USDA FERAL SWINE ERADICATION & CONTROL

PILOT PROGRAM FINAL REPORT

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TEXAS A&M AGRILIFE EXTENSION

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Acknowledgments

As with any endeavor of this nature, we greatly appreciate the efforts of all who contributed to this project and final report. The USDA Natural Resources Conservation Service (NRCS) and APHIS National Feral Swine Damage Management Program were instrumental in bringing together key players to help make this project possible. We thank all Feral Swine Eradication and Control Pilot Program (FSCP) project partners for their efforts in collecting survey data and timeliness in providing content and reviewing their respective sections of this report. Specifically, the USDA NRCS provided oversight throughout the development of this document. USDA APHIS Wildlife Services staff conducted most of the feral swine removal operations that ultimately resulted in the success observed by these FSCP projects and provided summary information regarding state-specific impacts of the FSCP. Texas A&M AgriLife Extension Service designed and implemented feral swine damage assessments across all FSCP states, and coordinated and collated data collected by FSCP partners in each state. The Alabama Cooperative Extension System—Auburn University provided overall coordination for the collection and presentation of content for this document. We extend a special thanks to the Alabama Cooperative Extension System Communications, Strategic Marketing, and Client Relations staff for their tireless assistance in producing this report: Glenda Freeman, editor, and Kelly Knowles and Bruce Dupree, designers.

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Introduction

Non-native invasive feral swine represent a critical natural resource management crisis confronting agricultural producers, property owners, and regulatory agencies responsible for safeguarding farming operations and environmental resources throughout the United States. With agricultural damage costs reaching billions of dollars per year, coupled with the difficulty of controlling this invasive species, feral swine have become a national issue over the last several decades. Feral swine impacts extend far beyond agricultural losses to encompass food safety concerns, contamination of water resources, displacement of native animal species, and pathogen transmission risks to livestock and humans. This comprehensive threat profile has prompted an expanding alliance of landowners, governmental entities, and conservation organizations to launch aggressive population control and eradication initiatives.

The Feral Swine Eradication and Control Pilot Program (FSCP) was implemented jointly by USDA's Natural Resources Conservation Service (NRCS) and Animal and Plant Health Inspection Service (APHIS). Total funding for the program was $75 million over the original five-year span of the 2018 Farm Bill. Under a continuing resolution signed in November 2023, a one-year extension provided an additional $15 million in funding, shared between the two agencies through Fiscal Year 2024.

At the start of the program, twenty pilot projects were funded in select areas of ten states: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Oklahoma, North Carolina, South Carolina, and Texas. A second round of funding included projects in Hawaii and Missouri and further expansion of projects in Alabama, Mississippi, North Carolina, Oklahoma, South Carolina, and Texas. Each pilot project consisted broadly of three coordinated components including targeted feral swine removal by APHIS Wildlife Services (WS), assistance to producers for feral swine control provided through grants with nonfederal partners and restoration efforts supported by NRCS through previously existing Farm Bill programs (i.e., EQIP). With the high feral swine populations in the areas where the program was implemented, it seemed paramount that removing feral swine would be the best and first course of action for restoring damaged areas and preventing further damages.

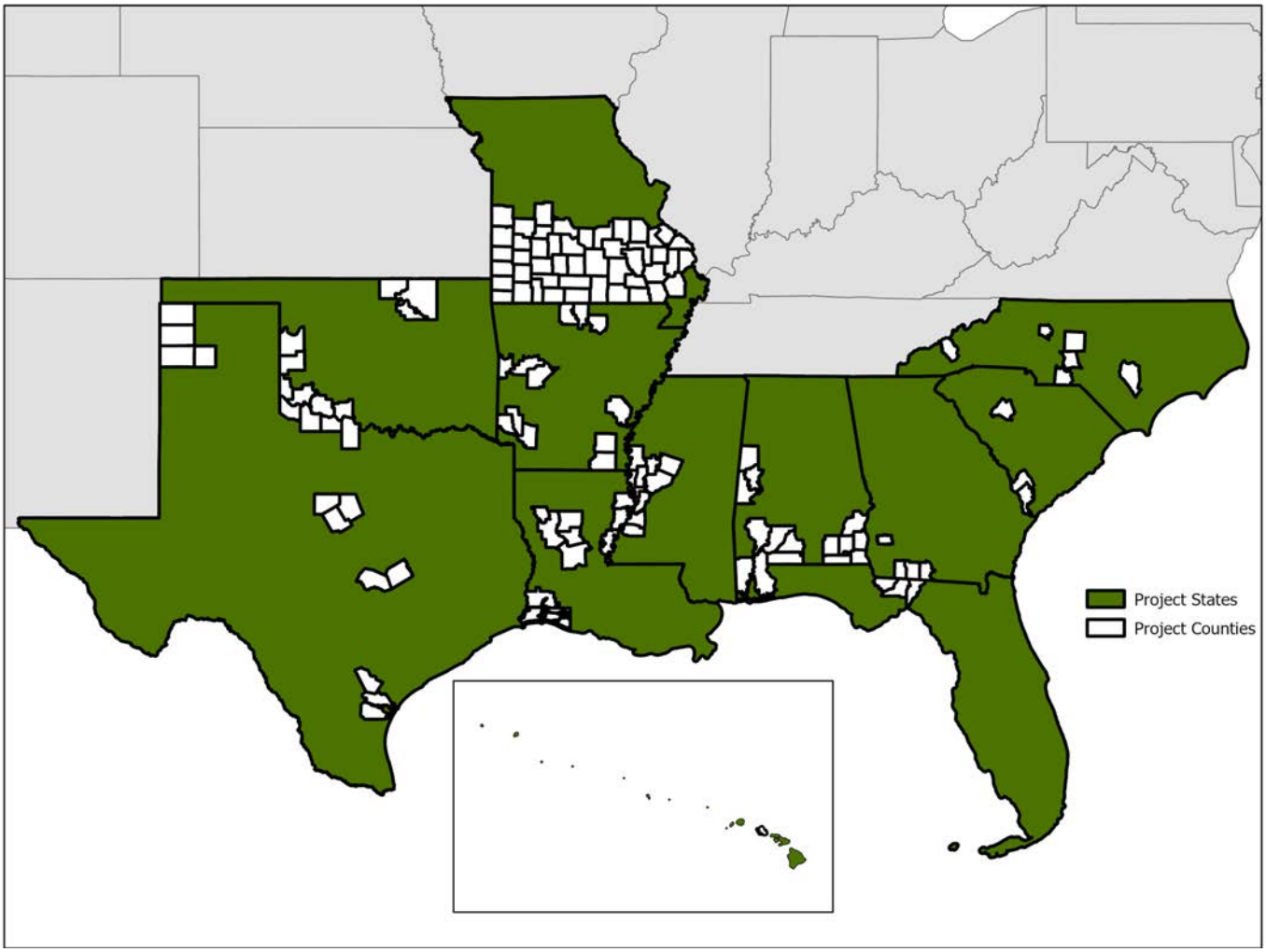
About the FSCP Projects

The FSCP formed new and unique partnerships among federal, state, and academic collaborators. Each pilot project was tailored based on several factors such as available resources, priority areas, landowner interest, distribution of feral swine, and types of resources to be protected, leading to enhanced engagement and success of each project. With partnership as the common theme across all the diverse FSCP projects, the fourteen NRCS partners leading FSCP projects in their respective states worked with an additional fifty-nine agencies directly involved in carrying out the FSCP projects and an additional sixty-eight agencies providing in-kind support. These partnerships were critical to establishing internal assessment capabilities that were used to develop and implement evidence-based measures of success that were included in a mid-project report. To access the report, visit the USDA Natural Resources Conservation Service website at www.nrcs.usda.gov.

Beyond direct feral swine population control, APHIS Wildlife Services conducted comprehensive support activities, including educational training and community outreach, disease monitoring programs, research initiatives to create advanced management technologies, and field implementation of cutting edge control methods during operational deployments. The successful integration of innovative technologies in feral swine control activities, such as the use of unmanned aerial systems (i.e., drones), remotely managed traps using telemetry, and science-based camera monitoring techniques, resulted in increased efficiency and effectiveness of feral swine control activities. During six years of APHIS Wildlife Services–led direct feral swine control efforts, protected acreage encompassing cropland, natural habitats, and pastureland grew to surpass 4 million acres. In-kind, cost share support for direct control activities totaled 26 percent of APHIS' costs to provide feral swine management, and properties receiving APHIS Wildlife Services feral swine management services for the duration of the Farm Bill pilot program experienced an average 75 percent reduction in damage to crops and pasture by the end of the fifth year of work.

The successful collaboration of NRCS, APHIS Wildlife Services, and partners resulted in the entire FSCP providing direct assistance to more than 6,700 rural landowners on almost 9 million acres to mitigate the devastating impacts of feral swine. In addition, more than 800 outreach programs related to feral swine and trapping techniques were delivered. Program partners provided nearly $30 million in cost share support to FSCP activities, and projects and research beneficial to protecting agricultural resources, native ecosystems, watersheds, and human and animal health in areas hard hit by feral swine were successfully implemented.

Counties with Feral Swine Eradication & Control Pilot Program Projects



USDA FERAL SWINE ERADICATION & CONTROL

PILOT PROGRAM FINAL REPORT

STATE PROJECT SUMMARIES

USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Alabama Project Summary

Quick Facts

NRCS grant partner: Alabama Soil and Water Conservation Committee
Location: Wiregrass (Barbour, Coffee, Dale, Geneva, Henry, Houston); Gulf Coast (Clarke, Conecuh, Baldwin, Escambia, Mobile, Monroe); Blackbelt (Greene, Pickens, Sumter) regions
Congressional districts: 1, 2, 7
Total NRCS investment: $5.7 million
Total APHIS allocation: $6.6 million
Participating landowners: 286
Acres impacted: 200,000+
Outreach programs conducted: 318
Estimated outreach program reach: 500+

Narrative

With populations reported in nearly all Alabama counties, feral swine cause significant damage to agriculture crops and natural resources throughout the state. For example, 38.4 percent of Alabama producers responding to a 2022 survey reported the presence of feral swine on their property during the previous 3 years[1]. Estimates of damage to agricultural crops were $18.5 million/year[1] for corn, soybeans, wheat, and sorghum[1]. Feral swine damage can be highly variable from farm to farm and among production fields within farms. Some peanut farmers in southeast Alabama, for example, reported losses of more than 50 percent of their crop soon after planting[2]. The impacts of feral swine on water quality can be significant[3] and pose substantial health risks to humans and livestock.

The Feral Swine Eradication and Control Pilot Program (FSCP) aimed to significantly reduce or eradicate feral swine populations in targeted watersheds to improve agricultural production and the environment. Watersheds within three project areas (Wiregrass, Coastal Plain, and Blackbelt) were selected based on historically abundant feral swine populations coupled with relatively high percentages of the land base in agriculture production. Within each project area, local soil and water conservation districts hired a feral swine coordinator to proactively solicit landowners' and producers' participation within designated watersheds where feral swine removal efforts would be concentrated initially. These feral swine coordinators then facilitated meetings among landowners and Animal and Plant Health Inspection Service Wildlife Services (WS) field staff to gain access to their properties to trap and eliminate feral swine. APHIS Wildlife Services obtained seventy wireless camera trap systems for removing feral swine. APHIS Wildlife Services provided twenty automated gates, camera systems, and six net traps during the project.

APHIS Wildlife Services provided participating landowners with intensive feral swine control efforts and technical guidance within delineated watersheds encompassing approximately 600,000 acres in the Wiregrass, Blackbelt, and Gulf Coast regions. A total of eleven APHIS employees were initially hired, and a variety of control techniques were employed to assist with the removal efforts. Approximately 44 percent of the acreage within the targeted watersheds received control efforts or were considered free of feral swine activity and associated damages. Elimination of agricultural damages, reinstating fallow fields for agricultural use, and a decrease in native species competition occurred in areas that had sufficient acreage (+500 acres) that supported year-round control efforts. Indirect impacts also decreased, including less fuel consumption (needed for replanting, field preparation, etc.) and equipment damage or repair, which often occurred when traversing areas heavily impacted by feral swine.

Testimonials

"There is no telling how bad it would be if y'all had not started the work. If you weren't here, we would lose at least $20,000 a year in damage even while doing what we could do by ourselves. Because we farm, we do not have the time to devote to it. It's a full-time job itself. We do not have to waste time replanting crops like we would if y'all weren't here. It has just been good having the help."
-Andy Williams, Wiregrass Region

"In 2017, pigs ruined 90 acres of corn just after planting. That was the last corn I planted in the Aliceville area. This year, I plan to plant 450 acres of corn primarily because of the constant trapping and removal of pigs in the area. I now have the confidence that a sustainable practice is in place to control the population. Without this effort, we cannot grow corn south of Aliceville."
-Lance Whitehead, Blackbelt Region

Alabama Project Summary (continued)

Additionally, participating landowners trained on control methods to address future feral swine damages and dispersal issues.

To encourage landowners to engage in feral swine removal throughout each project area, a feral swine Conservation Incentive Program (CIP) was created whereby landowners within the project areas could receive a 70 percent rebate on the purchase of either a commercially produced or self-assembled feral swine trap meeting stringent guidelines developed by the Alabama Soil and Water Conservation Committee (ALSWCC). The maximum financial assistance was $12,000 for landowners with more than 1,000 acres and $6,000 for landowners with less than or equal to 1,000 acres. To participate in the CIP, each landowner first had to complete an in-person or online technical training program on feral swine management with content developed by the Alabama Cooperative Extension System.

A social and digital media campaign encouraging landowners to participate in the CIP focused first on the counties in the program and then statewide. Statistics from the program show that the topic of feral swine removal is of significant interest statewide. ALSWCC provided subcontracts to Auburn University and the University of West Alabama to (1) monitor changes in water quality before and after feral swine removal, (2) assess crop damage using unmanned aerial systems (UAS), and (3) conduct surveys of FSCP participants to measures changes in feral swine damage over time. Information from these studies will be used to improve future feral swine removal efforts and programs.

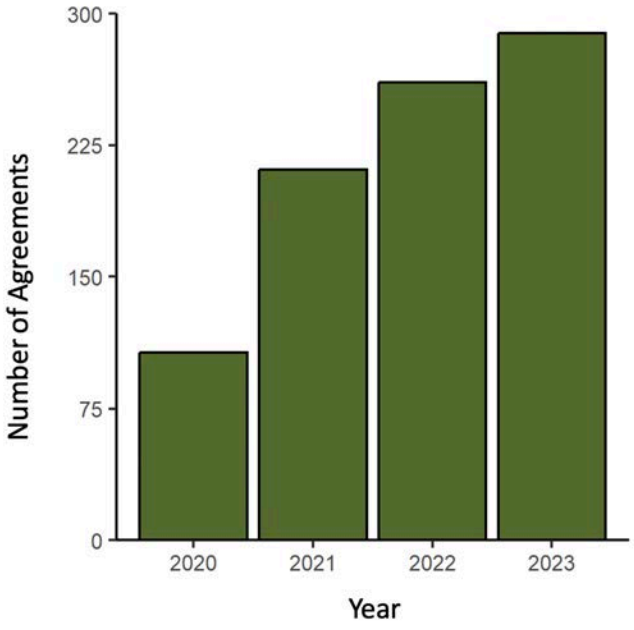


Figure 1. Number of APHIS Wildlife Services agreements with Alabama landowners increased from 107 in 2020 to 286 in 2023 with feral swine eliminated from twenty-one agreements as of 2023.

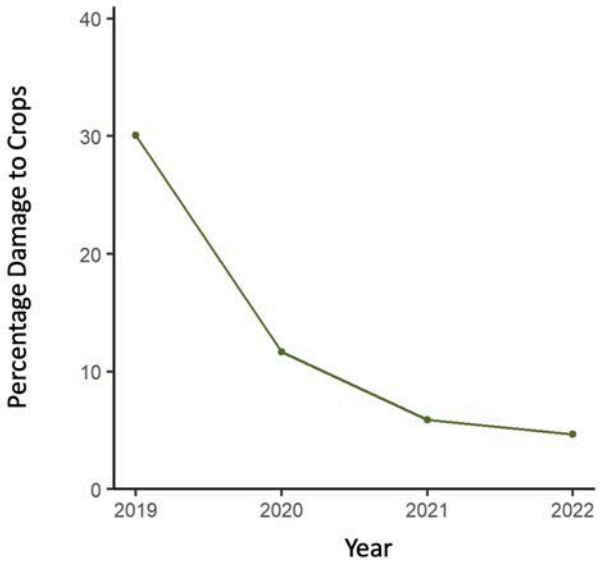


Figure 2. In Alabama's Black Belt project, the damage to crops by feral swine was reduced from 30 percent to 4 percent between 2019 and 2022.

