

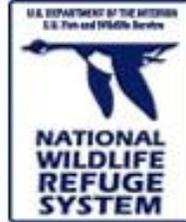
**DRAFT FERAL SWINE DAMAGE MANAGEMENT PLAN FOR
THEODORE ROOSEVELT
NATIONAL WILDLIFE REFUGE COMPLEX**

*Washington, Issaquena, Sharkey, Humphreys, Yazoo, Holmes, and Leflore Counties,
Mississippi*

Southeast Region



Draft Feral Swine Damage Management Plan
Theodore Roosevelt National Wildlife Refuge Complex



U.S. Department of the Interior
Fish and Wildlife Service
Southeast Region
January, 2015

Submitted by: _____ Date: _____
Mike Rich, Project Leader, Theodore Roosevelt NWR Complex

Concur: _____ Date: _____
Ricky Ingram, Area Supervisor, Southeast Region

Approved by: _____ Date: _____
David Viker, Regional Chief, Southeast Region

DRAFT FERAL SWINE DAMAGE MANAGEMENT PLAN

Chapter I. Introduction.....	1
Chapter II. Conformance with Statutory Authority	5
Chapter III. Statement of Purpose and Objective.....	7
Purpose.....	7
Objective, Discussion, and Strategies.....	7
Objective.....	7
Discussion	7
Strategies	8
Chapter IV. Assessment	10
Compatibility with Refuge Objectives.....	10
Biological Soundness	10
Economic Feasibility.....	10
Relationship with other Refuge Programs.....	11
Recreational Opportunity.....	11
Chapter V. Description of Management.....	12
Public Hunting.....	12
Trapping.....	12
Shooting.....	13
Aerial Gunning.....	14
Disease Surveillance, Education/Outreach, and Research.....	15
Chapter VI. Measures Taken to Avoid Conflicts with Other Management Objectives	17
Biological Conflicts	17
Public Use Conflicts.....	17
Administrative Conflicts	17
Chapter VII. Conduct of the Plan.....	18
Federal Register Publication.....	18
Refuge-specific Hunting Regulations when hunting is used as a tool	18
Public Involvement	18
Hunter Application and Registration Procedures	18
Literature Cited	19



LIST OF FIGURES

Figure 1. Distribution of feral swine in Mississippi in 1998 and 2009. (Mississippi Agricultural and Forestry Experiment Station n.d.).....	3
Figure 2. Theodore Roosevelt National Wildlife Refuge Complex Refuges and additional lands managed in the South Delta of Mississippi.....	4
Figure 3. Recent trends in feral swine harvested in Mississippi by deer hunters. (Mississippi Agricultural and Forestry Experiment Station n.d.)	9

CHAPTER I. INTRODUCTION

In 2006, the United States Fish & Wildlife Service (USFWS) completed the Theodore Roosevelt National Wildlife Refuge Complex (TRNWRC) Comprehensive Conservation Plan (CCP) to guide management actions and direction for five refuges. These refuges included Hillside, Mathews Brake, Morgan Brake, Panther Swamp, and Yazoo National Wildlife Refuges. In 2014, the USFWS drafted a CCP for Holt Collier and Theodore Roosevelt National Wildlife Refuges which are also in the TRNWRC. This Draft CCP will be available in 2015. The CCP process includes an extensive public scoping and public comment process in which feral swine were identified as one of the most problematic invasive species (U.S. Fish and Wildlife Service, 2006; U.S. Fish and Wildlife Service, 2015). Feral swine are also recognized on the Global Invasive Species Database (IUCN Invasive Species Specialist Group, 2010) as one of the top 100 of the world's worst invasive alien species. This management plan will outline the objectives and details necessary to begin feral swine damage management throughout the TRNWRC.

Feral swine (*Sus scrofa*) are referred to as wild pigs, wild boars, hogs, piney woods rooters, and other common names (Mayer & Brisbin, 2008). Feral swine were introduced to the eastern United States from Eurasia by early European settlers as a source of food. Populations occurring on the TRNWRC mainly consist of offspring of domestic or neglected domestic swine that have become feral or offspring of feral swine that have been captured for the purpose of starting wild, free-living populations for sport hunting. Feral swine are classified by the State of Mississippi as a "nuisance animal," and liberal regulations apply to their hunting and trapping (Mississippi Department of Wildlife, Fisheries, and Parks, 2014).

Rooting, wallowing, and feeding activities of feral swine cause serious erosion to levees, river banks and areas along streams throughout much of the TRNWRC. Feral swine damage soil and plant communities and compete with native wildlife for food and cover. Feral swine in Mississippi are also known to carry diseases such as pseudorabies (Pedersen et al., 2013), swine brucellosis (Pedersen et al., 2012), toxoplasmosis, and trichinella (Hill et al., 2014). They compete with native wildlife for food, particularly acorns, which are an important food for waterfowl, wild turkey, and deer and negatively impact farmed areas specifically managed for wintering waterfowl (U.S. Fish and Wildlife Service, 2006). Problems on surrounding lands are commonly blamed on TRNWRC refuges for "harboring" feral swine.

