC, Engeman RM, Tillman EA, Killian G, Smith B. 2016. Saving insular sea turtle nests: improved efficiencies in feral hog removal. International Wild Pig Conference. Myrtle Beach, SC, USA. (04/2016).

Hosier MA, Di Salvo PA, Nol P, Boughton RK, Tabak MA, Miller RS, Sweeney SJ. 2016. Tolerance of feral swine to simulated GPS ear tag transmitters. International Wild Pig Conference. Myrtle Beach, SC, USA. (04/2016).

Jones KC, Gorman TA, Rincon BK, Allen J, Haas CA, Engeman RM. 2016. Feral swine: a new threat to the remaining breeding wetlands of the endangered reticulated flatwoods salamander. Abstracts Southeast Partners in Amphibian and Reptile Conservation. Nauvoo, AL, USA. (02/2016).

Kay S, Fischer J, Beasley J, Boughton R, Campbell T, Cooper S, Ditchkoff S, Hartley S, Kilgo J, Wisely S, Wyckoff C, VerCauteren KC, Pepin K. 2016. Feral swine resource selection at local and landscape scales across the southeastern USA. International Wild Pig Conference. Myrtle Beach, SC, USA. (04/2016).

Kay S, Fischer J, Beasley J, Boughton R, Campbell T, Cooper SM, Ditchkoff S, Hartley S, Kilgo J, Wisely SM, Wyckoff C, VerCauteren KC, Pepin KM. 2016. Impact of environment factors and individual-level characteristics on feral swine movement rates. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples LS, Humphrys ST. 2016. Optimization of sodium nitrite an oral toxicant for feral swine. 70th Annual Conference of the Southeastern Association of Fish and Wildlife Agencies. Baton Rouge, LA, USA. (10/2016).

Lavelle MJ, VerCauteren KC, Snow N, Fischer J, Halseth J, Blass C, Pepin K. 2016. NWRC Feral Swine Project Research Overview. Feral Swine Technical Training. Columbiana, AL, USA. (03/2016).

Lavelle MJ, VerCauteren KC, Snow N, Fischer J, Halseth J, Blass C, Pepin, K. 2016. Overview of feral swine research being conducted by NWRC. Feral Swine Technical Training. National Feral Swine Damage Management Program Internal Meeting. Midway, UT, USA. (05/2016).

Lavelle MJ, VerCauteren KC, Snow N, Fischer J, Halseth J, Blass C, Staples L, Humphrys S, Foster J, Martin C, Kinsey J. 2016. Development and evaluation of delivery devices for dispensing bait selectively to feral swine. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Lewis J, Farnsworth M, Miller R, Grear D, Boughton R, White M, Orthmeyer D, VerCauteren KC. 2016. Development of a comprehensive wild pig field study: population dynamics, response to culling, space-use patterns, and behavioral interactions. International Wild Pig Conference. Myrtle Beach, SC, USA. (04/2016).

Lewis J, Farnsworth M, Miller R, Grear D, Boughton R, White M, Orthmeyer D, VerCauteren KC. 2016. Population density of wild pigs (*Sus scrofa*) in relation to landscape characteristics across the United States. International Wild Pig Conference. Myrtle Beach, SC, USA. (04/2016).

Merrill M, Boughton R, Sayler K, Hernández F, Bounds C, Moore S, Lord C, Wisely S. 2016. The role of feral swine in production diseases of cattle in south-central Florida. International Wild Pig Conference. Myrtle Beach, SC, USA. (04/2016).

Merrill M, Sayler K, Boughton R, Moore S, Lord C, Wisely S. 2016. Tick-borne pathogens of cattle and wildlife in south-central Florida. Emerging Pathogens Institute 9th Annual Research Day. Gainesville, FL, USA. (02/2016).

Pepin K, Beasley J, Boughton R, Campbell T, Cooper SM, Gaston W, Hartley S, Kilgo JC, Wisely SM, Wyckoff C, VerCauteren KC. 2016. Disease emergence dynamics and control in feral swine. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Pepin KM, Davis AJ, Cunningham FL, Eckery DC. 2016. Effects of lethal population control strategies in feral swine with and without immunocontraceptive control. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Salinas RA, Stiver W, Corn J, Lenhart S, Collins C, Madden M, VerCauteren K, Schmit B, Kasari, E, Odoi A, Hickling G, McCallum H. 2016. An individual based model for feral hogs in Great Smokey Mountains National Park. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/20/2016).

Sanders HN, Snow NP, Hewitt DG. 2016. Disease and Feral Swine. 15th South Texas Wildlife Conference. Cotulla, TX, USA. (08/2016).

Sanders HN, Snow NP, Hewitt DG. 2016. Feral Swine Research at Texas A&M University - Kingsville. Caesar Kleberg Wildlife Research Institute Houston Partners' Meeting. Texas A&M University-Kingsville, TX, USA. (08/2016).

Sanders H, Snow N, Hewitt D, Perotto-Baldivieso H, VerCauteren KC. 2016. Response of feral swine to the seasonal availability of wild turkey nests. Annual Conference of The Wildlife Society. Raleigh, NC, USA. (10/2016).

Snow NP, Halseth JM, Lavelle MJ, Hanson TE, Blass CR, Foster JA, Humphrys ST, Staples LD, Hewitt DG, VerCauteren KC. 2016. Bait preference for delivering pesticide to feral swine. The 27th Vertebrate Pest Conference. Newport Beach, CA, USA. (03/2016).