Research and Project Results

1. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from 107 in 2020 to 286 in 2023 (figure 1). Within the Black Belt project area, crop damage declined from 30 percent to 4 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

2. As of January 2023, 227 Alabama producers participated in the Conservation Incentive Program and purchased feral swine traps that were used to remove feral swine on 173,661 acres.

3. Using swine molecular source tracking, significant reductions in water quality in streams with feral swine were observed. On average, *E. coli* levels were 17.77 percent greater in streams positively linked with feral swine fecal contamination.

Lessons Learned

1. Use county lines to delineate project area boundaries, not watershed boundaries, to reduce public confusion regarding project eligibility. Doing so also makes promoting and advertising programs easier when using county boundaries versus watershed boundaries.

2. Use commonly recognized language to the public, such as “rebates” in place of “Conservation Incentive Program” or “cost share.” Using more commonly known terms by the public made promoting the program easier.

3. Promote programs using geotargeted (county boundaries) social and digital media ads. Engage professionals when working outside the project partners' area of expertise. Be willing to adapt and change the message as you learn more about what resonates with the public. Expand geographical areas to capture absentee landowners.

4. Expand the social and digital media campaign outside the targeted project areas to reach absentee landowners once the project area becomes saturated with ads. Interest in managing feral swine was high. During the first 2 months of a 4-month marketing campaign through Alabama's largest online newspaper and other social media platforms, the click-through rate (percentage of those reached who clicked on the ad to seek additional information) was 0.23 percent (online newspaper) and 6.48 percent (social media). A click-through rate of 0.1% or greater is the industry standard of a successful digital campaign: a click-through of 2 percent or greater is the industry standard for a successful social media campaign.

5. Communicate regularly and efficiently. Staying on top of communication will help prevent confusion, duplication of work, gaps in the program, etc.

6. Recommend producers who participate with APHIS Wildlife Services to purchase a trap to ensure continued removal of any feral swine that return to their property after the initial removal operations are completed.

7. Active control efforts should be conducted year-round and at a landscape level. Dual-leased lands (agricultural, recreational, etc.) typically present a challenge due to the lessor's goals and often limited management activities to certain times of the year. Controlling feral swine on small acreages is labor intensive due to constant dispersal issues from adjacent lands with no active management activities.

8. The development of a web resource or social media outlet where landowners can easily identify what control incentives are available at the county level will aid in education and unify resources available to landowners statewide.

Other Contributing Agencies

Alabama Association of Conservation Districts
Alabama Cooperative Extension System
Auburn University
University of West Alabama
Alabama Media Group
Alabama Wildlife Federation
Alabama Farmers Federation
Alabama Cattlemen's Association

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USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Arkansas Project Summary

Quick Facts

NRCS grant partner: Arkansas Department of Agriculture, Natural Resources Division
Location: West Arkansas River Valley (Logan, Sebastian, Yell Counties); North Central Ozarks (Baxter, Izard, Marian Counties); Southeast (Arkansas, Ashley, Drew Counties); Southwest (Howard, Hempstead, Sevier Counties)
Congressional districts: 1, 3, 4
Total NRCS investment: $3.9 million
Total APHIS allocation: $3.9 million
Participating landowners: 628
Acres impacted: 517,397
Outreach programs conducted: 32
Estimated outreach program reach: 3,000

Narrative

Although small feral swine populations have lived in Arkansas for generations, their numbers have increased dramatically in the past 30 years. Currently, feral swine are present in every county in Arkansas, with populations reported in all but Lonoke, Greene, and Clay counties[1]. Feral swine affect the state's economy and natural resources in ways that are difficult to measure economically and often underrepresent the actual cost of their damages to agriculture and the environment. One study found that feral swine cause an estimated $20 million in damage to commodity crops in the state[2], but damages to other properties, landscapes, and ecosystems often are challenging to measure and, therefore, unreported.

The Feral Swine Eradication and Control Pilot Program (FSCP), within the 2018 Farm Bill, successfully augmented feral swine control efforts in Arkansas. The Arkansas Department of Agriculture took the lead role in this FSCP project by facilitating and coordinating the hiring of conservation district field technicians to enhance further removal efforts supported by APHIS Wildlife Services and other partners on the Arkansas Feral Hog Eradication Task Force. Specifically, the goal of this FSCP project was to reduce damage caused by feral swine from each of the four pilot project areas, measure the success of these efforts, provide cost-share payments to landowners to incentivize survey responses, conduct outreach and education events within each project area, and evaluate the practical use of unmanned aircraft systems (UAS). To accomplish this goal, ten conservation district technicians were hired to work with APHIS Wildlife Services staff to conduct feral swine removal operations. These four areas included the West Arkansas River Valley (Logan, Sebastian, Yell Counties), North Central Ozarks (Baxter, Izard, Marian Counties), Southeast (Arkansas, Ashley, Drew Counties), and Southwest (Howard, Hempstead, Sevier Counties) regions of Arkansas. Compared to a scattered approach for feral swine removals, focusing efforts in these areas allowed for leveraging resources among several agencies.

Although APHIS Wildlife Services has historically been the agency for feral swine removal, conservation district technicians learned that many landowners were unaware of this agency and its mission. Most landowners were familiar with and trusted local conservation agency representatives who live and work in their communities, such as the conservation district technicians. Once this partnership was established, doors were opened to new, previously unreached audiences. When feral swine were successfully removed from one property, the owner often relayed to their neighbors the benefits of this service, which opened access to adjoining properties. The conservation district technician maintained relationships with landowners even after feral swine were trapped and responded quickly if feral swine reappeared.

APHIS Wildlife Services hired seven new employees and used existing personnel to assist 628 landowners on 517,397 acres of private property within the project areas. APHIS Wildlife Services provided direct control to landowners at no cost and used a variety of methods, including trapping, aerial removal, and shooting. The FSCP allowed APHIS Wildlife Services staff to partner with other federal, state, and local agencies to leverage funding and provide control in areas not previously possible. Overall, these efforts resulted in a reduction in feral swine abundance and damage. Damage across all resources declined dramatically since the start of the project with farmers reporting being able to grow crops in areas they could not in the past.

Testimonials

"The eradication program has helped my farm tremendously. I grow 20 acres of corn for feed, and this is the first year I've had no damage. Turkey and quail populations have increased as well. This is a very good program that needs to continue."
- Owen, North Central Ozarks

"Keep up the program so we can keep the pigs out."
- Debbie, North Central Ozarks

Arkansas Project Summary (continued)

The project's success contributed to a landowner mindset shift from recreational/opportunistic control to a multilandowner, damage reduction program focused on trapping. This cultural shift was due to APHIS Wildlife Services employees' outreach to landowners and APHIS Wildlife Services demonstrating that an intensive removal program focused on trapping reduces feral swine damage.

A subaward to the University of Arkansas was issued to measure the pilot project's success. This included telephone interviews of landowners before and after receiving feral swine removal services from conservation district staff, mail surveys to landowners adjacent to those receiving trapping services, and mail surveys to landowners in the pilot project areas. Landowners who received conservation district services and agreed to participate in a telephone interview were offered a $150 cost-share payment. A portion of this grant was also used to evaluate the use of UAS in estimating feral swine damages in agricultural crops and pastureland, locating feral swine in real time to facilitate their removal, and assessing populations before and after removal efforts.

Research and Project Results

1. Of those participating in follow-up phone interviews, nearly all landowners (206 of 207) who received feral swine removal services indicated that they were very satisfied with removal efforts and want this pilot project to continue to keep feral swine and their damages low to nonexistent on their land and neighboring properties.

2. Before feral swine removal operations began, participating landowners (n=207) estimated approximately 12,873 feral swine on their properties. This number declined to about 2,500 in a follow-up mail survey a year later.

3. Landowners receiving trapping services by July 2022 (n=166) reported $877,098 in total damages before feral swine trapping occurred, including losses in commercial crops, livestock, timber, food plots, improved pastures, roads, old fields, stream banks, property, and stored commodities. In a mail survey, a sample of landowners in the broader pilot project areas (n=218) reported $199,976 in total damages to pastures, commercial crops, timber, wetlands, and recreation/hunting lease lands.

4. Landowners receiving trapping services tended to have more significant feral swine damages to commercial crops, timber, recreational lands, and pasture/hayfields than other landowners within the project areas, indicating conservation district technicians successfully targeted those in need of feral swine removals.

5. When asked how much money would have been lost if feral swine were not removed from their properties, landowners (n=207) who received feral swine removal as part of this project reported approximately $886,145 in loss avoidance or approximately $4,281 per respondent. This figure does not include the surrounding landowners where the same feral swine also cause damage.

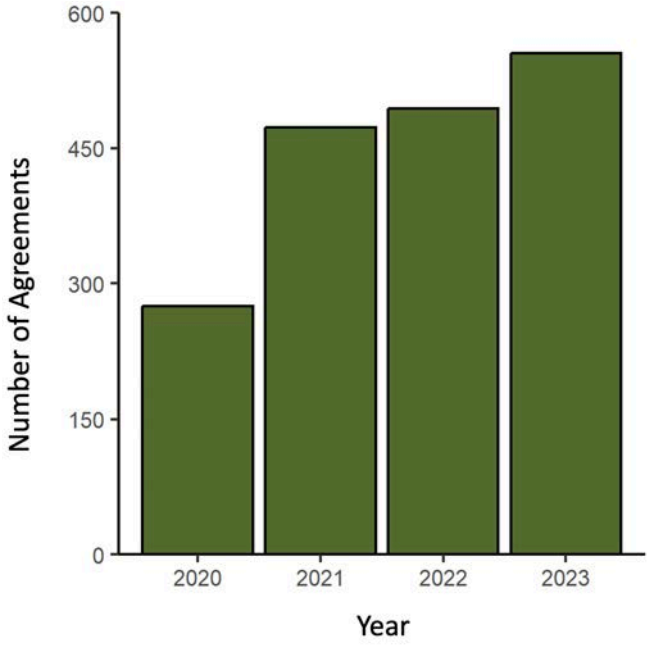

Figure 1. Number of APHIS Wildlife Services agreements with Arkansas landowners increased from 274 in 2020 to 548 in 2023.

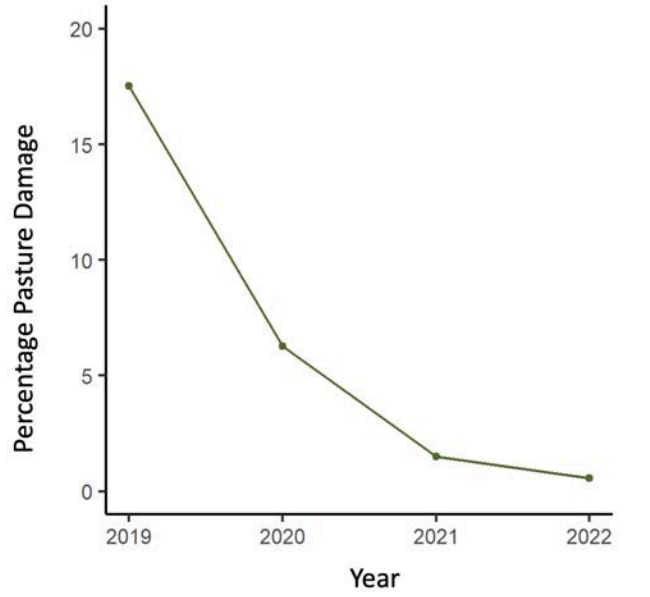

Figure 2. On average, pasture damage by feral swine declined from 17 percent to below 1 percent between 2019 and 2022 for landowners engaging APHIS Wildlife Services feral swine removal in Arkansas.

6. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from 274 in 2020 to 548 in 2023 (figure 1). On average across all project areas, pasture damage by feral swine declined from 17 percent to below 1 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

Lessons Learned

1. Conservation district technicians effectively gained the local trust and bridged access to private lands for feral swine removals. Landowners were more likely to provide access to someone known in the community. In many instances, conservation district technicians introduced willing landowners to APHIS Wildlife Services. Before this introduction, many landowners were unaware of the service they provide.

2. Coordinating efforts between APHIS Wildlife Services and conservation district technicians worked well mostly when both agreed to the premise of service to the landowner rather than agency competition. Development of a common metric—such as reduction of feral swine damages and landowner satisfaction, combined with the number of feral swine removed, with both agencies receiving credit—would encourage greater cooperation.

3. Implementing a $150 cost-share to incentivize survey respondents required a number of transactions, which called into question whether the additional workload was worthwhile. A possible recommendation is to drop the cost-share benefit because the removal service is currently free. Conservation district technicians indicated that free service was more important to landowner participation than the cost-share payment.

4. Conservation District technicians relied on the availability of APHIS Wildlife Services technicians, wildlife officers, landowners, or others in the community to dispatch feral swine, which hampered the efficiency of feral swine removals. It is recommended that alternatives be investigated to improve efficiencies so conservation district technicians are allowed to dispatch feral swine.

5. Unmanned aircraft systems (UAS), or drones, facilitated trapping strategies in areas where feral swine can be detected quickly, such as large, open cornfields. Feral swine were detected best after leaf drop when colder temperatures provide greater thermal contrast. Drones were helpful in assessing agriculture damages, but the ability to detect damage can vary from field to field and may require different lenses for detection.

6. Pilot projects demonstrated that an integrated feral swine trapping program can reduce damage. Continued and new partnerships with large landowning agencies are needed to expand the control efforts to a regional level. Large blocks of land with little or no consistent control are a reservoir for swine to immigrate into low-density areas.

7. Direct control efforts led by one agency ensure a consistent approach to feral swine control and data collection. Identifying one lead agency also helps with outreach and landowner participation due to decreased confusion on who landowners can call for assistance.

Other Contributing Agencies

Arkansas Game and Fish Commission
Arkansas Farm Bureau
The Nature Conservancy (Arkansas)
Central Arkansas Resource Conservation and Development Council
Arkansas Natural Heritage Commission

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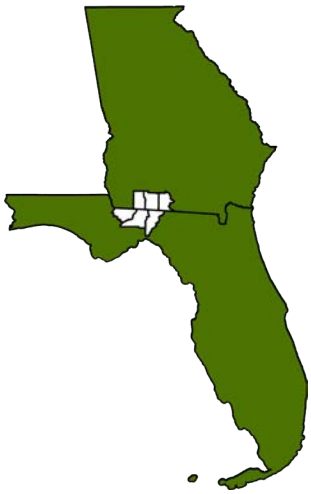
USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Florida-Georgia Project Summary

Quick Facts

NRCS grant partner: Tall Timbers Research Station
Location: Red Hills region
Florida: Jefferson, Leon, Gadsden Counties
Georgia: Brooks, Thomas, Grady Counties
Congressional districts: Florida: 2, 5; Georgia: 2, 8
Total NRCS investment: $1.8 million
Total APHIS allocation: $1.4 million
Participating landowners: 87
Acres impacted: 236,000
Outreach programs conducted: 6
Estimated outreach program reach: 200



Testimonials

"I really like working with my assigned trapper and talking to someone that is well-versed in hog control. The trapping program has been very successful, and I would like to see it continue because we'll likely never eradicate the hogs."
- Warren Bicknell, Thomas County, Georgia

"I had $180,000 in damage/year prior to the trappers. They removed over 350 hogs, and I've had no damage since they started trapping."
- Travis Sherman, Leon County, Florida

Narrative

The Red Hills region of northern Florida and southwestern Georgia is located between the Ochlockonee and Aucilla Rivers. The Aucilla River is designated Florida Outstanding Waters for its intact habitats, rich biodiversity, and relatively clean water.

The Red Hills landscape has been frequently treated with prescribed fire without interruption, harboring tremendous natural resources. Among more than 100 threatened and endangered species present are the last landscape-scale population of northern bobwhite and one of the largest populations of gopher tortoises on private lands[1]. The region also has numerous intact ephemeral wetlands that support high amphibian diversity. All resources are tied directly to the health of the ground cover vegetation in upland and lowland habitats.

Within the Red Hills region, feral swine have increased over the last 30 years. They are now found throughout the region, causing significant damage to bottomlands, watersheds, ephemeral ponds, upland native ground cover, and agricultural crops. Damage by feral swine has been significant in bottomland forests, forested drains, and along major lakes, such as Lakes Iamonia and Miccosukee.

Some large properties along the Ochlockonee River have extensive feral pig damage to crops and drainage systems to the point where almost no drain has an intact ground cover. During rain events, this ground disturbance impacts water quality, especially turbidity and nutrient loads in tributaries to the rivers. In addition to damaging fragile ecosystems, feral swine have disrupted wildlife, such as wild turkey and white-tailed deer, resulting in range-wide declines of both species.