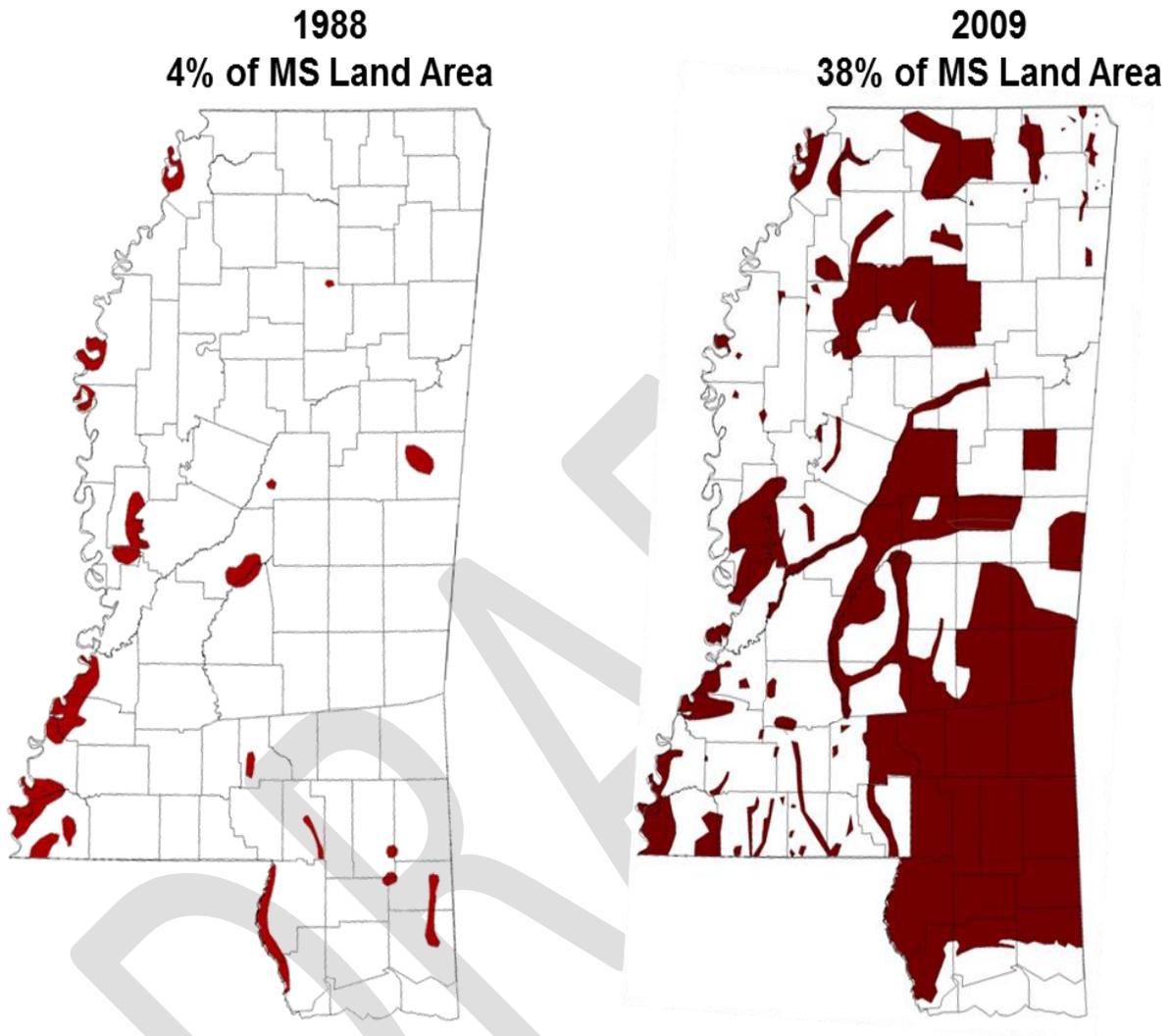
The United States has seen a recent and dramatic increase in the distribution and abundance of feral swine (Figure 1). All the counties represented by TRNWRC property (Figure 2) have reported the presence of feral swine.

Refuges in the TRNWRC were primarily established to provide and maintain habitat for wintering waterfowl and other migratory birds traveling throughout the Mississippi Flyway. Refuges in the TRNWRC provide important habitat for resting, feeding, and breeding needs for waterfowl, other birds, and resident wildlife. Although the TRNWRC has an overriding purpose of providing for the habitat needs of migratory birds, with an emphasis on waterfowl, each refuge within the Complex has a unique purpose and establishing legislation (U.S. Fish and Wildlife Service, 2006; U.S. Fish and Wildlife Service, 2015). Additionally, The North American Waterfowl Management Plan establishes certain habitat objectives for the region, and the TRNWRC refuges play a critical role in accomplishing the objectives. For example, objectives for the TRNWRC are to provide a minimum of 8,287 acres of managed water, including 4,505 acres of flooded moist-soil plants, 2,760 acres of flooded timber, and 1,022 acres of unharvested crops. Feral swine damage must be appropriately managed to ensure these objectives and others are reached.



The target area for this Feral Swine Damage Management Plan is the entire TRNWRC (see Figure 2). However, feral swine are not known to currently exist on Holt Collier, Yazoo, or Mathews Brake National Wildlife Refuges. Significant and expanding populations exist on Panther Swamp, Morgan Brake, Theodore Roosevelt, and Hillside National Wildlife Refuges. Feral swine populations will have to be monitored by limited refuge staff to document newly damaged areas or expanding populations. Proper feral swine damage management will necessitate documentation of these expanding populations; therefore, all employees should communicate with refuge managers regarding seeing or receiving reports of feral swine. Management actions should be implemented on a case-by-case basis and only when approved by a Refuge Manager.

Figure 1. Distribution of feral swine in Mississippi in 1998 and 2009. (Mississippi Agricultural and Forestry Experiment Station, n.d.)