Snow NP, Jarzyna MA, Hewitt DG, VerCauteren KC. 2016. Environmental mechanisms of feral swine invasion during 3 decades in the United States inform future expansion potential. Wild Pig Conference, Myrtle Beach, SC, USA. (04/2016).

Snow N, Jarzyna M, Hewitt D, VerCauteren KC. 2016. No limits on the invasion of feral swine throughout the United States. Annual Conference of The Wildlife Society. Raleigh, NC, USA. (10/2016).

Staples L, VerCauteren K, Snow N, Humphrys S, McMoaran D, Forester J. 2016. The development of sodium nitrite type baits as a tool in management of feral pig populations. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Sweeney SJ, Miller RS, Weber S, Grear DA, Walsh DP, Rhyan JC, Salman MD. 2016. International workshop on feral swine disease and risk management (Poster). 65th Wildlife Disease Association Annual International Conference. Cortland, NY, USA. (08/2016).

Tabak M, Miller R. 2016. Predicting transient population dynamics of species dependent on variable environmental conditions using a stochastic demographic model. Ecological Society of America. Fort Lauderdale, FL, USA. (08/2016).

Tabak M, Piaggio T, Ernest H, Miller R. 2016. The anthropogenic movement of wild pigs: causes and consequences. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Tolson KM, LaCour JM, Cunningham FL, LeBlanc DJ. 2016. Feral hog depredation of American alligator nests in southwest Louisiana. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC USA. (04/2016).

VerCauteren K. 2016. Overview of research being conducted by USDA/APHIS and other partner to aid in control of feral swine. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

VerCauteren K. 2016. Feral Swine Toxicants—Status and Future Needs. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

VerCauteren K. 2016. Discussion: Feral Swine Research—What's Needed and How Do We Get It. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

VerCauteren K. 2016. USDA's research on feral swine. Canadian Wild Pig Meeting. Saskatoon, Saskatchewan, Canada. (06/2016, Invited).

VerCauteren K. 2016. Represented USDA's research efforts on wild pigs and discusses with 3 Saskatchewan Prime Ministers (PM of Environment, PM of Agriculture, and PM of Fisheries and Wildlife). Regina, Saskatchewan, Canada. (06/2016, Invited).

VerCauteren KC. 2016. Wildlife-livestock interface: an old and new story in North America; Tools for studying disease transmission at the wildlife/livestock interface workshop. 12th European Wildlife Disease Association Congress. Berlin, Germany. (08/2016, Invited).

VerCauteren KC. 2016. Wildlife*Risk*assist practical case exercise. Tools for studying disease transmission at the wildlife/livestock interface workshop. 12th European Wildlife Disease Association Congress. Berlin, Germany. (08/2016, Invited).

VerCauteren KC. 2016. Feral swine: the latest ecological train wreck. Fort Collins Lions Club. Fort Collins, CO, USA. (09/2016, Invited).

VerCauteren KC. 2016. Current techniques and the development of new methods to manage wild pigs. Annual Conference of The Wildlife Society. Raleigh, NC, USA. (10/2016, Invited).

VerCauteren KC. 2016. WS/NWRC research to support APHIS goal of eradicating bTB from Michigan. USDA/APHIS/Veterinary Services Meeting with Michigan Department of Agriculture and Rural Development and Michigan Department of Natural Resources. Lansing, MI, USA. (12/2016, Invited).

VerCauteren K, Nolte D, Bodenchuk M, Mendoza M. 2016. Represented all APHIS feral swine research on APHIS Associate Administrator's Muddy Boots Tour. APHIS research to assess and control the impacts of feral swine in the US. San Antonio, TX, USA. (04/2016, Invited).

VerCauteren KC, Snow N. 2016. Part 1: Breadth of USDA/APHIS research efforts to control feral swine. Part 2: Update on development of a toxicant for feral swine. NWRC Seminar Series. Fort Collins, CO, USA.

Vicente J, VerCauteren KC, Rossi S, Gauthier D, Gortazar C. 2016. Tools for quantifying inter-transmission between wild/domestic populations. Tools for studying disease transmission at the wildlife/livestock interface workshop. 12th European Wildlife Disease Association Congress. Berlin, Germany. (08/2016, Invited).

Vicente J, VerCauteren KC, Rossi S, Gortazar C. 2016. Wildlife livestock interface talk and workshop. 12th European Wildlife Disease Association Congress. Berlin, Germany. (08/2016, co-lead putting on workshop).

Webster SC, Cunningham FL, Kilgo JC, Vukovich M, Rhodes OE, Beasley JC. 2016. The efficacy of Rhodamine-B as a biomarker in wild pigs (*Sus scrofa*). International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

2017

Brook R, Powers R, Lewis J, Miller R, Snow N, VerCauteren K. 2017. Summer daily movements and home ranges of invasive wild pigs in Saskatchewan. Canadian Agriculture and Natural Resources Conference. Regina, Saskatchewan, Canada. (09/2017, Invited).

Davis A, Leland B, Bodenchuk M, VerCauteren K, Pepin K. 2017. A call for science-based metrics of success for management actions addressing invasive species. Annual Conference of The Wildlife Society. Albuquerque, NM, USA. (09/2017).

Davis AJ, McCreary R, Pepin K. 2017. Quantifying site-level elimination certainty of an invasive species through occupancy analysis of camera-trap data. The Wildlife Society 24th Annual Conference. Albuquerque, NM, USA. (09/2017).