The overarching goal of the Florida-Georgia Feral Swine Eradication and Control Pilot Program (FSCP) was to establish a feral swine removal program on a landscape scale (hundreds of thousands of acres) to substantially reduce or eradicate local feral swine populations and to train landowners on how to be self-sufficient in maintaining low feral swine densities to ensure the long-term sustainability of removal efforts.

Tall Timbers established a trusted working relationship within this community, which was critical for implementing a project of this magnitude. Leveraging their landowner relationships, Tall Timbers staff continually solicited, secured access to, and coordinated landowner participation in feral swine removal operations conducted by APHIS Wildlife Services. They also collected damage data from participating landowners for the National Damage Assessment Program. To facilitate the long-term sustainability of removal operations, Tall Timbers developed several workshops to train landowners in best management practices (BMP) for feral swine removal and a mobile phone application (Hog Havoc) for reporting feral swine and damage.

APHIS Wildlife Services in Florida and Georgia each hired three full-time technicians to conduct removal operations for the Red Hills project area. Each agency had clearly defined roles, with APHIS Wildlife Services providing all removal operations while Tall Timbers organized outreach events, acquired relevant supplies and equipment, and led research efforts. APHIS Wildlife Services used a

Florida-Georgia Project Summary (continued)

simple three-pronged approach of trapping large groups of feral swine, removing individual and trap-shy feral swine through shooting, and utilizing aerial operations for approximately 2 weeks per year to supplement ground removal efforts. This approach allowed the removal of feral swine from inaccessible areas and the ability to assess the overall damage across the landscape. In Florida, feral swine were removed from twenty-eight properties encompassing 137,353 acres, while in Georgia, feral swine were removed from thirty-one properties totaling 98,802 acres.

Tall Timbers conducted several research studies to monitor and evaluate the outcomes of feral swine removal efforts. Changes in the abundance of native wildlife were monitored using systematic camera surveys on many of the project sites, and water quality was evaluated using feral swine-specific environmental DNA (eDNA) within the context of removal operations by APHIS Wildlife Services. These studies also included monitoring feral swine numbers and changes in physical land damage caused by feral swine.

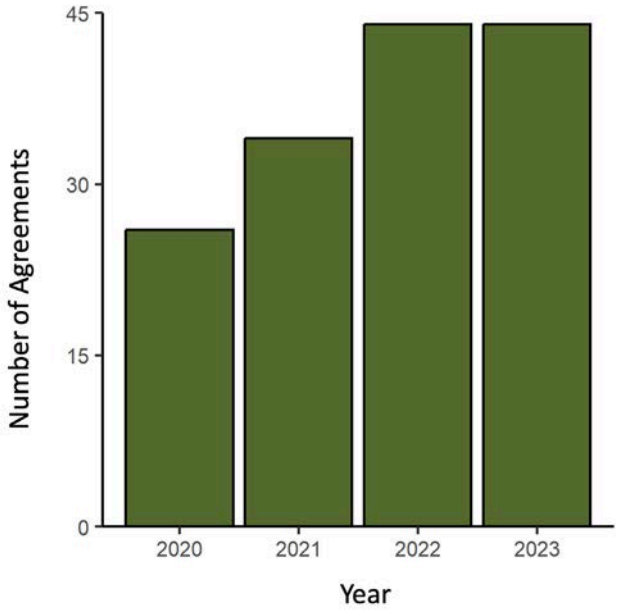


Figure 1. Number of APHIS Wildlife Services agreements in the Florida-Georgia project increased from twenty-six in 2020 to forty-four in 2023 with feral swine eliminated on two agreements as of 2023.

Research and Project Results

1. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from twenty-six in 2020 to forty-four in 2023 (figure 1). Crop damage declined from 21 percent to 1 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

2. More than 87 percent of landowners in the 400,000-acre Red Hills region participated in the project, providing trappers access to approximately 71 different properties. This level of landowner participation indicates the unity and support among landowners for feral swine removal.

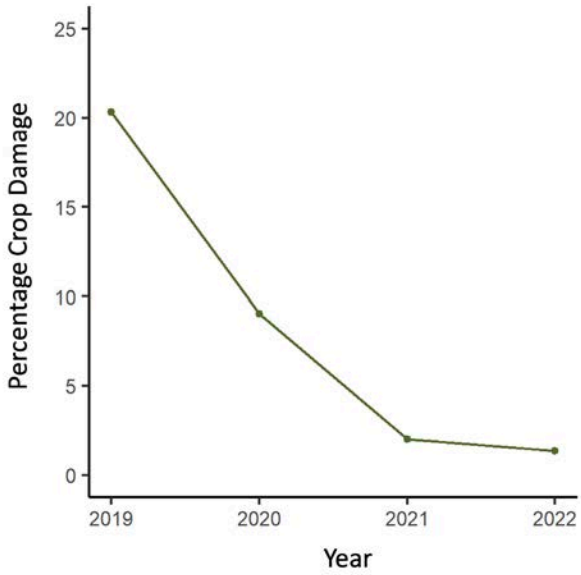


Figure 2. Crop damage declined from 21 percent to 1 percent between 2019 and 2022 for landowners participating in the Florida-Georgia project.

3. One hundred fifty-one game cameras were installed across nine properties within the Red Hills region. Preliminary results gathered from the 638,058 images taken indicate a noticeable reduction in the amount of feral swine damage on these properties. Results suggest that when feral swine numbers are reduced, turkeys return to areas previously abandoned.

4. Fourteen feral swine within the project areas were fitted with GPS collars. Data showed that home ranges varied between 1,000 and 3,000 acres, and multiple sounders used the same resting sites, typically areas where fire had been suppressed, resulting in dense overhead cover.

5. Due to the immense success of the FSCP, landowners from fourteen of twenty-eight properties in Florida and fifteen of thirty-one properties in Georgia contributed $180,000 to the Red Hills Feral Hog Coalition to fund two technicians as a stopgap measure to continue feral swine removal operations.

6. Land managers continue to have very low crop damage since the program began, as feral swine numbers appear to be drastically lower than when the pilot project began, allowing for the planting of crops and trees without major damage.

Lessons Learned

1. In some cases, a decline was observed in *E. coli* levels in water bodies sampled on some properties, but this decline may or may not have been a direct result of feral swine removal. The difficulty in observing a cause-and-effect relationship was likely due to the detection ability using swine eDNA and to varying water levels resulting from rainfall or drought. Future monitoring efforts should, therefore, consider the likelihood of current swine eDNA markers to detect actual feral swine presence in an area.

Florida-Georgia Project Summary (continued)

2. Permanent funding for this project will be imperative to its success. Due to the relatively short-term nature of this pilot project, turnover among cooperator staff (e.g., APHIS Wildlife Services operations staff) was high, resulting in significant challenges in developing and maintaining working relationships with landowners.

3. Having a leading local partner (Tall Timbers) was a major contributing factor to the project's overall success. Its long-standing presence in the local area as a dedicated land management organization, gave credibility to the project as a whole.

4. Implementing focused removal operations by APHIS Wildlife Services on vast amounts of contiguous land made elimination achievable for some properties inside the project area. Because of these contiguous properties and the effect of their success rates on each other, peer pressure also contributed to prompting reluctant land managers to join the project.

5. Information gathered during the project led to the realization that the overall feral swine density was lower than first anticipated. The population was seemingly larger due to feral swine traveling long distances and home ranges overlapping on multiple properties. The historical management practices likely assisted with harassing feral swine onto surrounding properties, which increased home range size.

6. Because of the intense management and frequent recreational use of the land in the project area, there were some challenges with accessing certain areas to conduct removal operations. However, this challenge can be overcome.

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[1]Masters, R. E., K. Robertson, B. Palmer, J. Cox, K. McGorty, L. Green, and C. Ambrose. 2007. Red Hills forest stewardship guide. Second edition. Tall Timbers Research Station and Land Conservancy, Tallahassee, Florida, USA.

USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Georgia Project Summary

Quick Facts

NRCS grant partner: Flint River Soil and Water Conservation District
Location: Calhoun County
Congressional district: GA-002
Total NRCS investment: $2.1 million
Total APHIS allocation: $2.4 million
Participating landowners: 12
Acres impacted: 85,996
Outreach programs conducted: 5
Estimated outreach program reach: 2,063

Testimonials

"From the onset of this project, regional staff noticed a dramatic decrease in sighting, sign, and damage across the nearly 20,000-acre landscape."
- Brian Vickery, project participant, Calhoun County

"After that first time y'all flew we couldn't find any sign—no rooting on roads, field edges—nothing... we really impacted the population hard then...."
- Doug Reed, project participant, Calhoun County

Narrative

Southwest Georgia is the epicenter of Georgia's top industry—agriculture. Most of the state's crops that designate Georgia as a top producer in the country are grown in this region. These include cotton, corn, peanuts, and pecans. The annual farm gate value of the region is approximately $2 billion per year, with a larger economic impact of approximately $16 billion per year[1]. Unfortunately, farmers have become increasingly concerned by the growing prevalence and damage caused by feral swine. According to a 2014 University of Georgia study, feral swine caused an estimated statewide loss of $98 million per year in crops, with an additional $51.7 million per year in noncrop property damage[2]. Row crops and vegetables are not the only economic sectors affected. Forestry, another industry in which Georgia leads the nation in production, is also negatively affected by the presence of feral swine. The majority of Georgia's pecan production acreage is located in the project area of southwest Georgia.

The Flint River Soil and Water Conservation District (FRSWCD) is a state agency based in southwest Georgia, which is comprised of nine counties. District supervisors and staff have a strong reputation and trust among farmers and landowners. Actively engaging landowners and farmers was a critical component of project success. Because of the established trust, the FRSWCD and its partners could coordinate and communicate effectively with local participants to ensure successful project implementation. The overarching goal of this FSCP pilot project was to effectively reduce feral swine populations through a collaborative and replicable pilot project. This includes reducing crop depredation and costs to agricultural producers, enhancing water quality, improving soil health, increasing native wildlife populations, and restoring aquatic and terrestrial habitats through a landscape-scale approach rather than a patchwork of control efforts across the watershed. Unlike other project designs, the FRSWCD focused on a select group of 12 adjoining landowners and farmers totaling approximately 63,000 acres. These acres were within a watershed where feral swine were removed by USDA Wildlife Services staff through aerial control or a combination of aerial and ground trapping control. APHIS Wildlife Services provided all of the control efforts by hiring three full-time employees beginning in early 2020. Trapping, shooting, and aerial operations were conducted strategically throughout the year and project area. Approximately 3 weeks of aerial operations were conducted to assist with ground operations each year during the life of the Farm Bill. These operations targeted inaccessible and resting areas for feral swine during the winter months. Aerial focus shifted to standing corn during the summer months as other removal methods proved unsuccessful. Ground operations were provided on approximately 40,000 acres and aerial support on approximately 85,000 acres. Aerial operations were provided on contiguous properties where ground operations were being conducted by property owners. Within the 63,000 acres, a core 26,000 acres was focused on for research efforts monitoring and evaluating impacts of feral swine removal. As the lead agency for this pilot project, the FRSWCD coordinated all partner efforts and project implementation and took the lead in introducing and facilitating access to farmer properties for USDA Wildlife Services to conduct removal operations. The FRSWCD also facilitated coordination and collaboration among all partnering agencies. To ensure long-term sustainability of efforts, the FRSWCD conducted comprehensive outreach, including in-person workshops, participant meetings, and an array of digital outreach materials hosted on georgiaferalswine.com.

Georgia Project Summary (continued)

Monitoring and evaluating the impacts of feral swine removal was accomplished through subawards with the University of Georgia Warnell School of Forestry and Natural Resources, the University of Georgia Tifton Veterinary Diagnostics and Investigational Laboratory, and The Jones Center at Ichauway. These investigations included monitoring feral swine before, during, and after removal operations by USDA Wildlife Services, conducting water quality analyses, tracing *E. coli* water sample sources, evaluating the efficacies of feral swine removal techniques, quantifying crop damage using unmanned aerial systems (UAS), measuring the impacts of feral swine on native wildlife populations within the project area, Judas pig monitoring and efficacy assessing through GPS data, and collecting damage data from participating landowners for the National Damage Assessment Program.

Research and Project Results

1. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from eight in 2020 to thirty-two in 2023 (figure 1), while crop damage declined from 9 percent to 1 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

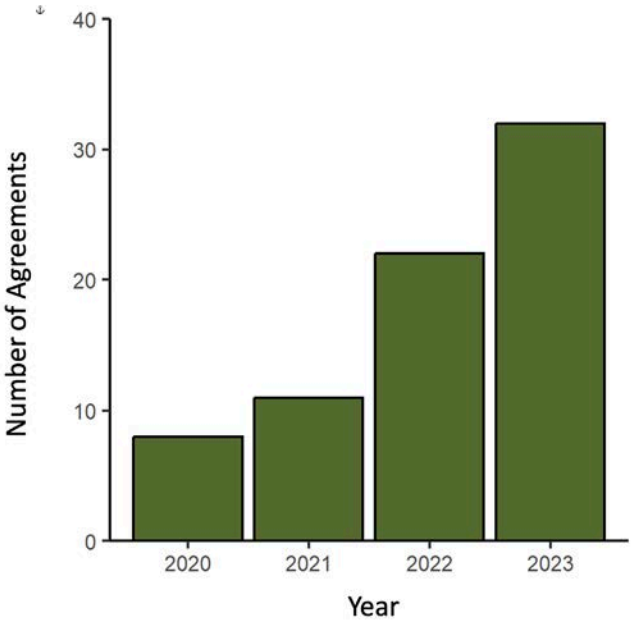

Figure 1. Number of APHIS Wildlife Services agreements with landowners in the Georgia project increased from eight in 2020 to thirty-two in 2023 with feral swine eliminated on one agreement as of 2023.

2. Initial analyses of 325,000 images from 147 passive wildlife cameras and monthly UAV flights over crop fields (corn, cotton, peanuts) indicate a 77 percent decrease in feral swine damage.

3. Continuous water quality sampling was an effective method of monitoring feral swine impacts on water quality. Through both low- and high-flow conditions, sites with the least removal efforts had the greatest water turbidity values.

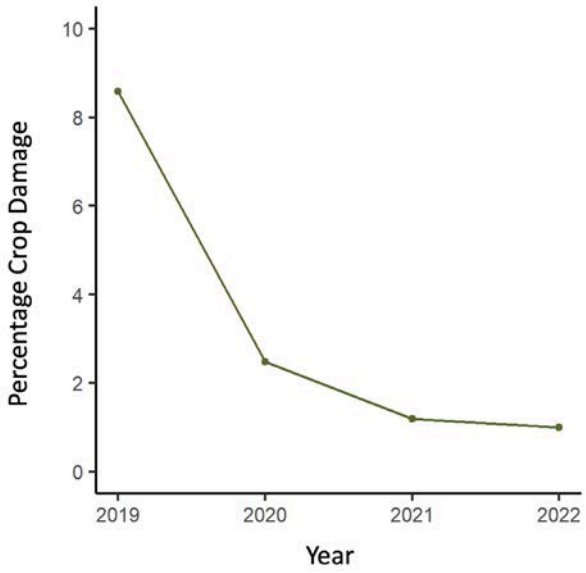

Figure 2. Crop damage from feral swine was reduced from 9 percent to 1 percent between 2019 and 2022 for landowners in the Georgia project.

4. Referred to as the Judas technique, feral swine are captured, released with a GPS collar, and monitored to know when they locate other feral swine for subsequent removal. Of thirteen feral swine released with GPS collars, it took approximately 34 days before they were observed with another group of feral swine.

Lessons Learned

1. Due to the diverse array of partners involved in this project, monthly check-in calls were immensely valuable in providing an opportunity for alignment across all facets of the project and creating an opportunity for collaboration among various aspects of project research. Likewise, annual meetings with participating landowners facilitated greater stakeholder engagement and the ability to maintain buy-in and awareness of project activities.

2. Mini conferences of pilot projects may be a good idea for more in-depth facilitated meetings to understand where there may be overlap or opportunities for collaboration. Periodic meetings with the nearby Florida FSPC project provided opportunities to share ideas and collaborate.

3. There are several local efforts around feral swine control in the region. Ensuring that local technical service providers have clear information and aligned language on effective feral swine control is critical. A more concerted and expanded effort is needed across the region, including working with other organizations and technical services providers, such as local NRCS field offices, to ensure consistent and shared messaging to local landowners.

Georgia Project Summary (continued)

4. This project targeted control efforts in a contiguous land base beginning with a core area and moving outward to enroll additional acreage and properties into the project. Rather than opening landowner sign-up across a watershed, which results in a patchwork of small, spatially inconsistent control areas, the targeted approach for selecting an area on which to focus removal operations allowed for intensive control in one large contiguous area.