CHAPTER II. CONFORMANCE WITH STATUTORY AUTHORITY

The TRNWRC maintains the policy of managing feral animals on refuges where it is compatible with the purposes for which the refuge was established and in close consultation with the Mississippi Department of Wildlife, Fisheries, and Parks. The following laws, regulations, and Executive Orders relate to the management of feral animals on Federal lands:

1. The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997, permits the uses of refuges provided that the proposed use is compatible with the primary purpose for which a refuge was established.
2. The Refuge Recreation Act of 1962, as amended, authorizes public hunting on refuges where the hunting program is compatible with the other major purposes for which the area was established.
3. The Fish and Wildlife Act of 1956, as amended, authorizes development, advancement, management, conservation, and protection of fish and wildlife resources.
4. Executive Order 12996, "Management and General Public Use of the National Wildlife Refuge System" recognizes compatible wildlife-dependent recreational activities involving hunting, among others, as priority general public uses of the National Wildlife Refuge System.
5. Title 50 CFR, Section 31.2 lists hunting as a method of surplus wildlife population control.
6. Title 50 CFR, Part 31, Section 14: (a) Animal species which are surplus or detrimental to the management program of a wildlife area may be taken in accordance with federal and state laws and regulations by federal or state personnel or by permit issued to private individuals. (b) Animal species which damage or destroy federal property within a wildlife refuge area may be taken or destroyed by federal personnel.
7. Title 50 CFR, Part 30, Section 11 (a) states that feral animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership that have reverted to the wild from a domestic state may be taken by authorized federal or state personnel or by private persons operating under permit in accordance with applicable provisions of federal or state law or regulation.
8. Executive Order 13112 (Federal Register/ Vol. 64 No. 25 / Monday, Feb. 8, 1999/Presidential Documents 6183) states in Sec. 2. Federal Agency Duties. that we should; (i) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (ii) monitor invasive species populations accurately and reliably; (iii) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (iv) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species.
9. Title 50 CFR 32.1 states that the opening of a wildlife refuge area to hunting will be dependent upon the provisions of law applicable to the area and upon a determination by the Secretary of the Interior that the opening of the area to hunting of migratory game



birds, upland game, or big game will be compatible with the principles of sound wildlife management and will otherwise be in the public interest.

10. Title 50 CFR 32.2 provides provisions which apply to each person while engaged in public hunting on a wildlife refuge.

Establishing and Acquisition Authorities include, but are not limited to:

- Fish and Wildlife Service Coordination Act of 1958 (16 USC 661-667-E)
- Emergency Wetlands Resources Act of 1986 (16 U.S.C. 3901(b))
- Fish and Wildlife Act of 1956(16 U.S.C. 742f(b)(1))

The mission of the U.S. Fish & Wildlife Service is:

“...working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.”

In addition to the overall mission of the Service, the National Wildlife Refuge System also has its own mission as set forth by Congress in the National Wildlife Refuge System Improvement Act of 1997. It is as follows:

“...to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.”

A major component of feral swine damage management and other major TRNWRC objectives include the establishment of partnerships with volunteers, hunters/anglers, private organizations, state and federal natural resources agencies, among others. Agencies such as the Mississippi Department of Wildlife, Fisheries, and Parks and United States Department of Agriculture play critical roles in reaching refuge objectives.

CHAPTER III. STATEMENT OF PURPOSE AND OBJECTIVE

PURPOSE

Although the TRNWRC has an overriding purpose of providing for the habitat needs of migratory birds, with an emphasis on waterfowl, each refuge within the TRNWRC has a unique purpose and establishing Legislation (U.S. Fish and Wildlife Service, 2006; U.S. Fish and Wildlife Service, 2015). The management goals of TRNWRC are to:

- Maintain habitat and species representative of the Lower Mississippi River Valley, with special emphasis on waterfowl, other migratory birds, and threatened and endangered species;
- Control and Manage Invasive, Pest, and Nuisance Species;
- Expand Research and Monitoring on the Complex Through Partnerships;
- Develop Land Protection and Conservation Partnerships;
- Identify and Protect Cultural Resources; and
- Provide Visitor Services.

TRNWRC is managed to provide public access to traditional, wildlife-dependent outdoor recreational activities. Objectives are achieved using habitat management tools that include timber management, water management, removal of noxious non-native species, protected sanctuary where appropriate, partnerships, as well as environmental education and interpretation.

OBJECTIVE, DISCUSSION, AND STRATEGIES

OBJECTIVE

Intensively manage feral swine populations to reduce damage and overall population size to aid in achieving management goals identified in the CCP.

DISCUSSION

Hard data are lacking on populations of feral swine on TRNWRC and current population trends. Evidence of feral swine, such as rooting, wallowing, and trails, has been documented along levees, roadways, swamps, moist-soil units, and crop areas. Observations by refuge staff, visitors, and public hunters also suggest increases in feral swine numbers over the last few years. However, numbers of feral swine are unknown due to their high fecundity, lack of validated techniques to estimate populations, dense bottomland hardwood habitat, open population, and nocturnal behaviors. Currently and in past years, feral swine have roamed at large on private property adjacent to lands of TRNWRC. The ecologically-rich swamps and marshes of TRNWRC have not been immune to the invasion of these animals. Feral swine are currently causing significant damage to natural resources and safety issues to many users. Habitats throughout TRNWRC have been compromised because of extensive rooting and large concentrations of feral swine in these areas. The purpose of controlling feral swine is to protect ±83,653 acres of wildlife habitat from feral swine destruction. Additional acres on Farmers Home Administration tracts and other lands under the management responsibility of TRNWRC may be considered for management by refuge managers.