Engeman RM. 2017. Wildlife Services Tech Note: Estimating feral swine damage to row crops just after planting; general procedural guide for WS-Operations to implement practical damage estimation. WS Damage Assessment Presentation Series, USDA/APHIS/WS National Wildlife Research Center. Fort Collins, CO, USA.

Engeman RM, Ondovchik M. 2017. Wildlife Services Tech Note: Estimating feral swine damage to row crops at harvest. WS Damage Assessment Presentation Series, USDA/APHIS/WS National Wildlife Research Center. Fort Collins, CO, USA.

Franklin A, VerCauteren K. 2017. Keeping wildlife out of your food: strategies to reduce transmission of food-borne pathogens. Annual Meeting of the USAHA. San Diego, CA, USA. (10/2017, Invited).

Kinsey J, Foster J, VerCauteren K, Snow N, Humphrys S, Staples L, Bush J. 2017. Efficacy of sodium nitrite based HOGGONE in a controlled free-range setting. Annual Conference of The Wildlife Society. Albuquerque, NM, USA. (09/2017).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples L, Humphrys S. 2017. Optimization of sodium nitrite as an oral toxicant for feral swine. Texas Chapter of the Wildlife Society. San Antonio, TX, USA. (02/2017).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples L, Humphrys S. 2017. Development of an oral toxicant for feral swine. Houston Rode: Ranch and Wildlife Expo. Houston, TX, USA. (03/2017).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples L, Humphrys S. 2017. Development of an oral toxicant for feral swine. Texas Parks and Wildlife Department Regional meeting: Region 3. Camp Allen, TX, USA. (03/2017).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples L, Humphrys S. 2017. Optimization of sodium nitrite as an oral toxicant for feral swine. Texas A&M AgriLife: Caldwell County Annual Feral Hog Seminar. Luling, TX, USA. (03/2017).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples L, Humphrys S. 2017. Development of an oral toxicant for feral swine. Texas Parks and Wildlife Department Regional meeting: Region 2. Marble Falls, TX, USA. (04/2017).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples L, Humphrys S. 2017. Development of an oral toxicant for feral swine. Texas Parks and Wildlife Department: State Hunter Education Instructor's Conference. Abilene, TX, USA. (04/2017).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples L, Humphrys S. 2017. Optimization of sodium nitrite as an oral toxicant for feral swine. Annual Conference of the Southeastern Association of Fish and Wildlife Agencies. Louisville, KY, USA. (10/2017).

Kinsey JC, Snow NP, VerCauteren KC, Foster JA, Staples L, Humphrys S, Bush JK. 2017. Efficacy of sodium nitrite based HOGGONE® in a controlled free range setting. The Wildlife Society Annual Conference. Albuquerque, NM, USA. (09/2017).

Paolini K, Street G, Strickland B, Tegt J, VerCauteren K. 2017. Spatiotemporal drives of habitat selection by feral pigs in an agricultural landscape. Annual Conference of The Wildlife Society. Albuquerque, NM, USA. (09/2017).

Pepin K, Davis A, VerCauteren K. 2017. Spatio-temporal strategies for efficient planning of feral swine population management. Annual Conference of The Wildlife Society. Albuquerque, NM, USA. (09/2017).

Sanders HN, Snow NP, Hewitt DG, VerCauteren KC, Perotto-Baldivieso HL. 2017. Depredation of simulated wild turkey nests by feral swine. Texas Chapter of the Wildlife Society, San Antonio, TX, USA. (02/2017).

Sanders HN, Snow NP, Hewitt DG, VerCauteren KC, Perotto-Baldivieso HL. 2017. Impact of invasive wild pigs on wild turkey reproductive success. Caesar Kleberg Wildlife Research Institute Partners' Meeting. San Antonio, TX, USA.

Snow NP, VerCauteren KC. 2017. Development of a toxic bait for feral swine. United States Environmental Protection Agency. Arlington, VA, USA. (06/2017).

Staples L, VerCauteren KC. 2017. Feral pig management: Australia vs US, 2017. Field efficacy of HOGGONE feral pig bait, containing sodium nitrite, for controlling feral pigs in Australia. 17th Australasian Vertebrate Pest Conference. Canberra, Australia. (05/2017).

Tabak M, Miller R. 2017. Evaluating the roles of propagule size, life history, and environmental conditions on the establishment success of an invasive species using transient dynamics models. The Wildlife Society Annual Conference, Albuquerque, NM, USA. (09/2017).

Tabak M, Piaggio A, Miller R, Sweitzer R, Ernest H. The effect of anthropogenic factors on movement of an invasive species. Ecological Society of America. Portland, OR, USA. (08/2017).

VerCauteren KC. 2017. Phase 2 wildlife management - addressing invasive and overabundant wildlife: the feral swine example. 17th Wildlife Damage Management Conference. Orange Beach, AL, USA. (02/2017).

VerCauteren KC. 2017. USDA research on feral swine. National Wild Pig Task Force Annual Meeting. Orange Beach, AL, USA. (03/2017, Invited).

VerCauteren KC. 2017. Pest animal status, challenges and directions: the US case. 17th Australasian Vertebrate Pest Conference. Canberra, Australia. (05/2017, Invited).

VerCauteren K, Foster J, Humphrys S, Snow N. 2017. Development of a sodium nitrite toxicant for wild pigs. 71st Annual Conference of the Southeastern Association of Fish and Wildlife Agencies. Louisville, KY, USA. (10/2017, Invited).