Other Contributing Agencies

University of Georgia, Warnell School of Forestry and Natural Resources
The Jones Center at Ichauway
University of Georgia, Tifton Veterinary Diagnostic & Investigational Laboratory
University of Georgia Cooperative Extension
McLendon Acres, Inc.
Georgia Department of Natural Resources

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[1]Mengak, M. T. 2015. Georgia wild pig survey final report. Warnell School of Forestry and Natural Resources Outreach Publication No.16–23, Athens, GA.

[2]Georgia Farm Gate Value Report. University of Georgia Center for Agribusiness and Economic Development, Nov. 2018.

USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Hawaii Project Summary

Quick Facts

NRCS grant partner: Hawaii Division of Forestry and Wildlife
Location: Windward, Oahu
Congressional district: 2
Total NRCS investment: $870,000
Total APHIS allocation:: $600,000
Participating landowners: 32
Acres impacted: 3,640
Outreach programs conducted: 1
Estimated outreach program reach: 76

Narrative

Feral swine are identified as a major nuisance in Hawaii across all landscapes. They directly reduce the quantity and quality of native forests, negatively impact water quality, and damage agricultural crops.

The Feral Swine Eradication and Control Pilot Program (FSCP) project in Hawaii was developed to reduce the impacts of feral swine on agricultural producers within the lower elevation areas of the Windward Oahu Soil and Water Conservation District (SWCD), a region dominated by small, diverse farming operations. Most of the agricultural production in this area consists of nurseries, kalo, papaya, ulu, cacao, and a diverse array of row-crop vegetables, including greens, corn, and tomatoes. There also is a scattering of livestock production, mainly cattle and horses. Most of the farms in this area are small, roughly 5 to 10 acres in size, with approximately 75 percent leased from one of the multiple large landowners in the area.

In addition to reducing damage to agricultural producers, the Hawaii FSCP addressed feral swine impacts within the higher-elevation forests of the Koʻolau Mountains, which supply groundwater for approximately 90 percent of the population on the island of Oahu[1]. As the island's main source of fresh water, groundwater recharge is the most valuable product produced by the Koʻolau forests, providing approximately 364 million gallons of water per day with a net present value of at least $1.42 to $2.63 billion[1]. Unfortunately, groundwater levels in aquifers such as the Pearl Harbor aquifer have declined by half since 1910. This is the most important aquifer for municipal use in Hawaii. Protecting it and others from further decline is of the utmost priority for Hawaii's sustainability.

Although feral swine are a significant nuisance in Hawaii, they are classified as a big game animal and have a long-established cultural and recreational value to many Hawaiians [2,3]. The Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife (DOFAW) is, therefore, tasked with reducing feral swine populations to reduce damage and managing feral swine in specified areas for recreational and cultural use.

Unlike other FSCPs, meat salvage and food security are often an issue when DOFAW interacts with the public. As such, a major component of the Hawaii FSCP project was to engage in communication with local hunters and trappers prior to removal of feral swine to ensure proper meat salvage and alleviate concerns from this stakeholder group regarding FSCP goals and activities.

The Hawaii FSCP was organized and implemented into two distinct phases. Phase one focused on feral swine removal from agricultural lands. Phase two targeted feral swine removal from higher-elevation mountain forest areas.

Most phase one participants were identified by the Oahu Soil and Water Conservation District staff. While NRCS and DLNR provided funding and coordination with state, county, and private landowners, APHIS Wildlife Services provided both direct and technical assistance in feral swine control. Direct control was facilitated through the hiring of three technicians who spent a total of 6,400 hours toward the project. Most of the farms for

Testimonials

"There was an overall reduction in crop damage and evident decrease in pig presence. There is no irrigation or crop damage in any fields currently."
- Mahiku Farms, Honolulu County

"Not a significant decrease in presence and damage; however, less plants have had their irrigation tubes pulled out, which is usually caused by pigs, and therefore the damage and presence has decreased slightly."
- Contemporary Landscaping, Honolulu County

this project were micro-farms, usually under 10 acres, and owned or leased by immigrants from Vietnam, Laos, Cambodia, and the Philippines who came to work as farmers/laborers in Hawaii. APHIS Wildlife Services technicians protected crops, including sugarcane, cacao, taro, coffee, papayas, avocado, mangoes, guavas, snap/string beans, tropical ornamental plants, and assorted tropical fruit trees from feral swine damage. Some of this work included overcoming language barriers from as many as four different ethnicities daily. Once removal operations by APHIS Wildlife Services were successful, traps and maintenance activities were transitioned to local community/landowner groups to ensure that trapping and meat salvage were maintained. Phase two began at this point.

As FSCP project leader, DOFAW staff took the lead role in overall project coordination and conducted producer assessments. The DOFAW, the Oahu Resource Conservation and Development Council, Pono Pacific, and the SWCD engaged local hunter groups to facilitate meat salvage during phase one operations. The University of Hawaii College of Tropical Agriculture and Human Resources was contracted to provide technical consultation on monitoring protocols and data analyses.

Research and Project Results

1. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from seven in 2021 to twenty-one in 2023 (figure 1). Crop damage declined from 37 percent to 13 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

2. Net traps had the greatest trap efficiency (0.49 pigs/trap night) followed by corral traps (0.22 pigs/trap night) and box traps (0.09 pigs/trap night). However, net traps were more expensive to purchase compared to building corral traps.

3. Based on landowner interviews, approximately $2.1 million per year in crop values were protected on thirty-two agriculture farms, cultural sites, wildlife habitat areas, and traditional Hawaiian farming operations.

4. Some of the properties were easier than others to determine the amount of total damage to crops. Mahiku farms reported the greatest amount in crop recovery and improvement and overall revenue return. Before removal operations, overall damage by feral swine was estimated at $30,000. Trapping reduced damage by an estimated 90 to 100 percent on the farm. No fields or irrigation are currently being affected, and all fields are currently viable and in use.

5. Catch rates of feral swine increased throughout the spring months (March–May) and at the start of the rainy season in Hawaii (September–January) but was significantly lower during the summer months.

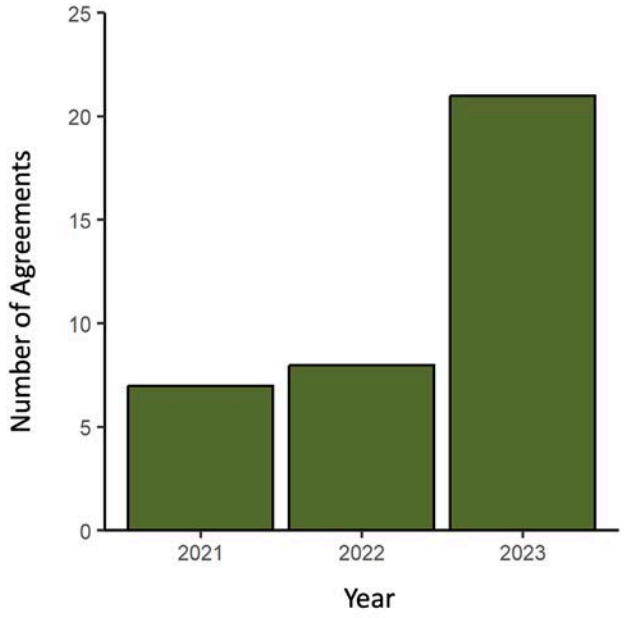

Figure 1. Number of APHIS Wildlife Services agreements with Hawaii landowners increased from seven in 2021 to twenty-one in 2023.

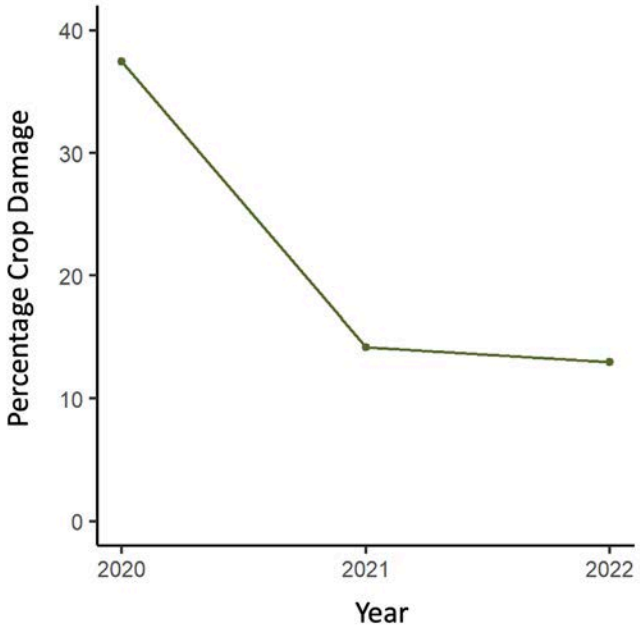

Figure 2. Crop damage by feral swine in Hawaii was reduced from 37 percent to 13 percent between 2020 and 2022.

Lessons Learned

1. Clear communication, coordination, and cooperation among all the agencies, landowners, and hunters involved in this FSCP were critical. Participants learned to better manage personnel time by effectively rotating trapping technicians along with the timing and duration of trapping efforts among several properties throughout the island. These actions increased the collective effectiveness in removal operations. Coordinating shared responsibilities among agencies helped overcome many of the logistical challenges of servicing several properties in a timely manner.

2. The proper use of remote camera technologies (game cameras) can significantly increase surveillance and trapping efficiency.

3. Because most properties serviced by the FSCP ranged from one- to eight-acre agricultural farms, feral swine removal operations on one property often effectively removed feral swine from adjacent and surrounding farms. A single trapping site often aided multiple landowners, who may have been experiencing the same pig incursions or moving sounders.

4. Being able to trap near the boundaries of upper watershed and Forest Reserve Systems allowed for the targeting of feral swine incursions. It prevented feral swine from finding a new area to cause damage and prevented feral swine from going to other neighboring farms and agriculture lands.

Other Contributing Agencies

Koʻolau Mountains Watershed Partnership
Oahu Resource Conservation and Development Council
Windward Oahu Soil and Water Conservation District
University of Hawaii Department of Natural Resources and Environmental Management
Oahu Resource Conservation and Development Council
Turtle Bay Resort/Kuilima Farm
Kamehameha Schools, Punaluʻu
First Presbyterian Church of Hawaii (FPC), Koʻolau
Kākoʻo ʻŌiwi
Ohulehule Forest Conservancy Lands
Honolulu Board of Water Supply Lands
Kualoa Ranch Lands
Waiahole Forest Reserve
Kawainui Marsh State Wildlife Sanctuary
Kaluanui Natural Area Reserve
Waimānalo Forest Reserve

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[2]Nogueira-Filho, S. L., S. S. Nogueira, and J. M. Fragoso. 2009. Ecological impacts of feral pigs in the Hawaiian Islands. Biodiversity and Conservation 18:3677.

[3]Ringma, J., D. Risch, and M. Price. 2017. Ecological modeling of optimal pig management strategies for recreational hunting and conservation purposes on Oahu: Stage 1 Report. The University of Hawaii, Department of Natural Resources and Environmental Management, Honolulu, Hawaii, USA.

USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Louisiana Project Summary

Quick Facts

NRCS grant partner: Louisiana Department of Agriculture and Forestry
Location: Red River, Natchitoches, Winn, Grant, and Rapides Parishes (Priority 1); Madison, Tensas, and Concordia Parishes (Priority 2); Cameron and Calcasieu Parishes (Priority 3)
Congressional districts: 3, 4, 5
Total NRCS investment: $3.4 million
Total APHIS allocation: $1.8 million
Participating landowners: 454
Acres impacted: 1,802,686
Outreach programs conducted: 8
Estimated outreach program reach: Unknown

Narrative

At an estimated population of 700,000 to 900,000 and increasing, feral swine are present in all 64 Louisiana parishes, causing significant damage to agriculture. A 2022 Louisiana State University Ag Center report estimated direct damage to agriculture by feral swine at $91.1 million in 2020[1]. Damage to rice alone was approximately $13 million.

Feral swine also pose a significant risk to Louisiana's vast network of waterways, bayous, wetlands, and riparian areas. The destructive feeding behavior of feral swine rooting in moist soil in search of roots, tubers, and invertebrates destroys native plant communities, damages soil quality, and causes erosion. They also may induce the spread of invasive plant species by creating disturbed areas that favor the establishment of highly competitive invasive species over native species. In these areas, feral swine often cause increased bacterial contamination in the form of *E. coli* and other pathogens.

Testing of feral swine by APHIS Wildlife Services, the US Geological Survey Wetland and Aquatic Research Center, and the Louisiana Department of Wildlife and Fisheries (LDWF) indicated increased incidences of pseudorabies, vesicular stomatitis, leptospirosis, and swine brucellosis[2]. LDWF surveillance testing of more than 1,000 feral swine statewide revealed that 5 percent were serologically positive for swine brucellosis. Moreover, the survey showed that during the 2019–2020 hunting season, more than 200,000 feral swine were harvested strictly by hunters. This did not include feral swine removed by agencies, professional trappers, or farmers.

The Louisiana Department of Agriculture and Forestry was selected as a grant recipient from NRCS to work in three priority areas, respectively: (1) Red River, Natchitoches, Winn, Grant, and Rapides Parishes; (2) Madison, Tensas, and Concordia Parishes; and

(3) Cameron and Calcasieu Parishes. Feral swine reduction and eradication activities on these private and public lands were synchronized for maximum effectiveness. The overarching goal of this FSCP was to reduce or eliminate feral swine damage using the existing conservation partnership's network, stakeholder engagement, and delivery and reporting system to reduce damage to agriculture and native ecosystems while protecting human and animal health.

The local Soil and Water Conservation District staff within each priority area was tasked with the following actions: conduct preactivity and damage assessment surveys on private lands; develop area-wide protocols for prioritizing and delivering technical assistance; coordinate enrollments and activities for prebaiting and trapping; assist in coordinating APHIS Wildlife Services operations with landowners; collect damage data from participating landowners for the National Damage Assessment Program; conduct postactivity stakeholder surveys; and conduct follow-up natural resource damage assessments.

Testimonials

"When trapping on my property began in 2021, I had already lost approximately 40 acres of planted corn to feral hogs. Throughout the remainder of 2021, almost 100 hogs were trapped and removed. With continued trapping, there was no known damage on my property by the end of planting this year (2022)."
- Karlton Methvin, Natchitoches Parish

"After hearing about the feral hog trapping efforts from the Madison Soil and Water Conservation District, I reached out to Justin and let him know I needed any help they could provide. Within the 2 years of trapping, they have trapped over 400 hogs, and my deer population is finally on the rise."
- Jim Brown, Madison Parish

Louisiana Project Summary (continued)

APHIS Wildlife Services hired four full-time technicians while leveraging funding from other cooperators to hire an additional five technicians to conduct feral swine removal operations on all three project areas ($120,000 from USFWS, two full-time technicians on Kisatchie National Forest by USFS). This approach allowed for greater flexibility in using technicians on both project sites and adjacent parishes to increase the effectiveness of efforts by limiting feral swine redistribution back into the project sites. As a direct result, damage management occurred on nearly double the acreage of project sites. The greatest numbers of feral swine were removed during the first 2 years of the project when population densities were highest. Since then, high-density areas of feral swine have been difficult to find, and feral swine populations have been reduced to a maintenance state in most of the areas of each project site.

Research and Project Results

1. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from 132 in 2020 to 202 in 2023 (figure 1) while natural resource damage declined from above 5 percent to 3 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

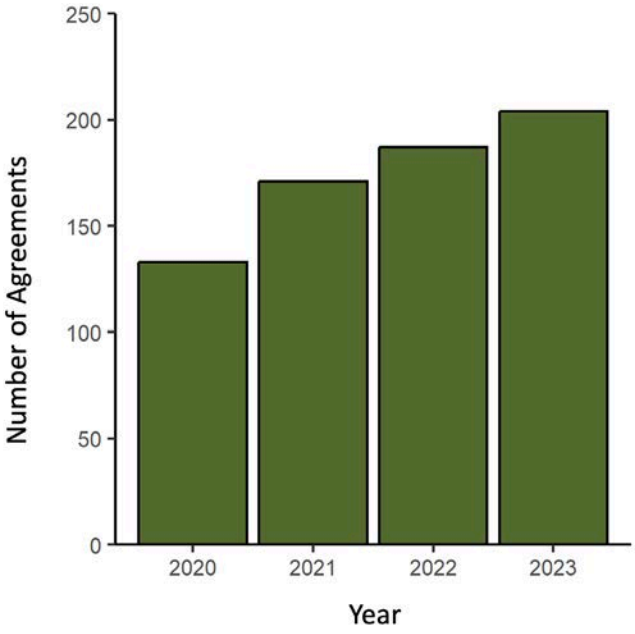

Figure 1. Number of APHIS Wildlife Services agreements with Louisiana landowners increased from 132 in 2020 to 202 in 2023.