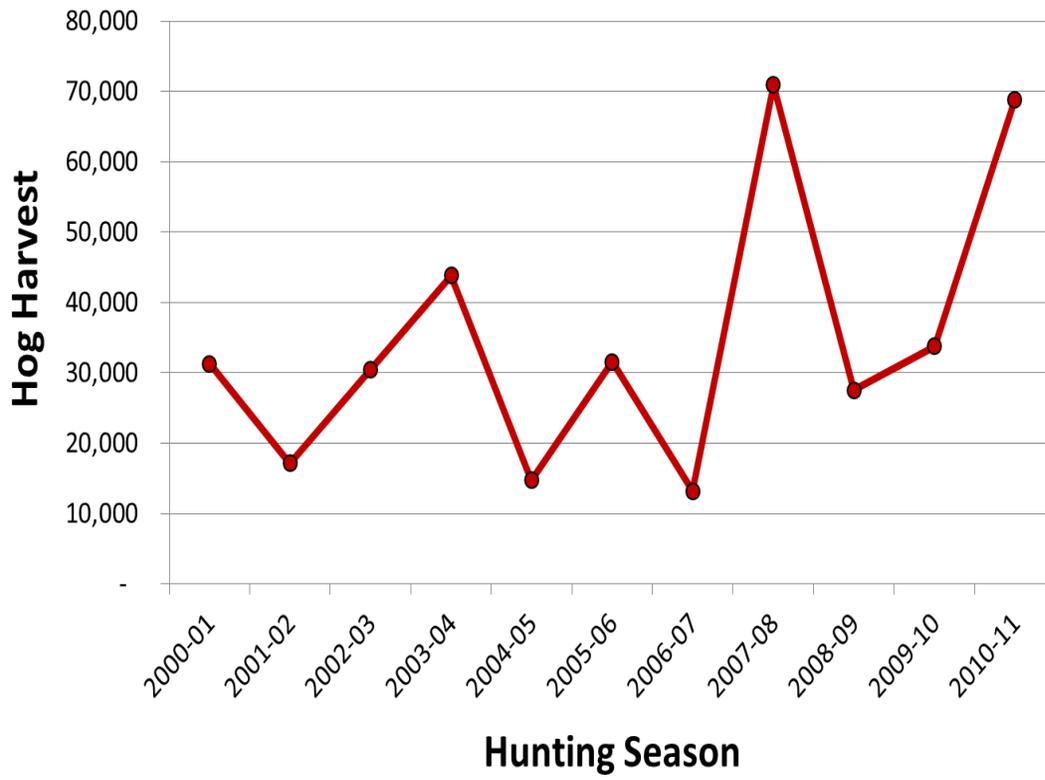


STRATEGIES

An integrated damage management approach is best suited to address feral swine problems at the TRNWRC. Partnerships will be necessary to accomplish most management objectives and may include the involvement of refuge employees, state and federal natural resource professionals, and hunters. Hunters play a significant role in helping address feral swine damage (Figure 3). Strategies should be closely coordinated with refuge law enforcement and local law enforcement when necessary. The following strategies have been/are currently being/will be implemented on TRNWRC, but may not be limited to the following list.

1. Public hunting in consultation with Mississippi Department of Wildlife, Fisheries, and Parks and TRNWRC refuge-specific seasons & regulations.
2. Trapping, ground-based shooting, including night shooting with artificial lights, and the use of dogs, conducted by USFWS personnel, volunteers, other governmental agencies, educational institutions, and/or contractors. All such operations by non-Service personnel would be covered by a refuge Special Use Permit.
3. Disease surveillance and monitoring conducted by USFWS personnel, other governmental agencies, and educational institutions.
4. Aerial gunning (from a helicopter or fixed-wing) operations conducted by USFWS personnel, other governmental agencies, and/or contractors.
5. Any other methods for controlling feral swine as approved by USFWS policy and refuge managers.
6. Supporting scientific research through partnerships with other governmental agencies and educational institutions.
7. Education and outreach to hunters and the general public regarding the negative impacts of feral swine.

Figure 3. Recent trends in feral swine harvested in Mississippi by deer hunters. (Mississippi Agricultural and Forestry Experiment Station, n.d.)



DRY



CHAPTER IV. ASSESSMENT

COMPATIBILITY WITH REFUGE OBJECTIVES

The objective of this Feral Swine Damage Management Plan is tiered to the complex CCPs and derives specifically from Goal 2, Objectives 2A and 2B (U.S. Fish and Wildlife Service, 2006) and from Goal 1, Objective 1.4 (U.S. Fish and Wildlife Service, 2015).

BIOLOGICAL SOUNDNESS

The purpose of reducing feral swine populations is to protect ±83,653 acres of wildlife habitat from various forms of damage. Rooting and wallowing activities cause serious erosion to river banks, infrastructure, and areas along streams as well as negatively impact water quality. Feral swine feed on crops planted for migratory birds and on native vegetation managed for waterfowl, reducing the availability of these resources for desirable wildlife. Feral swine also consume large quantities of acorns, which are an important food for waterfowl, turkey, squirrels, and deer. They carry diseases such as swine brucellosis and toxoplasmosis which are zoonotic. Pseudorabies can be transmitted to hunting dogs, panthers, and possibly wild canids. Furthermore, feral swine create wallows in wet sites, damaging soils and plant communities and reducing water quality. Feral swine have been shown to significantly reduce oak regeneration and survival of plantings (Sweitzer & VanVuren, 2002).

According to several Wild Hog Task Forces, such as in South Carolina, Missouri, and Mississippi, recent and dramatic increases in the distribution and abundance of feral swine have been documented. Feral swine had spread to at least 39 states by 2007 (Clay, 2007). Reported range of feral swine in Mississippi has increased by nine-fold in the last 2 decades (Figure 1). Damage to crops, ecosystems, livestock, and humans has also become more apparent. Some of the largest concentrations of feral swine in Mississippi exist on public lands which are located along streams, rivers, and swamps in sensitive habitats.