VerCauteren K, Snow N, Kinsey J, Lavelle M, Foster J. 2017. Research on the use of sodium nitrite for controlling wild pigs in the United States. Southeastern Association of Fisheries and Wildlife Agencies. Louisville, KY, USA.

Wishart J, Humphrys S, Staples L, VerCauteren KC, Snow N, McMoaran D, Foster J, Scriven J, Marshall D. 2017. Field efficacy of HOGGONE feral pig bait, containing sodium nitrite, for controlling feral pigs in Australia. 17th Australasian Vertebrate Pest Conference. Canberra, Australia. (05/2017).

2018

Davis AJ, McCreary R, Williams K, Snow N, Piaggio A, Pepin KM. 2018. A method for estimating the probability of local elimination of feral swine using camera trap and environmental DNA data. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Ellis C, Nol P, Wehtje M, Wolf L, Snow N, Halseth J, VanNatta E, Glow M, Lavelle M, Green S, Mays T, Wolf P, Hilton C, VerCauteren K. 2018. Immobilization of feral swine: Comparison of three novel drug combinations. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Engeman RM, Avery ML, Tillman EA. 2018. Wildlife Services Tech Note: Using GPS Measurements to Estimate Damage. WS Damage Assessment Series, USDA/APHIS/WS National Wildlife Research Center. Fort Collins, CO, USA.

Fischer J, Lutman M, Webber B. 2018. Unmanned aircraft system applications at the National Wildlife Research Center. Rock Mountain Chapter: The Society of Environmental Toxicology and Chemistry (SETAC). Fort Collins, CO, USA. (04/2018).

Fischer J, Lutman M, Webber B. 2018. Unmanned aircraft system applications at the National Wildlife Research Center. 13th Western Black Bear Workshop. Grand Junction, CO, USA. (05/2018).

Fischer J, Lutman M, Webber B. 2018. Unmanned aircraft system applications at the National Wildlife Research Center. Wyoming UAV Symposium. Laramie, WY, USA. (05/2018).

Foster JA, Kinsey JC, Bustamante J, Snow NP, Staples L, VerCauteren KC. 2018. Negligible risk of secondary mortality in turkey vultures (*Cathartes aura*) consuming wild pigs killed with HOGGONE. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Halseth J, Lavelle M, Snow N, VerCauteren K. 2018. Tech Note: Aging Feral Swine in the Field (Poster). International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Kinsey JC, Snow NP, Foster JA, VerCauteren KC. 2018. Evaluation of the effects of Rhodamine B on palatability of feral swine baits. Vertebrate Pest Conference. Rohnert Park, CA, USA. (02/2018).

Lavelle MJ, Ellis CK, Snow NP, Halseth JM, Glow MP, VanNatta EH, Sanders HN, Stone G, VerCauteren KC. 2018. Advancements in handling wild pigs: How trap shrouds and handling trailers can ease the process. International Wild Pig Conference: Science, Management, and Solutions. Oklahoma City, OK, USA. (04/2018).

Lewis JS, Corn JL, Mayer JJ, Jordan TR, Farnsworth ML, Burdett CL, VerCauteren KC, Sweeney SJ, Miller RS. 2018. Historical, current, and potential population size estimates of invasive wild pigs in the United States. International Wild Pig Conference: Science, Management, and Solutions. Oklahoma City, OK, USA. (04/2018).

Pepin, KM. 2018. Overview of research being conducted by USDA/APHIS to aid in control of feral swine, Missouri Natural Resources Conference 2018. Osage Beach, MO, USA. (02/2018, Invited).

Pepin, KM. 2018. Quantitative tools for monitoring management performance and planning efficient elimination of feral swine in MO. 2018. Missouri Natural Resources Conference. Osage Beach, MO, USA. (02/2018, Invited).

Pepin, KM. 2018. Decision-support tools for guiding management of invasions using ecological principles. 2018. UCLA departmental seminar. (03/2018, Invited).

Pepin, KM. 2018. Linking individual-level heterogeneity to population-level processes helps guide decision making in wildlife disease management. 2018. ESA symposium: “Novel modeling approaches in disease ecology.” (08/2018, Invited).

Pepin KM, Davis AJ, Wolfson DW, Miller RS, Tabak MA, Snow NP, VerCauteren KC. 2018. A method for evaluating progress of the APHIS National Feral Swine Damage Management Program using management data to estimate prevention of spatial spread. 2018. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Pepin, KM, Smyser TJ, Davis AJ, Miller RS, Tabak MA, Gellner G, Slootmaker C. 2018. Optimal allocation of a fixed budget for planning elimination of genetically structured pest populations. The Wildlife Society 25th Annual Conference. Cleveland, OH, USA. (10/2018, Invited).

Pepin, KM, Smyser TJ, Davis AJ, Miller RS, Tabak MA, Gellner G, Slootmaker C. 2018. The importance of demographic connectivity in determining effective control budgets and spatial prioritization of resources 2018. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Sanders HN, Snow NP, Hewitt DG, VerCauteren KC, Perotto-Baldivieso HL. 2017. Comparing depredation of simulated and natural wild turkey nests by invasive wild pigs. The Wildlife Society Annual Conference. Albuquerque, NM, USA. (09/2018).

Schlichting PE, VerCauteren KC, Boughton RK, White M, Glow MP, Sweeney SJ, Miller RS, Lewis JS. 2018. Estimating population parameters of invasive wild pigs from baited camera sites. International Wild Pig Conference: Science, Management, and Solutions. Oklahoma City, OK, USA. (04/2018).