2. With the cooperation and financial assistance of the Louisiana Department of Agriculture and Forestry, the Louisiana State University AgCenter designed and mailed a custom survey to 6,000 agriculture producers throughout Louisiana. The survey collected information about feral swine damage through the 2020 calendar year. More than 1,200 surveys were returned; of these, more than 950 respondents stated they owned or managed agricultural land totaling 659,887 acres, of which approximately 50 percent was cropland.

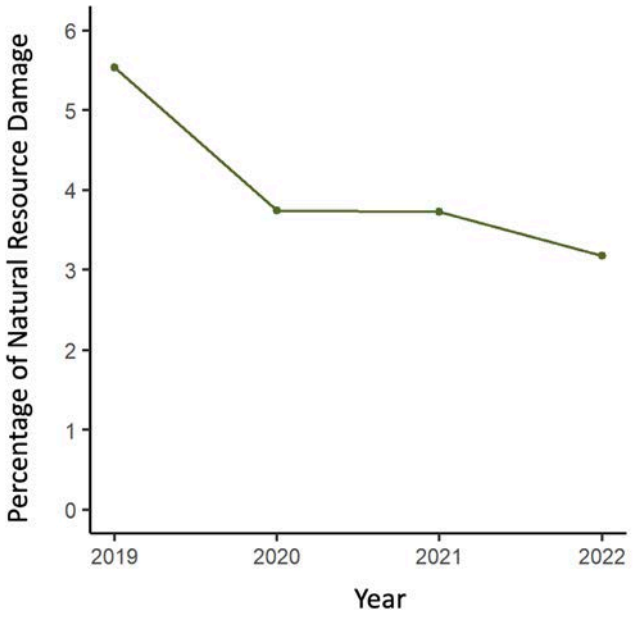

Figure 2. Natural resource damage by feral swine declined from above 5 percent to 3 percent between 2019 and 2022 in Louisiana.

3. Of the 950 respondents, 70 percent stated that feral swine interfered in some way with their farming operations in the past year; this included more than 60 percent with crop damage and almost 80 percent with negative impacts to their local wildlife habitats.

4. When asked about damage from feral swine over the three previous years, 39 percent indicated damage had remained the same, while 39 percent indicated damage had increased and 23 percent indicated that damage had decreased.

5. The majority of respondents (63 percent) indicated that they continue to deal with feral swine on their property, with 78 percent indicating that damage either increased or stayed the same during the time frame following the pilot program.

6. Statewide, an estimated loss of $66.2 million in agricultural land and $24.9 million in nonproduction land was attributed to feral hogs in 2020. Production loss estimates for 2020 included more than $14 million in sugar cane, more than $13 million in rice, and more than $9.3 million each for soybeans, corn, and hay. Nonproduction damage costs included more than $5 million to replant and restore pastures, more than $4 million to repair drains and levees, and more than $2 million to re-disk.

7. Multiple landowners in Winn Parish reported a lack of feral swine on game cameras for the first time in decades, which resulted in an increase in deer and turkey poult photos. This is a result of work conducted on the adjacent Kisatchie National Forest.

Lessons Learned

1. Project area boundaries should be flexible throughout the duration of the program to allow expansion of removal operations when feral swine densities are reduced or eliminated from the initial project areas.

2. Managers and field technicians need to be able to adapt to the ever-evolving climate of feral swine management. Several instances during the project required technicians to improvise field protocols to readily address new, unique challenges.

3. Maximizing the availability of equipment was critically important so field technicians would have the ability to choose the tool best suited for the job. It also provided leadership by example to landowners and managers, demonstrating an integrated approach to decision-making relevant to feral swine management.

4. Avoiding nontarget animals (e.g., black bears) presented significant challenges when attempting to capture feral swine in areas where both species were present. In some cases, feral swine removal was not possible.

5. Care should be used when selecting trap locations so curious passersby do not interfere with the trapping process. Using appropriate visual screening (e.g., sufficient distance from the road to allow natural vegetation to screen the trap from view) was critical.

Other Contributing Agencies

Red River Soil and Water Conservation District
Natchitoches Soil and Water Conservation District
Dugdemona Soil and Water Conservation District
Grant Soil and Water Conservation District
Rapides Soil and Water Conservation District
Tensas-Concordia Soil and Water Conservation District
Madison Soil and Water Conservation District
Gulf Coast Soil and Water Conservation District
Louisiana State University AgCenter
USDA Forest Service
US Geological Survey
US Fish and Wildlife Service
Louisiana Department of Wildlife and Fisheries
Louisiana Office of State Parks
National Wild Turkey Federation
Ducks Unlimited
Louisiana Landowners Association

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USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Mississippi Project Summary

Quick Facts

NRCS grant partner: Delta Wildlife
Location: Claiborne, Holmes, Humphreys, Issaquena, Jefferson, Sharkey, Washington, Warren, and Yazoo Counties
Congressional district: 2
Total NRCS investment: $3.0 million
Total APHIS allocation: $1.4 million
Participating landowners: 179
Acres impacted: 368,416
Outreach programs conducted: 10
Estimated outreach program reach: 150

Narrative

The nine-county project area of the Feral Swine Eradication and Control Pilot Program (FSCP) in the Mississippi Delta is one of Mississippi's most productive row crop agricultural areas. However, this area also holds some of the highest feral swine populations in the state. Feral swine cause tremendous amounts of damage by consuming and trampling crops and rooting and wallowing in crop fields. Rooting and wallowing cause crop loss and create holes and ruts that can damage farm equipment, endanger equipment operators, and cause soil erosion[1]. The crop loss due to feral swine in Mississippi exceeds $18 million annually and is largely comprised of damage to corn, soybeans, peanuts, and rice[2].

The purpose of the Mississippi Delta FSCP project was to reduce the economic damage feral swine cause to agriculture, forestlands, wetlands, wildlife, private property, and other associated infrastructure in the project area. As one of the partnering organizations of this FSCP project, Delta Wildlife coordinated a multipartner approach to reduce feral swine damage. The effort included feral swine removal support to landowners, farm operators, and farm managers; support to existing feral swine management activities by APHIS Wildlife Services; implementation of an outreach program to educate producers on feral swine removal techniques; and establishment of a long-term trap loan program to sustain feral swine trapping efforts after the formal project ends.

Landowners in the project area who had feral swine damage were identified through local soil and water conservation district offices. A Mississippi Association of Conservation Districts project coordinator then interviewed these landowners to document damages and assign priority for management activities. Delta Wildlife staff worked directly with farm operators and managers to implement removal activities. Damage caused by feral swine was documented before and 1 year after trapping operations to estimate the economic return on damage reduction. Researchers at Mississippi State University are analyzing the data.

APHIS provided direct support to existing feral swine management activities in the project area. APHIS Wildlife Services already had agreements with several landowners in the project area to conduct aerial gunning, night shooting, and trapping with existing resources not part of this FSCP project. However, the number of APHIS Wildlife Services staff in the project area was initially insufficient to actively trap all the areas where trapping was needed. Therefore, Delta Wildlife field staff assisted APHIS Wildlife Services with trapping efforts as needed within the project area until proper staffing levels were attained. APHIS Wildlife Services subsequently hired four technicians to conduct feral swine control operations in the South Delta project area, working with 179 private landowners, eight State Wildlife Management Areas (WMAs), six USFWS National Wildlife Refuges (NWR), and one USFS National Forest person. Corral, drop, and net traps were used predominantly throughout the year, and aerial operations were conducted from

Testimonials

"Thanks to the feral hog program with Delta Wildlife, our farm, recreational properties, and the South Delta are better places to live and work. [Delta Wildlife] are instrumental in helping us control feral pigs throughout the year, especially in our busiest times—planting and harvesting."
- Jeffrey Mitchell, Sharkey and Issaquena Counties

"We have seen a tremendous difference in our property since Delta Wildlife began trapping pigs for us. After removing well over 100 pigs, rooting in our food plots has been minimal; we have better-quality deer hunting; and we have had the best turkey hatch in several years."
- Bill Link, Yazoo County

January to April. Night operations also proved to be a valuable control technique when daylight access diminished due to hunting season.

Educating landowners regarding feral swine management and proper trapping techniques was equally as important as removing feral swine and reducing economic damage. Under the leadership of the Mississippi Department of Agriculture and Commerce (MDAC), educational materials used in outreach programs were produced by Mississippi State University and the Mississippi Department of Wildlife, Fisheries, and Parks. Furthermore, MDAC hosted several in-person feral swine management and trapping seminars while Delta Wildlife field staff provided additional one-on-one field training with landowners to facilitate continued feral swine removal by landowners after the FSCP project ends.

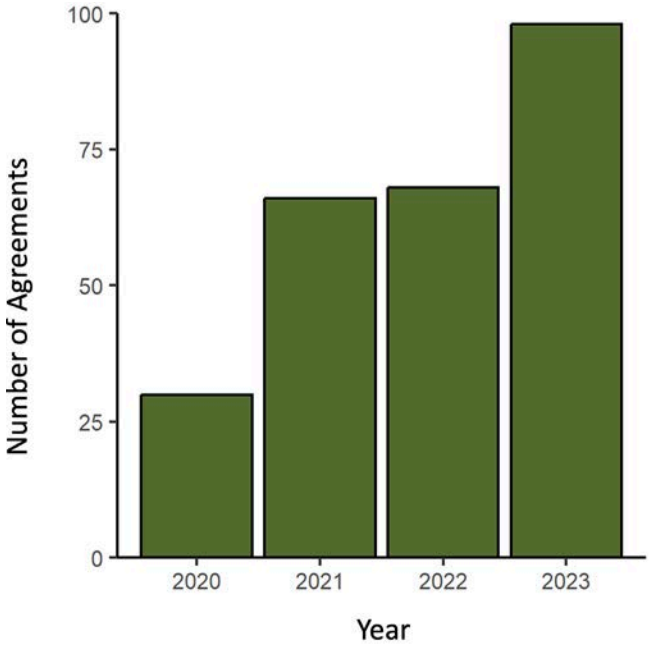

Figure 1. Number of APHIS Wildlife Services agreements with Mississippi landowners increased from thirty in 2020 to ninety-eight in 2023.

Research and Project Results

1. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from thirty in 2020 to ninety-eight in 2023 (figure 1). Crop damage declined from 6 percent to below 1 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

As of January 2023, 128 landowners enrolled 170,312 acres in the original four-county project area and an additional 69,322 acres have been enrolled in the five-county expansion project area at the time of this report.

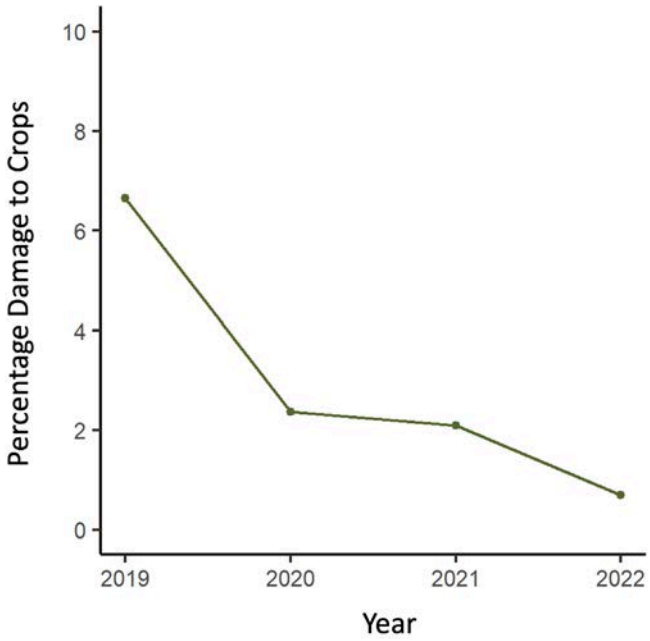

Figure 2. Crop damage by feral swine declined from 6 percent to below 1 percent between 2019 and 2022 in Mississippi.

2. Mississippi State University researchers are examining landscape features of the Mississippi Delta that may serve as predictors of areas where high levels of feral swine activity are likely to occur. Results from this study will be useful in guiding future removal activities.

3. Detailed field-level data regarding trapping input costs are being recorded to develop an accurate assessment of actual removal, ultimately benefiting landowners interested in trapping feral swine.

Lessons Learned

1. Clear and detailed standard operating procedures (SOP) and guidelines for all trappers working on the project were instrumental in consistently achieving positive results in a multicounty area. The development of SOPs allowed new hires to assimilate into the operation and significantly reduce training time.

2. Streamlined recordkeeping of trap inputs and efforts by field technicians/trappers was difficult in the beginning due to the volume of the trapping operation data being collected. To remedy this, an app was created for the technicians to use in the field to collect trapping and effort data for future analysis.

3. Building trust with landowners was important, especially in new areas. Literature detailing the trapping process, friendly and knowledgeable technicians, good communication, and professionalism garnered strong working relationships with landowners. Seasonal access can be problematic without a trusting relationship with property owners, as they do not want the trapping process to impose on recreational activities.

Mississippi Project Summary (continued)

4. Strong partnerships were key to the success of this FSCP project. It was important to clearly identify roles and responsibilities for project components, have a timeline for implementation, and have contingencies in place for obstacles along the way.

5. Employee retention was challenging due to technicians getting a year or two of experience and looking for a more stable position. Only term/temp employees could use base funding. The projects had a lot of overhead and requirements that could not be charged to permanent employees.

Other Contributing Agencies

Mississippi Soil and Water Conservation Commission
Mississippi Department of Agriculture and Commerce
Mississippi State University
Mississippi Department of Wildlife, Fisheries, and Parks
Mississippi Association of Conservation Districts

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[2]McKee, S. C., J. J. Mayer, and S. A. Shwiff. 2024. Comprehensive economic impacts of wild pigs on producers of six crops in the southeastern US and California. Agriculture 2024, 14, 153.

USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Missouri Project Summary

Quick Facts

NRCS grant partner: Missouri Department of Conservation
Location: Southern third of Missouri
Congressional districts: 4, 7, 8
Total NRCS investment: $3.4 million
Total APHIS allocation: $1.1 million
Participating landowners: 2,677
Acres impacted: 5,266,140
Outreach programs conducted: 302
Estimated outreach program reach: 243,732

Testimonials

"As of now, we haven't had any hogs for 6 months. Trappers have killed approximately 50 hogs on our place in 3 or 4 years. Trappers did a good job."
- N., Madison County

"We are making progress so far this year. We have seen less signs of hog damage than ever. Keep the FHEP well funded and the pressure on, or we could lose 10 years of hard work in 1 year."
- D., Reynolds County

"Appreciate all that MDC and the Feds are doing. Keep it up."
-L., Bollinger County

Narrative

The Feral Swine Eradication and Control Pilot Program (FSCP), within the 2018 Farm Bill, successfully augmented the state's feral swine control efforts as identified in the Missouri Feral Hog Elimination Partnership (MFHEP). In 2016, feral swine were estimated to occur in 459 watersheds across southern Missouri, encompassing 11.2 million acres, with producers incurring production losses of approximately $486,000/year[1]. In response to this growing spread of feral swine, the MFHEP was established to eliminate this growing threat to agriculture and natural resources.

MFHEP is a partnership among fifteen state and federal agencies and agriculture and conservation non-governmental organizations (NGOs) to eliminate feral swine from public and private lands throughout Missouri. MFHEP is unique compared to other states in that partnering agencies adopted an incident command system (ICS) approach to facilitate increased effectiveness and efficiency and ensure accountability. Although MFHEP experienced many early successes, feral swine populations were still present in approximately 190 watersheds, encompassing approximately 4.5 million acres in the state at the end of 2021. As such, FSCP funding provided much-needed support at a critical time in MFHEP's strategic approach toward eliminating feral swine in the state.

Three projects were selected to receive FSCP funding from NRCS to strategically and systematically eliminate feral swine populations. This FSCP funding aided in the following ways: (1) replacing equipment and supplies used by MFHEP staff to eliminate feral swine; (2) purchasing loaner equipment for landowners in the pilot project area to repair lands damaged by feral swine; and (3) conducting educational programs and fostering relationships with landowners. FSCP funding was used to assist trappers needing UTVs, trailers, etc. The funds also were used by county Soil and Water Conservation Districts (SWCD) to purchase no-till drills, offset discs, harrow carts, cultipackers, and a soil pulverizer, which were loaned to landowners to fix damage caused by feral swine.