The current number of swine now on the TRNWRC is unknown due to high fecundity rates, secretive behavior, hunting pressure and control on surrounding lands, dense habitat, and unlimited area to roam due to the inaccessibility of tracts managed by TRNWRC. Evidence of feral swine presence and resulting damage is easily documented. Observations by USFWS staff, visitors, and public hunters also indicate recent increases in the population. Habitats throughout TRNWRC have been compromised because of extensive rooting and large concentrations of feral swine in these areas .

ECONOMIC FEASIBILITY

Financial resources needed to properly implement a feral swine damage management plan are high. Annual administration costs include salary, equipment, information and outreach, fuel, hunting publications, contract support & administration, and supplies such as bait and traps. Even public hunting results in a significant cost of salary and administration by refuge personnel. The Service will take an integrated approach which includes partnerships with other governmental agencies, opportunistic management by USFWS personnel, and public hunter support. When appropriate, the refuge may seek funding for feral swine management from grants and donations.

RELATIONSHIP WITH OTHER REFUGE PROGRAMS

Feral swine damage management activities will be coordinated through refuge managers to minimize major conflicts with users. Potential major and minor conflicts with users will be evaluated on a case-by-case basis, with input from refuge law enforcement and supervisors. When practical, management activities will be conducted during low public use periods and/or in areas closed to the public. Final decisions regarding management activities will be the responsibility of the Refuge Manager and Project Leader. Federal Wildlife Officers (FWOs) will be made aware of final decisions of current feral swine management activities on TRNWRC.

RECREATIONAL OPPORTUNITY

Hunters are the largest public hunting group using the TRNWRC, with over 8,000 public use permits sold annually. Many public hunters are interested in taking feral swine. Therefore, public hunting is supported as a recreational tool and a control measure. The size and accessibility of each refuge associated with the TRNWRC varies and dictates when public hunting can be used as a control measure. Several factors contribute to this situation, such as season dates, habitat types, and weather.

DRAFT



CHAPTER V. DESCRIPTION OF MANAGEMENT

PUBLIC HUNTING

Public hunting on national wildlife refuges, state wildlife management areas, and private lands has been a time honored method of attempting to control feral swine throughout the United States. However, this management technique has not generally been successful by itself and usually needs to be used in conjunction with other tools to effectively reduce numbers and to achieve long term eradication goals of feral swine within a given geographical area. Where public hunting is used as a strategy to reduce swine populations, it can have the opposite effect because it sets up a perverse incentive for hog hunters to release swine illegally on public lands in order to augment swine populations and perpetuate hunting opportunities.

Currently, opportunistic take of feral swine by the general public is allowed during TRNWRC big game seasons, such as deer and turkey. Some states, including the neighboring state of Arkansas (Arkansas Game and Fish Commission, 2014), have banned or restricted hunting of feral swine on state WMAs because of concerns about perverse incentives and illegal transport/release of swine. The Service has followed the lead of Arkansas on refuges in that state, and may consider a similar action should the state of Mississippi enact similar regulations.

Hunting with dogs is also a popular sport, and in some cases can be effective for removing trap-shy individuals. Many factors come into play for this method to be successful. The experience of the dogs, the hunter, and the feral swine are all important. The Service typically does not allow hunting with dogs on refuges in order to avoid creating the incentives described above. Use of dogs by hog removal contractors operating under a Special Use Permit may be considered on a case-by-case basis. In this situation, care should be taken not to create an incentive for the contractor to maintain swine populations on the refuges, by, for example, using one-year, nonrenewable contracts. TRNWRC refuge managers may allow the use of dogs under special conditions which will be determined annually.

Conditions for the implementation of public hunting on TRNWRC are:

- Public take of feral swine will be opportunistic only, in conjunction with open season and with legal weapons for big game.
- Opportunistic take of feral swine by the public will be combined with other methods in an integrated management system.

TRAPPING

Trapping feral swine can be a very effective method of reducing populations and managing the damage they cause. Trapping has the following advantages relevant to TRNWRC: feral swine are relatively easy to trap, they may be dispatched humanely in the trap, and large traps which can trap entire sounders have relatively little effect on the social behavior of the remaining hog population. Disadvantages include the fact that a trapping program large enough to have a significant effect on the swine population requires high labor and cost inputs, bait attractiveness depends on the presence of alternative sources of food, monitoring by refuge personnel is required to ensure that trappers (if non-refuge personnel) are euthanizing all trapped animals and that traps are not damaged or tampered with by the public. In certain situations, particularly when only part of a sounder is trapped, the remaining members of the sounder may become trap-shy (Massei et al., 2011).

Many types of traps, doors and gates exist (Massei et al., 2011; West et al., 2009) and are currently being used on the TRNWRC. These devices can be used as a lethal control method if

captured feral swine are euthanized. Most designs are based on a basic box shape with some type of a gate door (Littauer, 1993). They may be used for single or multiple animal catches. Corrals or traps may have spring-loaded gates (Taylor, 1991), trip gates, drop gates, or hinged gates depending upon the trap-maker's preference (Littauer 1993). Technical guides, such as *Managing Wild Pigs* (West et al., 2009), help guide USFWS employees and others regarding trapping techniques.