Snow NP, Lavelle JM, Halseth JM, Glow MP, VanNatta EH, Davis AJ, Pepin KM, Staples LD, VerCauteren KC. 2018. Potential for large-scale removal of invasive wild pigs using a toxic bait to protect resources. Vertebrate Pest Conference. Rohnert Park, CA, USA. (02/2018).

Snow NP, Lavelle MJ, Halseth JM, Glow MP, VanNatta EH, Leland BR, Staples LD, VerCauteren KC. 2018. Field evaluation of HOGGONE sodium nitrite toxic bait for removing groups of invasive wild pigs. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

VanNatta EH, Wolfson DW, Tabak MA, Sweeney SJ, Snow NP, Archuleta BV, Boughton RK, Brook RK, Covington EL, Powers R, Miller RS, VerCauteren KC. 2018. Morphometric measurements and body weights of wild pigs in North America (Poster). International Wild Pig Conference: Science, Solutions, and Management. Oklahoma City, OK, USA. (04/2018).

VerCauteren K. 2018. Update on sodium nitrite field trials to control feral swine. Missouri Feral Hog Partnership Meeting. Osage Beach, MO, USA. (01/2018, Invited).

VerCauteren K. 2018. Distribution and abundance of feral swine in the United States. First Annual General Meeting of the ENETWILD Project. Parma, Italy. (01/2018, Invited).

VerCauteren K, Neskey J. 2018. The management of humans with interests in invasive wild pigs. The Wildlife Society Annual Meeting. Cleaveland, OH, USA. (10/2018).

VerCauteren KC, Snow NP, Lavelle MJ, Halseth JM, Glow MP, VanNatta EH, Davis AJ, Pepin KM, Staples LD. 2018. Potential for large-scale removal of invasive wild pigs using a toxic bait to protect resources. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Wishart J, Staples L, Humphrys S, Marshall D, VerCauteren K, Snow N, MacMorran D, Foster J. 2018. Field assessments of HOGGONE meSN feral pig bait for control of feral pigs in Australia. Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Wolfson D, Tabak MA, Miller RS, Norouzzadeh MS, Newkirk ES, Halseth JM, Boughton RK, Beasley JC, Schlichting PE, VerCauteren KC, Clune J. 2018. Solutions for big data: harnessing the power of machine learning to automate the identification of camera trap images (Poster). International Wild Pig Conference: Science, Management, and Solutions. Oklahoma City, OK, USA. (04/2018).

Economics and Human Dimensions of Natural Resources Project Publications FY14-FY18:

2016

Anderson A, Slootmaker C, Harper E, Holderieath J, Shwiff SA. 2016. Economic estimates of feral swine damage and control in 11 U.S. states. *Crop Protection*, 89, 89-94.

Shwiff SA, Sweeney SJ, Elser JL, Miller RS, Farnsworth ML, Nol P, Shwiff SS, Anderson AM. 2016. A benefit-cost analysis decision framework for mitigation of disease transmission at the wildlife-livestock interface. *Human-Wildlife Interactions*, 10, 91-102.

Slootmaker C, Harper E, Anderson A, Holderieath J, Shwiff S. 2016. Economic impacts of feral swine on limited resource farmers in the United States. *United States Department of Agriculture; Animal and Plant Inspection Service; Wildlife Services; National Wildlife Research Center Report.*

2017

Harper EE. 2017. Factors predicting feral swine management preferences and willingness to pay. *Doctoral dissertation*, Colorado State University.

Harper EE, Bright A, Slootmaker C, Teel T, Shwiff SA. 2017. Influences on acceptance of various management options for wild pigs. *Journal of Wildlife Management,* In review.

Harper EE, Slootmaker C, Anderson A, Holderieath J, Shwiff S. 2017. Damage estimates of feral swine damage and control in 11 states. *Vertebrate Pest Conference Proceedings.*

Miller F, Liu L, Shwiff SS, Shwiff SA. 2017. Macroeconomic impact of foot-and-mouth disease vaccinations in the mid-western U.S.: A general equilibrium simulation. *Transboundary and Emerging Diseases,* In review.

Miller R, Sweeney S, Slootmaker C, Grear D, DiSalvo P, Kiser D, Shwiff SA. 2017. Cross-species transmission potential between wild pigs, livestock, poultry, wildlife, and humans: Implications for disease risk management in North America. *Scientific Reports,* 7, 7821.

Shwiff S, Haden Chomphosy W, Holderieath J, Anderson A. 2017. Economics of invasive species damage and damage management, Chapter 3, In press.

Shwiff SA, Harper E, Anderson A, Holderieath J, Reddy G, Wilson S, Williams J, Lyons W, Slootmaker C. 2017. Feral swine damages associated with limited resource farmers. *Wildlife Research,* In review.

Shwiff SA, Harper EE, Anderson A, Holderieath J, Reddy PG, Wilson ST, Williams JL, Lyons LW, Slootmaker C. 2017. Wild pig damages incurred by limited resource producers. *Human-Wildlife Interactions,* In review.

Slootmaker C, Anderson A, Harper EE, Shwiff S. 2017. Limited resource producer preferences for wild pig presence in the southeastern United States. *Agricultural Economics,* In review.

2018

Holderieath JJ, Pendell DL, Hadrich JC, Anderson A, Slootmaker C, Harper E, Shwiff SA. 2018. Valuing the absence of feral swine in the United States: A partial equilibrium approach. *Crop Protection,* 112, 63-66.