Four University of Missouri Extension System specialists received funding to provide educational support throughout twenty-seven southern and southeastern Missouri counties. The outreach educators were tremendously beneficial in establishing relationships at county levels with groups such as farm bureaus, cattlemen's associations, SWCDs, county commissions, and many others. The educators built relationships with landowners in areas where feral swine were endemic. They established landowner co-ops and assisted in signing up additional landowners as cooperators. In Carter County alone, the educator signed up participants, equating to an additional 30,000 acres of private land, making the aerial operations much more efficient.

Research and Project Results

1. Since 2016, there has been a 80 percent reduction in watershed occupancy of feral swine throughout their range in Missouri. Feral swine have been completely eliminated from one of six elimination areas (the western portion of the Lakes Region FSCP project areas). This area encompasses 1.4 million acres in portions of eleven counties in southwest Missouri. Moreover, the total number of feral swine removed by MFHEP staff has declined sharply since 2020, indicative of reduced populations within the project areas.

Missouri Project Summary (continued)

2. Developing an ArcGIS Field Maps data collection and management system increased the efficiency, coordination, and data integrity among partnership trappers from different agencies. Law enforcement officers also were able to access the data to aid patrol and enforcement efforts.

3. Partnering with the USDA APHIS National Wildlife Research Center, MFHEP used genetic-based research to identify fifteen distinct feral swine populations in Missouri resulting from inter- and intrastate movement.

4. The use of unmanned aircraft systems (UAS) greatly improved the efficiency and effectiveness of aerial removal operations, particularly in removing the last remaining feral swine in one of the project watersheds.

5. Social network analysis of MFHEP provided a quantitative assessment of participants involved in feral swine elimination efforts in Missouri. The study revealed that individuals from federal and state governments (the largest number of participants), voluntary sector entities, and universities were all involved in the network.

6. Feral swine were eliminated from 84.9 percent of APHIS Wildlife Services feral swine management agreements by 2023 (figure 1), with significant decreases in reported damage (figure 2).

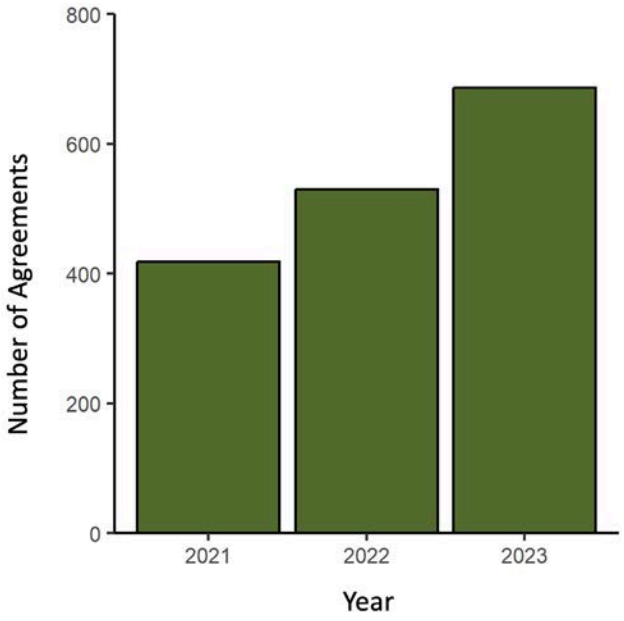

Figure 1. Number of APHIS Wildlife Services agreements with landowners in Missouri increased from 418 in 2021 to 616 in 2023 with feral swine eliminated on 523 agreements as of 2023.

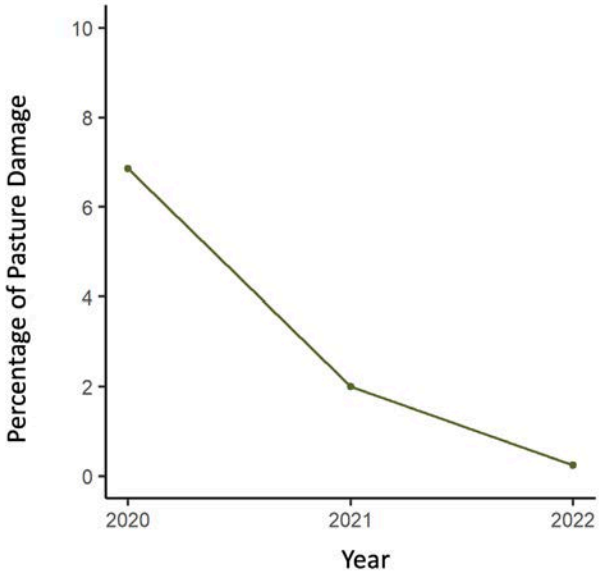

Figure 2. Pasture damage from feral swine declined from nearly 7 percent to below 1 percent between 2020 and 2022 in Missouri.

Lessons Learned

1. Development of the incident command structure (ICS) substantially improved efficiency, effectiveness, and accountability. The structure brought all partners and players together to work toward a common goal while eliminating duplication of effort.

2. Orders to close feral swine hunting on all public lands were critical to success. Hunting closures were essential to curtailing the culture of recreational hunting of feral swine and intentional releases.

3. Passage of HB 369 was critical to curtailing the spread of feral swine. The law redefined feral swine and made transporting, releasing, or possessing them illegal. It also imposed more substantial penalties for violations.

4. A dedicated helicopter for conducting removal operations during the winter and additional UAS support proved critical in effectively targeting feral swine at low densities.

5. Funding of four University of Missouri Extension specialists was a key to facilitating the continued success of feral swine elimination. The educators reestablished relationships with members of SWCDs, county commissions, county farm bureaus, and cattlemen's association chapters and engaged landowners not previously a part of MFHEP elimination efforts.

Missouri Project Summary (continued)

6. Development and refinement of systematic baiting protocols were critical to operational success. Systematic baiting helped detect feral swine in areas with lower population densities.

7. Purchasing and staging equipment at County Soil and Water Conservation District offices has helped build relationships with landowners and assisted the MFHEP in gaining access to previously inaccessible properties. Equipment availability for landowner use demonstrated MFHEP's commitment to restoring lands damaged by feral swine.

Other Contributing Agencies

USDA APHIS Veterinary Services
USDA Forest Service, Mark Twain National Forest
US Department of Interior Fish and Wildlife Service, Mingo National Wildlife Refuge
Missouri DNR State Parks
Missouri Department of Agriculture
Missouri Department of Health and Senior Services
US Dept of Defense Army Corps of Engineers (Little Rock, St. Louis, and Kansas City districts)
US Department of Interior National Park Service, Ozark National Scenic Riverways
US Army, Fort Leonard Wood
Missouri Farm Bureau
L-A-D Foundation, Pioneer Forest
Quail and Upland Wildlife Federation
Conservation Federation of Missouri

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[1]Anderson, A., C. Slootmaker, E. Harper, J. Holderieath, and S.A. Shwiff. 2016. Economic estimates of feral swine damage and control in 11 US states." Crop Protection 89:89–94.

USDA Feral Swine Eradication & Control Pilot Program (FSCP)

North Carolina Project Summary

Quick Facts

NRCS grant partner: North Carolina Department of Agriculture
Location: Sampson, Davie, Haywood, Montgomery, Randolph, and Anson Counties
Congressional district: 2
Total NRCS investment: $1.8 million
Total APHIS allocation:: $0.9 million
Participating landowners: 3,420
Acres impacted: 686,395
Outreach programs conducted: 372
Estimated outreach program reach: 106,752

Narrative

In the last three decades, an increase in feral swine presence has been documented in North Carolina. With this, concerns about crop damage and transmission of diseases from feral swine to livestock have subsequently increased.

In a recent regional study, more than 30 percent of producers surveyed in North Carolina reported the presence of feral swine in the counties where they farmed; just more than 10 percent of these farmers reported that feral swine impacted their farming operations[1]. Feral swine are reported to cause $5.9 million annually in damage to crops in North Carolina alone, with the largest losses occurring in the production of sweet potatoes[1]. Feral swine are also known to carry more than 34 diseases that may pose significant risks to livestock and humans[2],[3]. These diseases can cause losses to producers by either costly veterinary bills or loss of livestock[4].

The domestic pig industry brings in $7.1 billion annually to the state and represents 44,000 jobs. Building the state capacity to reduce the impact of diseases important to the domestic pig industry had not been effectively mapped out until this pilot program was initiated.

The goal of this project was to provide training to crop, livestock, and poultry producers to substantially reduce or eliminate damage caused by feral swine within select high-priority work zones. Disease sampling was also conducted on feral swine removed during this study to understand better the role of feral swine in maintenance and transmission of diseases of concern to livestock producers in this portion of the state.

The North Carolina Department of Agriculture and Consumer Services (NCDACS) took the lead role in implementing the FSCP. Significant help was provided by partner agencies, including the North Carolina Department of Public Health, North Carolina State University Extension, North Carolina Wildlife Resources Commission, APHIS Wildlife Services, and APHIS Veterinary Services. APHIS Wildlife Services hired three full-time technicians to work alongside existing swine biologists to proactively locate feral swine populations in the project area and remove these populations when land access was granted. Highest priority was assigned to feral swine populations near commercial swine operations.

During the first year of the FSCP, habitat models were used to identify several high-priority work zones where removal activities would be focused. These zones included four watersheds spanning a six-county area (Sampson, Davie, Haywood, Montgomery, Randolph and Anson). Once identified, outreach programs were conducted to inform and engage crop, livestock, and poultry producers within the work zone about the FSCP and to solicit their involvement. During this period, equipment purchases were made to conduct feral swine removal operations during the second and third years of the FSCP.

Once participating producers were identified, NCDACS staff conducted site visits with producers to determine the extent and nature of feral swine damage and to coordinate subsequent removal operations. Removal operations were then conducted by NCDACS staff (in five of six counties) and APHIS Wildlife Services (one county) on properties of producers participating in the FSCP. Partner agencies were instrumental in assisting NCDACS and Wildlife Services in developing contacts with local producers and accessing their properties to conduct removal operations.

Trapped feral swine were tested to determine what, if any, transmissible diseases were present. After trapping, work zones were reassessed for the reporting of feral swine damage. Estimates of damage reduction were calculated using in-field assessments to quantify damage and the current value of crops.

Testimonials

"Last year, I lost five acres in one field, and my neighbor lost probably 10 acres in one field. I called the USDA and they've been nothing but help to me; they caught 33 on the first night."
Town hall participant, Sampson County

"You all done a number on them; there is no longer any hog sign over here."
Prestage Farm operator, Sampson County

Research and Project Results

1. Damage reduction was estimated at approximately $1.8 million in 2022 on NCDACS removal sites, with an additional $1.6 million on sites serviced by USDA Wildlife Services. These figures were determined based on reduced acreage damage to areas where feral swine removal was conducted (approximately 90 to 95 percent population reduction) and the current value of those crops.

2. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from twenty-three in 2020 to sixty-one in 2023 (figure 1), while crop damage declined from 9 percent to 0 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

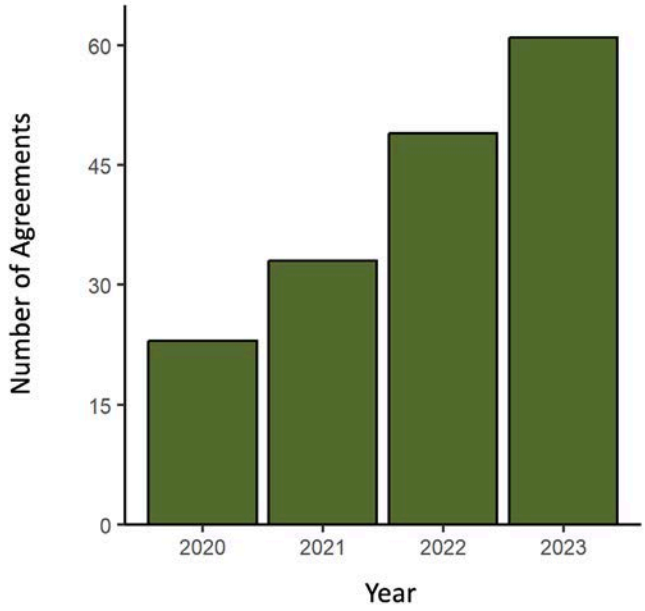

Figure 1. Number of APHIS Wildlife Services agreements with North Carolina landowners increased from twenty-three in 2020 to sixty-one in 2023 with feral swine eliminated on thirty-three agreements as of 2023.

3. This FSCP project served as the catalyst for developing a coordinated response program among several federal, state, and local agencies to prepare for potential transboundary animal disease incursions by feral swine.

4. Enzootic pneumonia (*Mycoplasma hyopneumonia*) is an important cause of significant financial losses in the US commercial swine industry. Of 153 bronchial swabs from feral swine tested, 51 percent were positive for enzootic pneumonia, demonstrating feral swine as a reservoir for this pathogen.

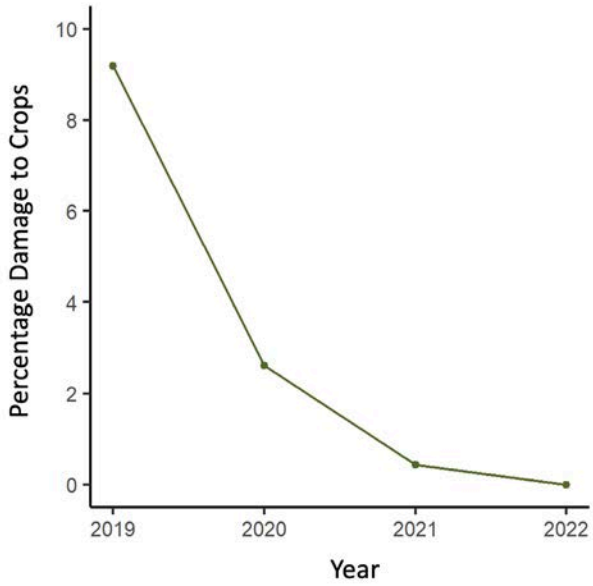

Figure 2. In North Carolina, damage to crops from feral swine was reduced from 9 percent to 0 percent between 2019 and 2022.

Lessons Learned

1. Trap loan programs were challenging for many reasons. Many people in need of feral swine removal lack the time, expertise, and patience required to effectively trap and eliminate the entire sounder, especially those landowners engaged in other agricultural activities. Removal activities were most effective when using partnerships with other agencies (e.g., Soil and Water Conservation Districts, USDA Wildlife Services, Catawba College) that had extensive trapping experience, knowledge of local terrain, relationships with landowners, and available field personnel dedicated to trapping feral swine.

2. Areas where feral swine hunting was financially and culturally motivated were especially challenging to effectively trap as there was less incentive to remove feral swine. The program successfully convinced some former hog hunters that the propagation of feral swine populations is a detriment to other wildlife of interest to hunters, landowners, and the public.

3. By providing producers and landowners with the skills to properly and effectively remove feral swine, workshops and outreach programs taught by interagency teams can increase the number of feral swine populations removed from the landscape more efficiently than any single agency could do alone.

4. A significant challenge involved conflicts with other users of the property, mainly hunters. Most conflicts arose just before or during hunting season. However, continual communication with the landowner and other property users minimized conflict. Cooperators should be informed during initial consultations of potential issues that may arise and how to coordinate activities to minimize potential use conflicts on the property.

Other Contributing Agencies

Catawba College
North Carolina Association of Soil and Water Conservation Districts
North Carolina Department of Public Health
North Carolina State University Extension
North Carolina Wildlife Resources Commission
USDA APHIS Veterinary Services

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[1]McKee, S., A. Anderson, K. Carlisle, and S. A. Shwiff. 2020. Economic estimates of invasive wild pig damage to crops in 12 US states. Crop Protection 132.

[2]Corn, J. L., and M. J. Yabsley. 2020. Diseases and parasites that impact wild pigs and species they contact. Pages 83–126 in K. C. Vercauteren, J. C. Beasley, S. S. Ditchkoff, J. J. Mayer, G. J. Roloff, and B. K. Strickland, editors. Invasive wild pigs in North America: ecology, impacts, and management. CRC Press, Boca Raton.

[3]Miller, R. S., S. J. Sweeney, C. Slootmaker, D. A. Grear, P. A. Di Salvo, D. Kiser, and S. A. Shwiff. 2017. Cross-species transmission potential between wild pigs, livestock, poultry, wildlife, and humans: implications for disease risk management in North America. Scientific Reports 7:1–14.

[4]Anderson, A., C. Slootmaker, E. Harper, R. S. Miller, and S. A. Shwiff. 2019. Predation and disease-related economic impacts of wild pigs on livestock producers in 13 states. Crop Protection 121:121–126.

USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Oklahoma Project Summary

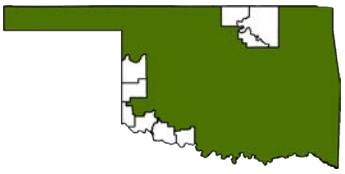
Quick Facts

NRCS grant partner: Conservation Commission of Oklahoma
Location: Tillman, Cotton, Jackson, Harmon, Kay, Beckham, Roger Mills, Osage, and Pawnee Counties
Congressional districts: 3, 4
Total NRCS investment: $2.1 million
Total APHIS allocation: $2.7 million
Participating landowners: 415
Acres impacted: 3,203,743
Outreach programs conducted: 12 in-person and numerous online
Estimated outreach program reach: 3,500

Narrative

Feral swine have been an increasing nuisance throughout Oklahoma in the past several decades, with all 77 counties reporting established feral swine populations[1]. The pervasiveness of these animals throughout the agricultural community is astounding. In a 2022 study, 85 percent of landowner respondents indicated that feral swine were present within the county where they farmed, and 67 percent of producers reported feral swine present on their properties within the previous 3 years. Crop losses to feral swine in Oklahoma are reported to be more than $18 million annually[2], with additional noncrop damages through livestock predation, disease, veterinary services, and medical treatments at $4 million per year[3]. Feral swine are also strongly associated with waterways in this region of the United States and contribute to reduced water quality[1].

In conjunction with the Feral Swine Eradication and Control Pilot Program (FSCP), the Oklahoma Conservation Commission (OCC) worked in partnership with six conservation districts in southwestern Oklahoma and three conservation districts in northern Oklahoma to reduce damage caused by feral swine in the respective project areas. One goal of this FSCP was to create feral swine–free zones along the Red River in southwestern Oklahoma and along the Kansas border. The other goal was to develop a self-sustaining feral swine control program administered by the cooperating conservation districts for continued removal operations once the FSCP project ends. To accomplish these goals, the OCC hired a technician in each of the four project areas to serve as the local project coordinator (Kay County in north central, Red River County in southwest, Osage and Pawnee Counties in north central, and Upper Red River County in western parts of the state). These technicians played a major role in contacting landowners to complete damage assessments, schedule access for APHIS Wildlife Services removal operations, scout and prebait areas for trapping, and monitor trapping sites.



Working in partnership, the OCC and APHIS Wildlife Services purchased and deployed seventy-five feral swine traps, ten thermal optics, four thermal aerial drones, and fifty live feed camera systems during feral swine removal operations. Both agencies developed clearly defined roles for the technician from each agency. OCC technicians worked side by side with APHIS Wildlife Services personnel to deploy feral swine traps throughout the project areas where participating landowners granted access. These technicians also worked with the local conservation districts in each project area to provide program outreach accessible to all county residents needing feral swine control and to educate agricultural producers about programs available to assist with damage repair. APHIS Wildlife Services conducted all feral swine removal operations with four technicians dedicated to the FSCP project. Through these joint efforts, feral swine information and education increased throughout the state, the number of cooperating landowners increased substantially, and feral swine populations were reduced within the project areas.

The OCC was keenly interested in monitoring the impacts of feral swine control on improvements in water quality. Using historical and current water quality data collected

Testimonials

"I have had hog trapping efforts on my property for 2 years now because of hog damage on my pastureland, cultivated land, and noncultivated land. I can't begin to assign a value to the services provided to me, between the man hours and equipment needed, to get rid of hogs on my property; it is invaluable."
- Jason Orgain, Roger Miller County

"The feral swine control program (FSCP) has been a real plus for me. The FSCP employee and his APHIS partner have reduced the damage we have experienced as well as the associated time-consuming trapping/disposal burden on me. The program has been a huge help to us in managing our operation."
- Dan Sebert, Pawnee County

through the OCC Rotating Basin Monitoring Program, the agency established a water quality baseline for small streams in the project areas to compare with post-implementation water quality data. This information was also used to prioritize additional efforts needed in areas with the strongest overlap between feral swine–related water quality problems and agricultural damage by feral swine. These areas were the focus of more intensive water quality monitoring that involved more frequent turbidity and bacteria testing. Post-implementation data is currently being collected for comparison to previous conditions to evaluate improvements in water quality as a result of feral swine control.

Research and Project Results

1. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from eighty-seven in 2020 to 338 in 2023 (figure 1). In the Kay County project area, crop damage declined from 14 percent to 0 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

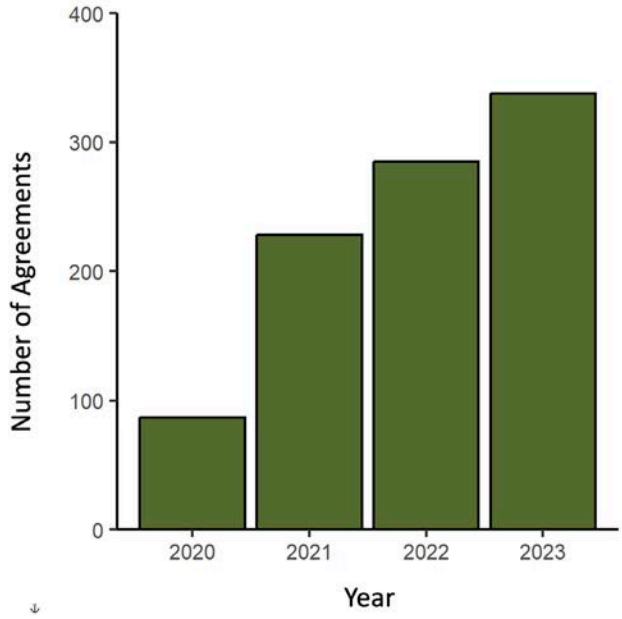


Figure 1. Number of APHIS Wildlife Services agreements with Oklahoma landowners increased from eighty-seven in 2020 to 338 in 2023 with feral swine eliminated on two agreements as of 2023.

2. The Kay County project area is close to being declared a "feral swine free zone" in areas where landowners have allowed access for removal operations. The project's goal to reduce feral swine damage by 80 percent was reached.

3. During the course of this FSCP project, an estimated $33,017,400 in damage was prevented across 3,203,743 acres.

4. In some portions of the project areas, complete eradication of feral swine was achieved across a contiguous landscape consisting of multiple adjacent farms.

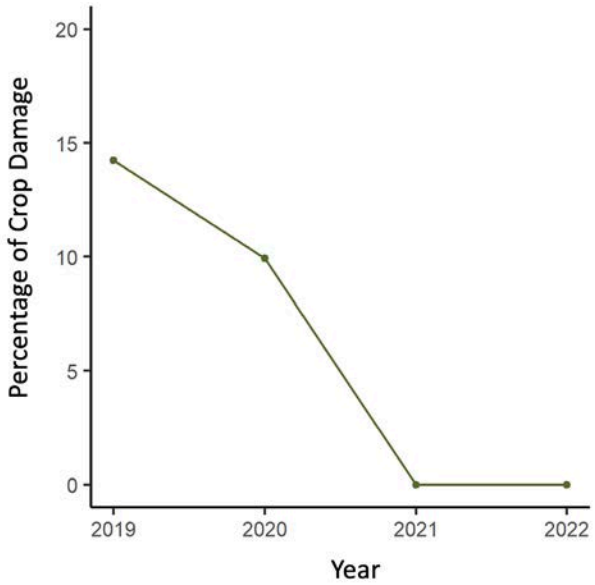


Figure 2. In the Kay County project, crop damage by feral swine was reduced from 14 percent to 0 percent between 2019 and 2022.

Lessons Learned

1. Outreach was key to the success of the FSCP project. Gaining the participation of multiple adjacent landowners allowed for a greater chance of not only reducing but also eradicating local feral swine populations. Given the challenges experienced due to the pandemic, agencies should consider additional ways to reach and engage landowners. Education of the broader public on the threats caused by feral swine was a key component to the success of the program.

2. A significant obstacle to success was the continued movement of feral swine within the state. Lease hunting, guided hunting, and high fence hunting facilities for feral swine are financial incentives for landowners and as a result create limited access to properties that would otherwise participate in the programs.

3. An initial goal was to develop self-sustaining feral swine control programs administered by the cooperating conservation districts. However, this proved not to be possible. The cost of maintaining electronic traps, bait, and staff to scout-bait-monitor was difficult. APHIS Wildlife Services had the trained staff to properly implement feral swine control programs. Providing the necessary resources to the federal agency that already had the proper mission to complete the work makes the most sense.

Other Contributing Agencies

Tillman, Cotton, Jackson, Harmon, Kay, North Fork of Red River, Upper Washita, Osage and Pawnee County Conservation Districts
Noble Research Institute
Oklahoma Department of Wildlife Conservation
Oklahoma Association of Conservation Districts
Oklahoma Tribal Conservation Advisory Council
Oklahoma Farm Bureau
Oklahoma Farmers and Ranchers Association
Oklahoma Cattlemen's Association
Farm Credit of Western Oklahoma

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USDA Feral Swine Eradication & Control Pilot Program (FSCP)

South Carolina Project Summary

Quick Facts

NRCS grant partner: University of Georgia Savannah River Ecology Laboratory and Warnell School of Forestry and Natural Resources; South Carolina Department of Natural Resources; Newberry Soil and Water Conservation District
Location: Newberry, Hampton, and Jasper Counties
Congressional districts: 5, 6
Total NRCS investment: $1.4 million
Total APHIS allocation: $2.8 million
Participating landowners: 93
Acres impacted: 129,799
Outreach programs conducted: 4
Estimated outreach program reach: 2,600

Narrative

Feral swine are found in all forty-six counties in South Carolina and cause significant damage to agricultural and environmental lands throughout the state. Environmentally, feral swine presence in South Carolina is associated with increased soil erosion, decreased water quality, destruction of native, rare, and endangered plant communities, and depredation of threatened species such as the loggerhead sea turtle[1]. South Carolina is also home to many cattle and domestic hog operations, with more than 330 in Hampton and Newberry Counties alone. The feral swine population poses a risk of disease transmission to these domestic animals[2], [3], [4]. Economically, feral swine trample and consume crops, root pasture and suburban lands, and damage infrastructures, such as fences and roads, costing the state an estimated $115 million in damages annually[5],[1],[6].

South Carolina has hundreds of thousands of acres of agricultural land susceptible to damage from feral swine. The problem is increasing as the feral swine population continues to grow. The state has seen an increase in hunter-harvested feral swine since 2004, with a 33 percent annual increase in 2017 alone[3]. Despite the expanding impacts and costs associated with the management of feral swine, the extent to which feral swine management reduces populations and diminishes environmental and agricultural damages is rarely quantified.

The Feral Swine Eradication and Control Pilot Program (FSCP) in South Carolina and its associated funding with the USDA Natural Resources Conservation Service were awarded to the University of Georgia, the South Carolina Department of Natural Resources (DNR), and the Newberry Soil and Water Conservation District to support three distinct projects in the state. Across each of these

three projects, the University of Georgia's Savannah River Ecology Laboratory and Warnell School of Forestry and Natural Resources were contracted to conduct research regarding changes in feral swine populations and damage as removal efforts were conducted.

The research objective was to quantify changes in feral swine population size and associated damages to agricultural and environmental resources in conjunction with feral swine removal efforts conducted under the FSCP. These efforts involved extensive removal of feral swine by APHIS Wildlife Services. Predictions indicated that professional control efforts would substantially decrease local feral swine populations, resulting in a corresponding decrease in both agricultural and environmental damage. In addition, the data gained would fill critical gaps in our knowledge of the efficacy of feral swine control programs. This information is needed to inform and adapt management plans to reduce the impacts and spread of this highly invasive species. To accomplish this objective, the University of Georgia's

Testimonials

"[Wild pigs] have become so much of a problem that we have to rethink what we're planting, when we're planting it, and what fields we choose to plant in. If it's not your problem today, it will be your problem tomorrow. I appreciate what the researchers do, what the NRCS does, and what the USDA has done because I think it's another step in the process to fix the problem; it's a step in the right direction."
-Austin Jackson,
Producer,
Aiken County

"Feral swine are a threat to our economy, health, and ecosystem in Jasper County. The obstacles are endless on how to control these animals. We support the pilot program and will assist in any way possible to see this program succeed."
-Thomas Stanley,
Farm Bureau,
Jasper County

South Carolina Project Summary (continued)

Savannah River Ecology Laboratory and Warnell School of Forestry and Natural Resources, South Carolina Department of Natural Resources, and the Newberry Soil and Water Conservation District collaborated to lead monitoring efforts under the FSCP in South Carolina in cooperation with APHIS Wildlife Services, which led feral swine removal efforts. South Carolina DNR and Newberry Soil and Water led outreach efforts, while the University of Georgia led monitoring efforts to quantify the impacts of control efforts under the FSCP in South Carolina. Within this framework, these organizations worked with personnel of the Hampton and Jasper Soil and Water Conservation Districts to implement outreach and monitoring efforts within local communities throughout the counties selected for this pilot program.

Beginning in 2020, feral swine population, crop, and rooting surveys were initiated in conjunction with feral swine removal efforts conducted across a subset (n=19) of privately owned agricultural properties enrolled in the program throughout Newberry, Hampton, and Jasper Counties, South Carolina. Monitoring efforts were conducted through a combination of remote camera surveys, rooting damage field surveys, and landowner damage questionnaire surveys. All surveys were implemented immediately before initiation of control efforts and repeated every 6 months (camera surveys) or annually (crop and environmental damage surveys) from January 2020 through July 2022.

The camera surveys generated an index of feral swine population size for each property at approximately 6-month intervals. Agricultural damage assessments were conducted for eighteen properties involved in this study using in-person and telephone surveys. Landowners signed up through the removal program were contacted before control efforts to gather precontrol crop damage data and again roughly 1 and 2 years later to reassess crop damage after control efforts were implemented. Landowner responses from these surveys were used to estimate landowner-reported changes in crop damage caused by feral swine following the implementation of the program. Systematic rooting damage surveys were conducted annually on eighteen of the nineteen properties to quantify changes in environmental rooting damage attributed to feral swine.

Results thus far reveal that within 12 to 24 months of implementing trapping by APHIS Wildlife Services, control efforts successfully reduced the abundance of feral swine on private agricultural lands enrolled in the project. These population reductions were found to directly influence the extent of damage caused by feral swine, as environmental rooting damage decreased by 99 percent within 2 years of implementation of population control measures.

Collective results demonstrate that investment in feral swine management was worthwhile in many ways. Extensive trapping programs by trained professionals, such as through the FSCP, can remove large portions of feral swine populations from the landscape, reduce agricultural and environmental damage and economic impacts to private landowners, and be used along with monitoring programs to help landowners form adaptive approaches to maximize the efficacy of management investments.

Research and Project Results

1. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from forty-three in 2020 to 100 in 2023 (figure 1) while crop damage declined from 4 percent to less than 1 percent (figure 2).

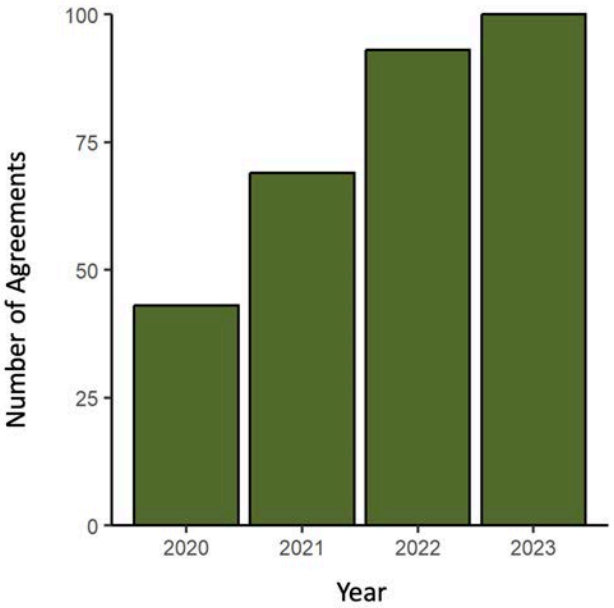

Figure 1. Number of APHIS Wildlife Services agreements in South Carolina increased from forty-three in 2020 to 100 in 2023 with feral swine eliminated on two agreements as of 2023.