Bait is needed to attract feral swine to the trap. Grain-based baits are preferred, and soured grain, usually fermented corn, is also commonly used. Pre-baiting the trap is important in order to achieve the maximum effectiveness of a cage trap. Letting feral swine become comfortable in and around the trap greatly increases the chance for multiple catches. The availability of natural foods may decrease attractiveness of trap baits and hence will hinder trap success. This is particularly true in the warm months of the year (Littauer, 1993). USFWS personnel, contractors, other governmental agencies, educational institutions, and/or volunteers may be used to implement this method .

Conditions for the implementation of trapping on TRNWRC are:

- All individuals engaged in pig trapping on TRNWRC lands will provide timely, up-to-date maps of the locations of traps to the Complex office.
- Traps and their immediate environs will be posted to prohibit entry by the public in order to avoid trap disturbance/damage, unauthorized removal of pigs, danger to the public, and legal jeopardy in regards to hunting over bait.
- All pigs in traps will be humanely killed in the trap; no pigs will be released or removed alive from the refuge.
- All trapped and euthanized pigs will be removed from the immediate trap area and left onsite. No parts of any feral swine will be used for meat or other purposes other than disease/parasite sampling or permitted research data collection (see below).

SHOOTING

Feral swine can be shot opportunistically or in baited areas, either during the day or at night with artificial lighting. The advantages of ground-based shooting include relatively low cost compared with trapping or aerial gunning, the potential for fairly quick reductions in population, and flexibility in response to changes in population numbers or locations. Disadvantages include the likelihood that pigs will quickly learn to avoid shooters and may relocate or shift activities to nighttime, requiring more expensive and potentially hazardous night shooting operations (Massei et al., 2011). While shooting has its place in an integrated feral swine damage management plan, this tool usually will not reduce the population to a great extent unless implemented intensively, day and night, throughout the year and in conjunction with other methods (Mapston, 2004).

Stand hunting or still hunting can be conducted in baited areas or at feeders. Intensive shooting may cause feral swine to shift their home range or become more nocturnal. When this happens, swine can be shot at night using a spotlight, night-vision, or infrared lighting. It is recognized that extended baiting for purposes of shooting or trapping could have an unintended positive effect on swine by providing supplemental feeding. Care will be taken to keep baiting short-term and with adequate monitoring such as trail cameras. USFWS personnel, contractors, other governmental agencies, educational institutions may be used to implement this method.

Conditions for the implementation of ground-based shooting of feral swine on TRNWRC are:



- Shooting will only be conducted by qualified personnel either employed by or contracted by the U.S. Fish and Wildlife Service or USDA APHIS Wildlife Services.
- All non-Service personnel implementing this method will operate under a Special Use Permit issued by TRNWRC.
- Safety will be the highest priority, and swine will be killed as humanely as possible. Wounded animals will be tracked and dispatched.
- All pigs shot will be left onsite. No parts of any feral swine will be used for meat or other purposes other than disease/parasite sampling or permitted research data collection (see below).

AERIAL GUNNING

Helicopters are the primary aircraft used for aerial control of feral swine. This is a very selective method, and depredation problems can be reduced quickly. Large numbers of feral swine can be taken in a single aerial control operation (Mapston, 1997). Advantages of aerial gunning for hog control include cost-effectiveness, efficiency, and the ability to cover large areas quickly and easily. Disadvantages of this method include the fact that as hog populations are reduced, per-unit cost of removal can become quite high due to the high fixed-cost component of helicopter gunning. Also, the method can be problematic in urban or suburban interface areas and is ineffective in densely vegetated habitats (Massei et al., 2011). For these reasons, aerial gunning should only be used as a component in a larger, integrated control program in which different methods are combined to maximize the advantages and compensate for the disadvantages of each method.

Aerial control conducted by USFWS personnel will be conducted in accordance with the Department of Interior Aerial, Capture Eradication and Tagging of Animals Handbook (351 DM-2-351 DM 3). Other governmental agencies and contractors may have additional requirements and policy. USFWS personnel, contractors, other governmental agencies, and educational institutions may be used to implement this method. In all cases, trained, experienced wildlife professionals will be used for aerial gunning operations. Safety of personnel and the public will be the first priority, and every effort will be made to kill the swine as humanely as possible. When aerial gunning is to occur the complex Federal Wildlife Officer will be involved in the planning and implementation stages as additional measures will need to be taken such as but not limited to the following: closing county roadways, closing portions of the refuge to public entry, informing and coordinating with local sheriff department, Mississippi Department of Wildlife, Fisheries, and Parks, and refuge neighbors. Additional FWOs may need to be brought in to ensure the public's safety.

Conditions for the implementation of aerial gunning on TRNWRC:

- All aerial gunning will be conducted by qualified, experienced personnel either employed or contracted by the U.S. Fish and Wildlife Service or USDA APHIS Wildlife Services.
- All non-Service personnel implementing this method will operate under a Special Use Permit issued by TRNWRC.
- Safety will be the highest priority, and swine will be killed as humanely as possible. Wounded animals will be tracked if possible and dispatched.
- All pigs shot will be left onsite. No parts of any feral swine will be used for meat or other purposes other than disease/parasite sampling.

-
- Aerial gunning operations will be coordinated with the refuge Federal Wildlife Officer, Mississippi Department of Wildlife, Fisheries, and Parks, and, if appropriate, with local law enforcement agencies. Areas to be covered by aerial gunning operations may be closed to public access, and refuge or public roads may be closed as appropriate.

DISEASE SURVEILLANCE, EDUCATION/OUTREACH, AND RESEARCH

Ecological and economic damage associated with feral swine in the United States has been well documented in the scientific literature (Pimental et al., 2000; Pimentel et al., 2005). Plant regeneration, soil properties, and water permeation are often impacted by feral swine (Seward et al., 2004). Crop losses can be significant, and were estimated at \$800 million in 2000 (Pimental et al., 2000). Swine are known to carry diseases, such as swine brucellosis, toxoplasmosis, pseudorabies, and many others (Straw et al., 1999; Seward et al., 2004). For these reasons, refuge managers may support continued disease surveillance, public education/outreach, and research. These activities will be conducted under the following conditions.