Shwiff SA, Shwiff SS, Chomphosy HW, Brown VR, Anderson AM. 2018. Review and synthesis of vertebrate invasive species economic impacts 2018. *Ecological Economics,* In review.

Economics and Human Dimensions of Natural Resources Project Presentations FY14-FY18:

2014

Shwiff SA, Anderson A, Slootmaker C, Shwiff SS, Cunningham F, Miller R. 2014. Feral swine damage assessment and measuring the benefits of management. Wildlife Disease Biologist Meeting. Fort Collins, CO, USA. (Invited).

Shwiff SA, Anderson A, Slootmaker C, Shwiff SS, Cunningham F, Miller R. 2014. Feral swine damage assessment and measuring the benefits of management. Professional Agricultural Workers Conference. Tuskegee, AL, USA.

Shwiff SA, Anderson A, Shwiff SS. 2014. Regional economic modeling to estimate the One Health economic impact of wildlife diseases. Vertebrate Pest Conference. Waikoloa, HI, USA.

Shwiff SA, Holderieath JJ, Anderson A, Slootmaker C, Cunningham F, Nolte D. 2014. The economics of feral swine damage and control. Wild Pig Conference. Montgomery, AL, USA.

Shwiff SA, Sweeney SJ, Miller RS, Farnsworth ML, Nol P, Shwiff SS, Anderson A. 2014. A bioeconomic decision model for disease mitigation at the wildlife-livestock interface. Vertebrate Pest Conference. Waikoloa, HI, USA.

2015

Shwiff SA. 2015. Estimating the economic impact of an FMD outbreak in the US. United States Animal Health Association Meeting. Providence, RI, USA.

Shwiff SA, Anderson A, Slootmaker C, Harper E. 2015. Estimating the economic impact of feral swine damage to the United States. Wild Pig Policy Forum. Biloxi, MS, USA. (Invited).

Shwiff SA, Slootmaker C. 2015. Economic impacts of Feral Swine on limited-resource producers in the Southeastern United States. Professional Agricultural Workers Conference. Tuskegee, AL, USA.

Harper E. 2015. Beliefs about feral swine and their management. Economics Project Meeting. Fort Collins, CO, USA. (Invited).

2016

Anderson A, Slootmaker C, Harper E, Holderieath J, Shwiff SA. 2016. Results from a new USDA survey of feral swine damage and control in an 11-state region. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Haden-Chomphosy WK. 2016. Research and management allocations in invasive species management. Western Graduate Student Showcase. University of Utah, Salt Lake City, UT, USA. (10/2016).

Miller RS, Sweeney SJ, Slootmaker C, Holderieath JJ, Grear DA, Di Salvo PA, Kiser D, Shwiff SA. 2016. Host range overlap among pathogens of free-ranging swine, other wild and farmed species, and humans – implications for risk management of feral swine in North America (Poster). 65th Wildlife Disease Association International Conference. Cortland, NY, USA. (08/2016).

Miller RS, Sweeney SJ, Slootmaker C, Holderieath J, Grear DA, Di Salvo PA, Kiser D, Shwiff SA. 2016. Risk and consequences of pathogen sharing between wild pigs, livestock, poultry, and humans: implications for disease risk management of free-ranging swine in North America. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Shwiff SA. 2016. Economic impacts of feral swine on limited-resource producers in the Southeastern United States. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Shwiff SA. 2016. Updating the Pimentel Number ($1.5B annual with 0.8M Ag). International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Shwiff SA, Anderson A, Slootmaker C, Harper E. 2016. Determining the economic impact of feral swine to the US. National Feral Swine Damage Management Meeting. Myrtle Beach, SC, USA. (04/2016).

Shwiff SA, Anderson A, Slootmaker C, Holderieath J, Harper E. 2016. Survey estimates of feral swine damage to 10 US states. Wild Pig Meeting. Myrtle Beach, SC, USA. (04/2016).

Shwiff SA, Anderson A, Slootmaker C, Holderieath J, Harper E. 2016. Survey estimates of feral swine damage to 10 US states. National Feral Swine Damage Management Program Review. Riverdale, MD, USA. (Invited).

Shwiff SA, Slootmaker C. 2016. The economic impact of foot and mouth disease to us domestic and international markets. The Institute for Infectious Animal Diseases Working Group Meeting. Atlanta, GA, USA. (Invited).

Shwiff SA, Slootmaker C. 2016. The potential domestic and international economic impacts of foreign animal diseases. US Animal Health Association Meeting. Greensboro, NC, USA. (Invited).

Slootmaker C, Anderson A, Shwiff S. 2016. Learning by trapping: The value of reducing uncertainty about feral swine density. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Slootmaker C, Shwiff SA. 2016. Economic impacts of feral swine on limited-resource producers in the southeastern United States. Professional Agricultural Workers Conference. Tuskegee, AL, USA.

2017

DeGroot S. 2017. Interpretations of feral swine management strategies. Economic Project Meeting. National Wildlife Research Center, Fort Collins, CO, USA. (05/2017, Invited).

DeGroot S. 2017. Survey implementation of feral swine questionnaire. HDNR Lecture Course. Colorado State University, Fort Collins, CO, USA. (03/2017, Invited).

Haden-Chomphosy WK. 2017. Applications of R&D modeling to the provision of public goods: Invasive species management. PhD. Dissertation Proposal. Colorado State University, Fort Collins, CO, USA. (05/2017).