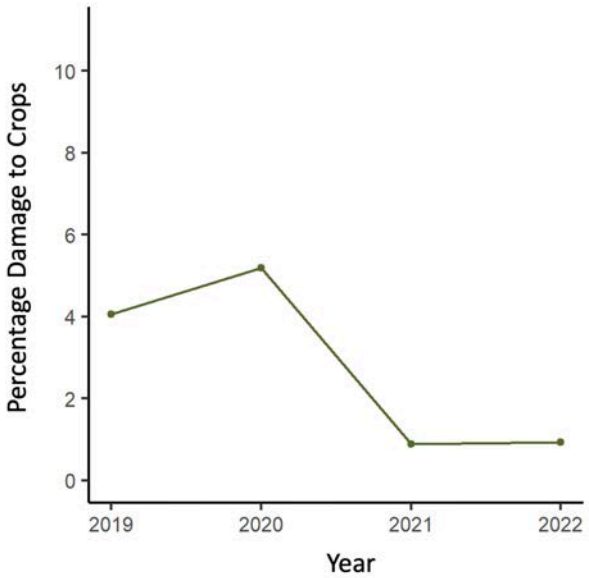

Figure 2. In South Carolina, damage to crops from feral swine declined from 4 percent to below 1 percent between 2019 and 2022.

South Carolina Project Summary (continued)

2. Monitoring of feral swine abundance at regular intervals started before implementation of control by APHIS Wildlife Services. Results following implementation efforts demonstrated an approximate 70 percent reduction in feral swine population sizes on enrolled properties. This provided clear evidence of the efficacy of removal efforts and a critical baseline for estimating changes in crop and environmental damage moving forward.

3. Since the implementation of population control efforts by APHIS Wildlife Services, the project has demonstrated a substantial reduction in environmental damage from feral swine. Within 2 years of project initiation, rooting damage by feral swine has been reduced by 99 percent among enrolled properties.

4. Results following the implementation of population control efforts by APHIS Wildlife Services demonstrated an approximate 40 percent decrease in landowner estimates of agricultural damage. We anticipate these losses to be reduced even further through additional monitoring of crop damage on enrolled properties through the completion of the project.

Lessons Learned

1. Monitoring efforts can be most effective before removal operations are initiated. However, there was a mismatch in the timing of the arrival of funding for monitoring efforts and arrival of funding for removal operations, with funds for removal efforts arriving first. This made it challenging to conduct monitoring programs before trapping was initiated. However, solutions were identified to implement monitoring before trapping on numerous properties. If possible, funding for monitoring efforts should be provided before funding to initiate trapping to ensure that high-quality baseline data can be collected.

2. With so many properties enrolled, coordinating survey efforts between project partners as well as between partners and individual property owners was challenging. Surveys needed to be optimized for individual properties based on the timing of crop planting, individual management goals, controlled burns, etc. This challenge was addressed, to some extent, by creating a single point of contact for landowners and then establishing regular communication among relevant project partners.

3. We experienced some challenges in accessing properties during white-tailed deer and wild turkey hunting seasons as well as challenges with multiuse properties (e.g., farming vs. leased for hunting). These challenges included restricted access during all or a portion of hunting seasons or limited time allowed on properties to avoid morning and evening hunts. We were able to effectively work on all properties, but gaining access required a case-by-case approach.

4. Both APHIS and nonfederal partners were already conducting landowner surveys for their own respective needs at the onset of the project. This created confusion among some landowners, so these were condensed into a single survey, and relevant information was shared among partners to reduce the possibility of survey fatigue among participants.

Other Contributing Agencies

Newberry County Tax Assessor's Office
Jasper County Tax Assessor's Office
Hampton County Tax Assessor's Office
USDA Farm Service Agency
USDA Forest Service

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USDA Feral Swine Eradication & Control Pilot Program (FSCP)

Texas Project Summary

Quick Facts

NRCS grant partner: Texas State Soil and Water Conservation Board
Location: Upper Leon River (Eastland, Erath, and Comanche Counties), Canadian River project (Hartley, Oldham, and Potter Counties), and Red River (Hardeman, Wilbarger, Wichita, and Clay Counties). Additional priority counties: Milam, Williamson, Dallam, Bee, San Patricio, and Nueces.
Congressional districts: 11, 13, 15, 17, 25, 27, 31, 34
Total NRCS investment: $4.4 million
Total APHIS allocation: $2.7 million
Participating landowners: 703
Acres impacted: 2,300,860
Outreach programs conducted: 15
Estimated outreach program reach: 15,305

Testimonials

"In my opinion [trap loan equipment] is the most effective trapping method I've seen. With the traps and the use of the helicopters, over time I think we could see hog numbers decrease drastically."
- Nahum Patschke, Williamson County

"This program is incredibly helpful and successful! My feral pig population has decreased tremendously."
- Jim Smith, Milam County

Narrative

Feral swine remain one of the greatest damage management challenges to wildlife, agriculture, and watershed health in the United States. These animals have established themselves across Texas and pose a variety of challenges including riparian and sedimentation damage, agricultural loss, predation, transmittal of disease and parasites, and environmental damage to both urban and rural environments. Recent studies estimate that the population of feral swine has increased in the United States from 2.4 million to 6.9 million, with 2.6 million feral swine in Texas alone[1]. These numbers make feral swine one of the most abundant large-animal invasive species in the nation.

New research suggests that the once accepted value of $1.5 billion-plus of yearly crop damage and control costs across the United States may be much higher[2]. In 2020, the Texas A&M Department of Agricultural Economics reported that the total agricultural damage in Texas exceeded $100 million a year, with studies pointing as high as $230 million. These costs do not take into consideration damage to natural resources.

As feral swine populations grow, so does the level of economic, biologic, and natural resource damage. This non-native invasive species continues to be a threat to Texas waterways and ecosystems. Feral swine activities have a detrimental effect on watersheds and water quality by causing increased sediment loads, algae blooms, oxygen depletion, bank erosion, and contamination by parasites and bacteria. Destruction of habitat for native wildlife and the predation of wildlife are also a concern for the overall health of watersheds and the ecosystems within.

The Texas State Soil and Water Conservation Board (TSSWCB) partnered with fifteen local soil and water conservation districts to establish a smart trap loan program for farmers, ranchers, and landowners in these priority counties. The participating State Soil and Water Conservation Districts (SWCDs) purchased three to eight corral-style traps, including motion-detection cameras and remote activation. TSSWCB also partnered with the Texas Wildlife Damage Management Association (TWDMA) to support nine wildlife damage management specialists hired through the Texas A&M AgriLife Extension Service Cooperative Wildlife Services Program. These technicians coordinated the SWCD trap loan program, which included receiving requests from landowners for trap loans, assisting landowners in trap placement and construction, monitoring traps used by the trap loan program, delivering and retrieving traps, providing cameras, and collecting data on trap uses in the program.

APHIS Wildlife Services provided feral swine removal to cooperating landowners, who could select preferred methods for APHIS to use, including ground and aerial shooting, corral-style trapping, and snaring. Most cooperating landowners selected all methods, though some restrictions were necessary (e.g., no aerial hunting during deer season) to meet the landowner's specific objectives. Direct control was applied as available, with APHIS helicopter gunning rotating between project areas and ground methods applied when feral swine populations were present. Feral swine removal operations were timed specifically before planting and as crops matured to maximize the benefits of removal. Trap loan participants were able to request a trap either directly

from an APHIS Wildlife Services technician or through the county Soil and Water Conservation Board. Traps were delivered and assistance was provided in selecting the location and erecting the trap. The technician also had access to the trap cell program to monitor the trap usage to effectively move traps when they were not being used. Trap loan participants were also provided up to 100 pounds of corn at no cost for each trap loan event.

TSSWCB partnered with the Texas A&M Natural Resources Institute (NRI) for the education portion of this project. NRI conducted more than a dozen feral swine outreach programs, reaching more than 300 landowners. They also used social media, marketing, and online learning to boost the program's message to more than 15,000 people in target counties.

Research and Project Results

1. To date, 75 traps have been loaned to more than 150 landowners, resulting in the removal of a substantial number of feral swine by landowners.

2. Social media marketing was a very cost-effective way to market upcoming educational programs about the pilot program. For example, for just more than $189, 11,000 people in four counties were targeted.

3. Landowner agreements with APHIS Wildlife Services feral swine removal assistance increased from 293 in 2020 to 580 in 2023 (figure 1). Crop damage declined from 15 percent to 4 percent for landowners engaging APHIS Wildlife Services feral swine removal (figure 2).

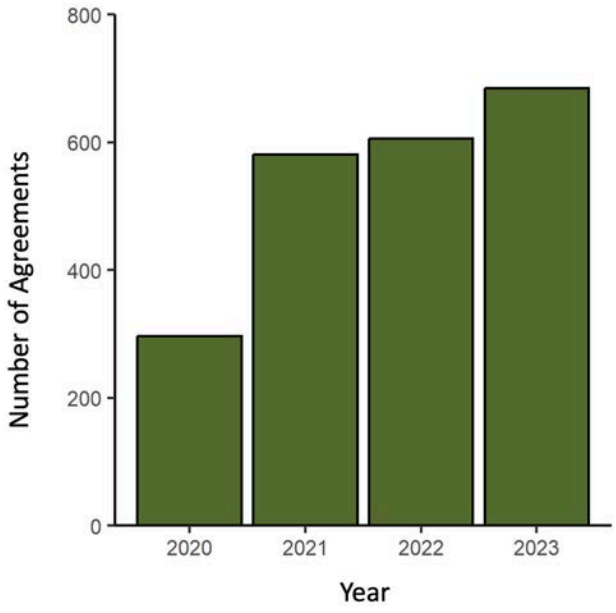

Figure 1. Number of APHIS Wildlife Services agreements with Texas landowners increased from 293 in 2020 to 580 in 2023 with feral swine eliminated on 11 agreements as of 2023.

4. Feral swine damage can be controlled using a landscape level approach. To date, the collaborative approach significantly reduced feral swine in the Canadian River pilot project area, reduced crop and pasture damage in the Upper Leon River and Red River pilot areas, and reduced crop damage in the Coastal Bend and Williamson/Milam County areas. The partnership announced that feral swine no longer inhabit Dallam County.

5. The Pilot Projects averted in excess of $10.1 million in feral swine damage. This figure does not accurately estimate damage averted to nonrespondents of the surveys.

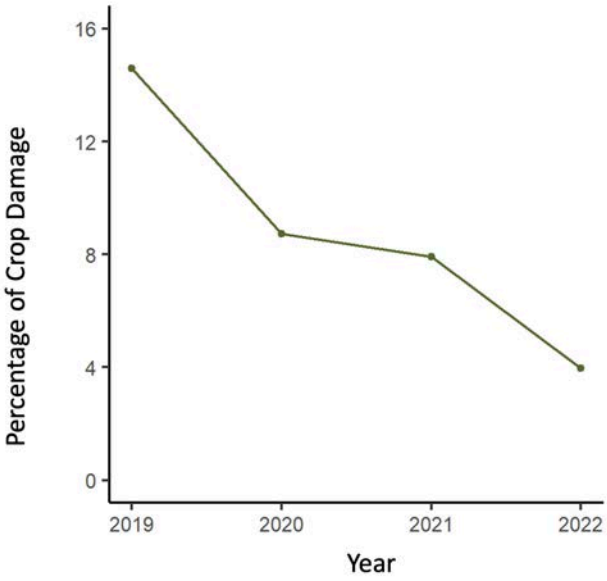

Figure 2. Crop damage by feral swine was reduced from 15 percent to 4 percent between 2019 and 2022 in Texas.

Lessons Learned

1. Effective marketing and outreach are crucial to the success of a new program. Social media marketing is a very valuable tool in bringing more awareness to programs.

2. Building relationships with key partners early in the process helps with continuity and helps ensure the success of programs like this.

3. Landowners with extensive feral swine damage participated in both direct management and trap loan services. This required program administration to evaluate which services were best positioned to resolve the conflict and to coordinate among trap loan participants and direct management. Oversight of the trap loan program had to be conducted in close coordination with direct management.

Texas Project Summary (continued)

4. The overall percentage of land worked within each project area was not indicative of the scope of the feral swine problem. Cooperative agreement landowners had greater damage then noncooperating landowners, indicating that the APHIS Wildlife Services program addressed a larger proportion of the problem than percentages would indicate. Further, landowners in close proximity to brush had greater interest in control while those in the center of cultivation had no crop damage and no need for control. In these cases, removing pigs on 10 percent of the landscape, for example, addressed 90 percent of the crop damage.

Other Contributing Agencies

Texas Farm Bureau
Texas Corn Producers
Texas Wildlife Damage Management Association (TWDMA)
Texas A&M Natural Resources Institute (NRI)
Canadian River Soil and Water Conservation District (SWCD)
Cross Timbers SWCD
Hartley SWCD
Little Wichita River SWCD
Lower Pease River SWCD
Oldham SWCD
Upper Leon SWCD
Wichita SWCD
Wilbarger SWCD
Central Texas SWCD
Little River-San Gabriel SWCD
Taylor SWCD
Bee SWCD
Nueces SWCD
San Patricio SWCD

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Selected Research Highlights

Alabama

- Greater concentrations of *E. coli*, nitrate, magnesium, and potassium were found in streams with fecal contamination by wild pigs; however, the effects of wild pigs on water quality were scale-dependent and differed significantly across regions[1].
- Physiographic stream type may influence the degree of exposure to waterborne pathogens such as *E. coli* and fecal coliform and subsequent risk of waterborne disease[2].
- Unoccupied aircraft systems (UAS) coupled with deep learning algorithms successfully (>90 percent accuracy) delineated areas of wild pig damage in corn and peanut crop fields[3].
- Traveling an average of 1.2 kilometers over a 30-day post-trapping period, wild pigs were found to stay relatively close to the trap site after a trapping event. This limited post-trapping movement and reduced the likelihood of rapid disease spread among untrapped individuals[4].

Florida

- Wild turkeys appeared to shift their activity patterns to fully active midday to avoid wild pigs. Likewise, deer activity patterns shifted after wild pig removals. Both deer and turkey avoided areas with wild pigs[5].
- Wild pig removal efforts were successful in reducing damage across study sites, as evidenced by significant reductions in wild pig signs and damage[5].
- Wild pigs preferred forested wetland and upland hardwood habitats, particularly in areas with longer intervals between prescribed fires[6].
- Wild pigs used areas farther from open water in the low forage season (January–April) and selected areas closer to open water in the high forage season (May–December), likely due to increasing temperatures in the summer[6].

Georgia

- In an agro-forested landscape, male wild pigs showed a preference for agricultural fields during the planting/harvesting season (May–October). They also showed a strong preference for forested wetlands throughout the year[7].
- Wild pigs and white-tailed deer had an inverse relationship in pecan orchards during summer, fall, and winter, yet a positive relationship in forested wetlands and mixed forests during fall and winter. Meanwhile, wild pigs and eastern wild turkeys had a negative association during summer within mixed forests[8].
- Aerial gunning resulted in a 46 percent decline in wild pig detections on camera traps. During the aerial gunning campaign, wild pig detections in closed canopy forests increased, suggesting avoidance behavior in response to removal efforts[9].
- Between 2021 and 2022, wild pig damage averaged $107,694 annually across 3,517 hectares of corn, cotton, and peanut fields[10].
- Monthly water quality samples indicated that agricultural areas with high wild pig density had elevated total suspended solids (TSS) and low concentrations of environmental DNA[11].

Mississippi

- Among 249 landowners surveyed in Mississippi, pig-related damages are estimated to exceed $5 million annually, with the majority of losses attributed to crop damage[12].
- Removal of wild pigs conducted a year before reported damage has a significant effect on reducing damage[12].
- Using data from trapping and aerial gunning, each wild pig removed is estimated to reduce localized damages by 40 to 60 percent the following year[12].
- Wild pig trapping programs that supply all the labor and technology in the Mississippi Delta region cost approximately $200 per pig[12].

South Carolina

- Population models revealed a 70 to 90 percent reduction in the wild pig population in properties enrolled in the program after 24 months of control[13].
- Within 2 years of project initiation and following population control efforts by USDA-APHIS-Wildlife Services, rooting damage by wild pigs was reduced by 99 percent, and a 40 percent reduction in landowner-perceived estimates of agricultural damage was achieved among properties enrolled in the program[13].
- All contemporary whole-sounder trap designs (corral, drop, passive net) are highly effective at capturing entire social groups of wild pigs, with little difference in performance between trap types[14].
- Wild pigs consume a highly diverse diet, including vertebrates, with amphibians identified as the most frequently consumed vertebrate group and thus potentially most vulnerable to impacts from wild pigs[15].
- Rooting damage by wild pigs occurs more frequently during early winter months, in hardwood stands, in areas close to water, and in areas with less ground vegetation and greater understory stem density, but less frequently in areas with dense stands of trees and near roads[16].
- Density estimates of wild pigs on private lands in South Carolina ranged from 0.60-30.97 wild pigs/km2 (median density was ~5.5 wild pigs/km2)[17].

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