Conditions for implementation of disease surveillance:

- Sampling will be conducted by qualified personnel following established protocols for safety and effectiveness.
- A systematic approach will be taken to ensure that information obtained is timely and accurate.
- Sampling will be conducted on swine killed via any of the methods described above.

Conditions for implementation of public education/outreach:

- The goal of public education and outreach about feral swine damage management is to foster public understanding of feral swine damage and promote public support for Service efforts to control swine populations on TRNWRC.
- Messages to be used in public education and outreach include:
 - Feral swine are exotic pests which pose serious threats to wildlife, including game, crops, domestic animals, and humans.
 - The Service is working with a network of agency and academic partners to identify and implement the safest, most effective, and most humane methods to control feral swine populations and reduce the threats.
- Messages will be communicated to the public through any of the following media:
 - Printed material such as brochures and leaflets
 - Signs and kiosk information
 - Web-based information provided on FWS web pages
 - Environmental education program information including school programs

Conditions for implementation of feral swine damage research:

- All research will be conducted by qualified agency/academic partners and will be focused on one or more of the following objectives:
 - Characterize the nature and extent of the threats posed or damage caused by feral swine on TRNWRC. Threats and damage include disease, wildlife



competition and direct predation, damage to vegetation, soils, refuge infrastructure, and cultural resources.

- Identify and test efficacy of swine control methods.
- All research will be conducted under an approved Special Use Permit issued by TRNWRC.
- No parts of any feral swine will be used for meat or other purposes other than obtaining data for specific research objectives.
- All research personnel will coordinate with TRNWRC Project Leader or his/her designee to ensure their safety and that of the public.

CHAPTER VI. MEASURES TAKEN TO AVOID CONFLICTS WITH OTHER MANAGEMENT OBJECTIVES

BIOLOGICAL CONFLICTS

Refer to (U.S. Fish and Wildlife Service, 2006).

PUBLIC USE CONFLICTS

Feral swine damage management may overlap with refuge hunting seasons to some degree during control activities, however; all efforts will be made to avoid conflicts. Visitor use is expected to be high, so work in closed areas and during lower use times (nighttime) will be conducted accordingly. The demand for non-consumptive wildlife oriented use on TRNWRC is expected to be low. Conflicts between feral swine damage management personnel and non-consumptive users may occur. Refuge managers and refuge law enforcement staff will address conflicts when necessary. Restrictions on lethal methods as well as designating specific sites away from highly used public use areas and trails will be used to reduce potential conflicts. Should serious conflicts arise, considerations will be given to time and space scheduling and/or zoning. The demand for consumptive uses on TRNWRC is expected to increase as additional land is acquired and opportunities increase. While conflicts within user groups are expected to be minimal, they may occur. To mitigate potential conflicts, when the public hunting tool is used, certain areas of the refuges in the TRNWRC may be closed to all other public use activities and/or users may be limited through a limited draw or Special Use Permit system.

ADMINISTRATIVE CONFLICTS

Limited resources are available to administer this plan. Actions will not be encumbered with unnecessary procedures requiring funds and manpower to enforce. The only considerations to be observed will be procedures to ensure that the resources are not significantly damaged and that participants are assured of safety. TRNWRC wildlife and recreational programs are administered utilizing current personnel and funds allocated to the Complex. Public Use Permits and Special Use Permits will be made as simple as possible, if needed, in order to minimize the personnel and funding needed to administer this plan. Assistance may be sought from other refuges, governmental agencies, and others if significant administrative conflicts arise. Refuge managers will be required to approve all feral swine damage management actions.



CHAPTER VII. CONDUCT OF THE PLAN

FEDERAL REGISTER PUBLICATION

Feral swine damage management via public hunting will be regulated through refuge-specific hunting regulations which are published annually in Title 50 of the Code of Federal Regulations. The feral swine damage management plan will also be conducted through volunteer agreements, Special Use Permits, and/or contracts.

REFUGE-SPECIFIC HUNTING REGULATIONS WHEN HUNTING IS USED AS A TOOL

The feral swine damage management plan currently provides for the use of 7 strategies (see Chapter 3 above). The only tool requiring specific public restrictions would be the public hunting tool which will be regulated by Public Use Permits issued by TRNWRC. Annually, the TRNWRC sells Public Use Permits which are required to be signed by each hunter and in his/her possession at all times while hunting. Information specific to all public hunting opportunities on the TRNWRC is published in Title 50 of the Code of Federal Regulations and available on brochures found at <http://www.fws.gov/trcomplex>.

PUBLIC INVOLVEMENT

During 2006, the USFWS completed a Comprehensive Conservation Plan (CCP) which covered the five refuges then included in the TRNWRC: Hillside, Mathews Brake, Morgan Brake, Panther Swamp, and Yazoo NWRs (U.S. Fish and Wildlife Service, 2006). In 2014, the Service drafted a CCP for Holt Collier and Theodore Roosevelt National Wildlife Refuges, which were added to the TRNWRC. This document will be available sometime during 2015. Both documents went through an extensive public scoping and public comment process in which feral swine were identified as one of the most problematic invasive species. This Feral Swine Damage Management Plan is a step-down plan to the 2006 CCP, and its objective is tiered to that of the 2006 CCP.