Harper EE. 2017. Wild pig national survey: Human Dimensions research shaping wildlife management. Western Association of Fish and Wildlife Agencies Annual Conference, Human Dimensions Committee. Vail, CO, USA. (07/2017, Invited).

Shwiff SA. 2017. The potential domestic and international economic impacts of foreign animal diseases. National Institute for Animal Agriculture Annual Conference. Columbus, OH, USA. (Invited).

Shwiff SA. 2017. The potential domestic and international economic impacts of foreign animal diseases. National Institute for Animal Agriculture Annual Conference. University of Vermont, Burlington, VT, USA. (Invited).

Shwiff SA, Slootmaker C. 2017. 2017 Producer Survey: Feral Swine Impacts to Livestock Production. Professional Agricultural Workers Conference. Auburn, AL, USA.

Shwiff SA, Slootmaker C. 2017. U.S. FMD outbreak scenarios and corresponding economic impact analysis. US Animal Health Association Meeting. San Diego, CA, USA. (Invited).

2018

Shwiff SA. 2018. Building Resilience to the Economic Threat of Invasive Species. Johns Hopkins School of Advanced International Studies Dean's Forum. Washington, DC, USA. (Invited).

Shwiff SA. 2018. Measuring the economic impacts of Wildlife Services management efforts. National Feral Swine Damage Management Program National Meeting. Oklahoma City, OK, USA. (Invited).

Shwiff SA, Anderson AA. 2018. Estimating the economic impact of feral swine damage and damage management. Wild Pig Meeting. Oklahoma City, OK, USA.

Genetics Project Publications FY14-FY18:

2016

Kierepka EM, Unger SD, Beasley JC, Rhodes OE, Cunningham FL, Piaggio AJ. 2016. Identification of robust microsatellite markers for wild pig fecal DNA in humid climates. *Journal of Wildlife Management*, 80, 1120-1128.

2017

Williams KE, Huyvaert KP, Piaggio AJ. 2017. Clearing muddied waters: Capture of environmental DNA from turbid waters. *PLoS ONE,* 12, e0179282.

2018

Anderson WM, Boughton RK, Wisely SW, Merill MM, Boughton EH, Robeson MS, Piaggio AJ. 2018. Using DNA metabarcoding to examine wild pig (*Sus scrofa*) diets in a subtropical agro-ecosystem. *Proceedings of the Vertebrate Pest Conference*, Submitted.

Davis AJ, Pepin KM, Snow N, Williams KE, Piaggio AJ. 2018. Accounting for observation processes across multiple levels of uncertainty improves inference of species distributions and guides adaptive sampling of environmental DNA. *Ecology and Evolution,* In press.

Engeman RM, Byrd RW, Dozier J, McAlister MA, Edens JO, Kierepka EM, Smyser TJ, Myers N. 2018. Eliminating feral swine from a barrier island under challenging conditions and the benefits to sea turtle nesting at an important nesting beach. *Acta Ecologica*, Submitted.

McCann BE, Smyser TJ, Schmit BS, Newman RA, Piaggio AJ, Malek MJ, Swafford SR, Sweitzer RA, Simmons RB. 2018. Molecular population structure for feral swine in the United States. *The Journal of Wildlife Management*, 82, 821-832.

Okuda K, Toma R, Negishi Y, Hinton TG, Smyser TJ, Tamate HB, Kaneko S. 2018. Did domestic pigs that escaped after the Fukushima Daiichi nuclear power plant accident cause genetic contamination of the wild boar population? *Japanese Journal of Conservation Ecology*, 23, 137–144.

Robeson, MS, Khanipov K, Golovko G, Wisely SM, White M, Bodenchuk M, Smyser TJ, Fofanov Y, Fierer N, Piaggio AJ. 2018. Diet of an invasive omnivore. *Ecology and Evolution* 8, 185-196.

Robeson MS, Khanipov K, Golovko G, Wisely SM, White MD, Bodenchuk M, Smyser TJ, Fofanov Y, Piaggio AJ. 2018. Assessing the utility of metabarcoding for diet analyses of the omnivorous wild pig (*Sus scrofa). Ecology and evolution, 8*, 185-196.

Smyser TJ, Tabak MA, Slootmaker C, Robeson MS II, Miller RS, Bosse M, Megens H.-J, Groenen MAM, Paiva SR, de Faria DA, Blackburn HD, Schmit BS, Piaggio AJ. 2018. Bridgehead populations of admixed wild and domestic lineages contribute to rapid expansion of invasive feral swine. *Molecular Ecology,* Submitted.

Williams KE, Huyvaert KP, VerCauteren KC, Davis AJ, Piaggio AJ. 2018. Detection and persistence of environmental DNA from an invasive, terrestrial mammal. *Ecology and Evolution,* 8, 688-695.

Zhang X, Sun H, Cunningham F, Li L, Hanson-Dorr K, Hopken MW, Cooley J, Long L-P, Baroch J, Li T, Schmit B, Lin X, Olivier A, Jarman R, DeLiberto TJ, Wan, X-F. 2018. Tissue tropisms opt for transmissible reassortants during avian and swine influenza A virus co-infection in swine. *Proceedings of the National Academy of Sciences*, Submitted.

Genetics Project Presentations FY14-18:

2014

Piaggio AJ. 2014. Going with the flow: Using waterways to detect Burmese pythons and feral swine. North American Congress for Conservation Biology eDNA Symposium. Missoula, MT, USA. (07/2014).

Piaggio AJ. 2014. What's DNA got to do with it? The application of DNA to feral swine management. National Wildlife Disease Program and National Feral Swine Damage Management Program Conference. Fort Collins, CO, USA. (09/2014).

Piaggio AJ, Williams KE. 2014. Developing tools for detecting feral swine and their impacts to agriculture and wildlife. Society for Range Management. Orlando, FL, USA. (02/2014).

Piaggio AJ, Williams KE. 2014. Developing tools for detecting feral swine and their impacts to agriculture and wildlife. Wild Pig Conference. Montgomery, AL, USA. (04/2014).

Williams KE, Piaggio AJ. 2014. Molecular detection of feral swine in water samples using eDNA (Poster). Wild Pig Conference. Montgomery, AL, USA. (04/2014).

Williams KW, Piaggio AJ, Huyvaert KP. 2014. Detecting feral swine DNA from environmental samples. National Wildlife Disease Program and National Feral Swine Damage Management Program Conference. Fort Collins, CO, USA. (09/2014).

2015

Eckery DC, Horak KE, Piaggio AJ. 2015. The "omics" of wildlife damage management. The Wildlife Society Meeting. Winnipeg, Manitoba, Canada. (10/2015).

Williams KE. 2015. Using Environmental DNA to detect invasive species: Molecular detection of feral pigs in water. Seminar. Colorado State University, Fort Collins, CO, USA. (12/2015).

Williams KE, Piaggio AJ. 2015. Going with the flow: Using waterways to detect Burmese pythons and feral swine. USGS eDNA. Webinar. (09/2015).

Williams KW, Piaggio AJ, Huyvaert KP. 2015. Molecular detection of feral pigs using eDNA. (Poster). Graduate Student Showcase. Colorado State University, Fort Collins, CO, USA. (02/2015).

Williams KW, Piaggio AJ, Huyvaert KP. 2015. Molecular detection of feral pigs using eDNA. (Poster). Front Range Student Ecology Symposium. Colorado State University, Fort Collins, CO, USA. (02/2015).

2016

Keiter DA, Davis A, Kierepka L, Pepin K, Kilgo J, Vukovich M, Piaggio T, Cunningham F, Rhodes OE, Beasley J. 2016. Empirical comparison of density estimators for wild pigs. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Piaggio AJ, Hopken MW. 2016. How does genetics help wildlife management and disease? National Wildlife Disease Conference. Fort Collins, CO, USA. (06/2016).

Piaggio AJ, Robeson MS, Fierer N, Fofanov Y. 2016. DNA detection of wild pig diet. Wild Pig Meeting. Myrtle Beach, SC, USA. (04/2016).

Smyser TJ. 2016. Development of the National Feral Swine Genetic Archive. National Wildlife Research Center Seminar Series. Fort Collins, CO, USA. (05/2016).

Smyser T. 2016. National Feral Swine Genetic Archive. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

Williams KE. 2016. Using Environmental DNA to detect invasive species: Molecular detection of feral pigs in water. 2016. Wild Pig Conference, Sheraton Myrtle Beach Convention Center. Myrtle Beach, SC, USA. (04/2016).

Williams K, Piaggio T. 2016. Implementing the eDNA Device for Detection of Feral Swine in Water. International Wild Pig Conference: Science, Management, and Solutions. Myrtle Beach, SC, USA. (04/2016).

2017

Smyser TJ, Robeson MS, Megens H-J, Bosse M, Groenen MAM, Paiva SR, Paiva D, Blackburn HD, Schmit BS, Piaggio AJ. 2017. Genetic origins of US feral swine populations. 97th Annual Meeting of the American Society of Mammalogists. Moscow, ID, USA. (06/2017).

2018

Mangan AM, Smyser TJ, Archuleta BV, Piaggio AJ. 2018. Tool for detecting feral swine (Poster). International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Mangan AM, Smyser TJ, Piaggio AJ. 2018. Rooting out population genetic structure of a destructive, invasive species in Texas. 98th Annual Meeting of the American Society of Mammalogists. Manhattan, KS, USA. (06/2018).

Piaggio AJ. 2018. Applied genetics: Managing wildlife and wildlife pathogens through DNA. Invited Wilhelminenberg Seminar talk. University of Veterinary Medicine Vienna, Austria. (06/2018, Invited).

Piaggio AJ, Williams KE, Davis AJ. 2018. Environmental DNA to detect invasive species. European Congress of Conservation Biology. Jyväskylä, Finland. (06/2018).

Pepin KM, Slootmaker C, Smyser TJ, Davis AJ, Miller RS, Tabak MA, Gellner G. 2018. The importance of demographic connectivity in determining effective control budgets and spatial prioritization of resources. International Wild Pig Conference. Oklahoma City, OK, USA. (04/2018).

Smyser TJ. 2018. Analysis of the ancestral origins of feral swine. The International Conference on the Status of Plant & Animal Genome Research (PAG XXVI). San Diego, CA, USA. (01/2018, Invited).

Smyser TJ. 2018. The national feral swine genetic database and findings that apply to Missouri. Missouri Natural Resources Conference. Osage Beach, MO, USA. (02/2018, Invited).

Smyser TJ. 2018. Genetic ancestry of feral swine. APHIS Science Talks. Riverdale, MD, USA. (04/2018, Invited).

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Smyser TJ, Tabak MA, Pepin KM, Davis AJ, Miller RS. 2018. A population genomics approach to estimating migration with small sample sizes and genetically similar populations. The Wildlife Society 25th Annual Conference. Cleveland, OH, USA. (10/2018, Invited).

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