Compliance with the National Environmental Policy Act (NEPA) for this Draft Feral Swine Damage Management Plan will be ensured by the preparation of a Draft Environmental Assessment. Both documents will be made available during a public comment period in January, 2015. Comments received during the public comment period will be considered, and the Service will respond to substantive comments. The final Feral Swine Damage Management Plan will be posted on the internet at http://www.fws.gov/refuge/panther_swamp/, and copies of the document will also be available at the TRNWRC Headquarters Office in Yazoo City, MS.

HUNTER APPLICATION AND REGISTRATION PROCEDURES

This procedure is only applicable to the Public Hunting Tool when used. Management of feral swine take by hunters will occur in the same manner as all of the other hunting opportunities on the TRNWRC. Each hunter must be licensed in Mississippi and possess a TRNWRC Public Use Permit. The permit must be signed by the hunter and in his/her possession at all times while hunting on the TRNWRC. Hunters will also be required to complete and return User Information Cards to document each visit. Hunting permits will be available via the internet at http://www.fws.gov/refuge/panther_swamp/ or at offices located in Yazoo City, MS and Hollandale, MS.

LITERATURE CITED

- Arkansas Game and Fish Commission, 2014. *Feral Pig Regulations*. [Online] Available at: <http://www.agfc.com/hunting/Pages/HuntingRegulationsFeralHog.aspx> [Accessed 20 November 2014].
- Clay, W., 2007. Hogs gone wild. *Human Wildlife Conflicts*, 1(2), pp.137-38.
- Hill, D. et al., 2014. Surveillance of feral swine for *Trichinella* spp. and *Toxoplasma gondii* in the USA and host-related factors associated with infection. *Vet. Parasitol.*, 205(3-4), pp.653-65.
- IUCN Invasive Species Specialist Group, 2010. *Sus scrofa*. [Online] Available at: <http://www.issg.org/database/species/ecology.asp?si=73&fr=1&sts=&lang=EN> [Accessed 20 November 2014].
- Littauer, G., 1993. Control Techniques for Feral Hogs, Pages 139-148. In C. Hanselka & J. Cadenhead, eds. *Feral Swine: A Compendium for Resource Managers*. College Station, TX: Texas Agricultural Experiment Station. pp.139-48.
- Mapston, M., 1997. Feral hog control in Texas. In *Proceedings: National Feral Swine Symposium*. Riverdale, MD, 1997. USDA-Animal and Plant Health Inspection Services.
- Mapston, M., 2004. *Feral hogs in Texas*. College Station, TX: Texas Cooperative Extension Texas A&M University.
- Massei, G., Sugoto, R. & Bunting, R., 2011. Too many hogs? A review of methods to mitigate impact by wild boar and feral hogs. *Human-Wildlife Interactions*, 5(1), pp.79-99.
- Mayer, J. & Brisbin, I.J., 2008. *Wild Pigs in the United States*. Athens, GA: University of Georgia Press.
- Mississippi Agricultural and Forestry Experiment Station, n.d. <http://wildpiginfo.msstate.edu/booklet.pdf> *Wild hogs in Mississippi*. booklet. Mississippi State, Mississippi: Mississippi Agricultural and Forestry Experiment Station.
- Mississippi Department of Wildlife, Fisheries, and Parks, 2014. *Wildlife and Hunting: Nuisance Wildlife*. [Online] Available at: <http://www.mdwfp.com/wildlife-hunting/nuisance-wildlife.aspx> [Accessed 08 December 2014].
- Pedersen, K. et al., 2012. Apparent prevalence of sine brucellosis in feral swine in the United States. *Human-Wildlife Interactions*, 6(1), pp.38-47.
- Pedersen, K. et al., 2013. Pseudorabies in feral swine in the United States, 2009-2012. *Journal of Wildlife Diseases*, 49(3), pp.709-13.
- Pimental, D., Lach, L., Zuniga, R. & Morrison, D., 2000. Environmental and economic costs of nonindigenous species in the United States. *BioScience*, 50(1), pp.53-65.
- Pimentel, D., Zuniga, R. & Morrison, D., 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. *Ecological Economics*, 52, pp.273-88.
- Seward, N.W., VerCauteren, K.C., Witmer, G.W. & Engeman, R.M., 2004. Feral swine impacts on agriculture and the environment. *Sheep and Goat Research Journal*, 19, pp.34-40.
- Straw, B., D'Allaire, S., Mengeling, W. & Taylor, D., eds., 1999. *Diseases of Swine*. 8th ed. Ames, IA: Iowa State University Press.



Sweitzer, R. & VanVuren, D., 2002. PSW-GTR-184 *Rooting and foraging effects of wild pigs on tree regeneration and acorn survival in California's oak woodland ecosystems*. Gen. Tech. Rep. USDA Forest Service.

Taylor, R., 1991. Number 28 *The feral hog in Texas*. Federal Aid Report Series. Austin, TX: Texas Parks and Wildlife Department.

U.S. Fish and Wildlife Service, 2006. *Theodore Roosevelt National Wildlife Refuge Complex Comprehensive Conservation Plan*. Atlanta, GA: U.S. Department of the Interior Fish and Wildlife Service, Southeast Region.

U.S. Fish and Wildlife Service, 2015. *Theodore Roosevelt and Holt Collier National Wildlife Refuges, Mississippi; Draft Comprehensive Conservation Plan and Environmental Assessment*. Atlanta, GA: U.S. Department of the Interior Fish and Wildlife Service, Southeast Region.

West, B.C., Cooper, A.L. & Armstrong, J.G., 2009. Managing wild pigs: a technical guide. *Human - Wildlife Interactions Monograph*, 1, pp.1-55.