

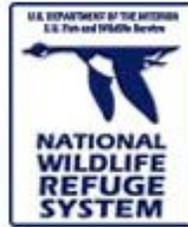
**DRAFT NUISANCE ANIMAL MANAGEMENT PLAN AND
ENVIRONMENTAL ASSESSMENT FOR
TENNESSEE
NATIONAL WILDLIFE REFUGE COMPLEX**

Southeast Region



Tennessee National Wildlife Refuge Complex

DRAFT NUISANCE ANIMAL MANAGEMENT PLAN AND ENVIRONMENTAL ASSESSMENT



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

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SECTION A. DRAFT NUISANCE ANIMAL MANAGEMENT PLAN

Chapter I. Introduction

SCOPE AND RATIONALE

The following Nuisance Animal Management Plan (NAMP) will encompass two National Wildlife Refuges (TNNWRC); Cross Creeks and Tennessee National Wildlife Refuges (NWR). Cross Creeks NWR which contains 8,862 acres located in one tract in Stewart County and along both sides of the Cumberland River (Lake Barkley) for a total of 12 miles. Habitat types on Cross Creeks include; open water 2,800 acres, Wetlands 1,500, Woodlands 2,542, Croplands 1,300, Grasslands 600 and infrastructure 120 acres.

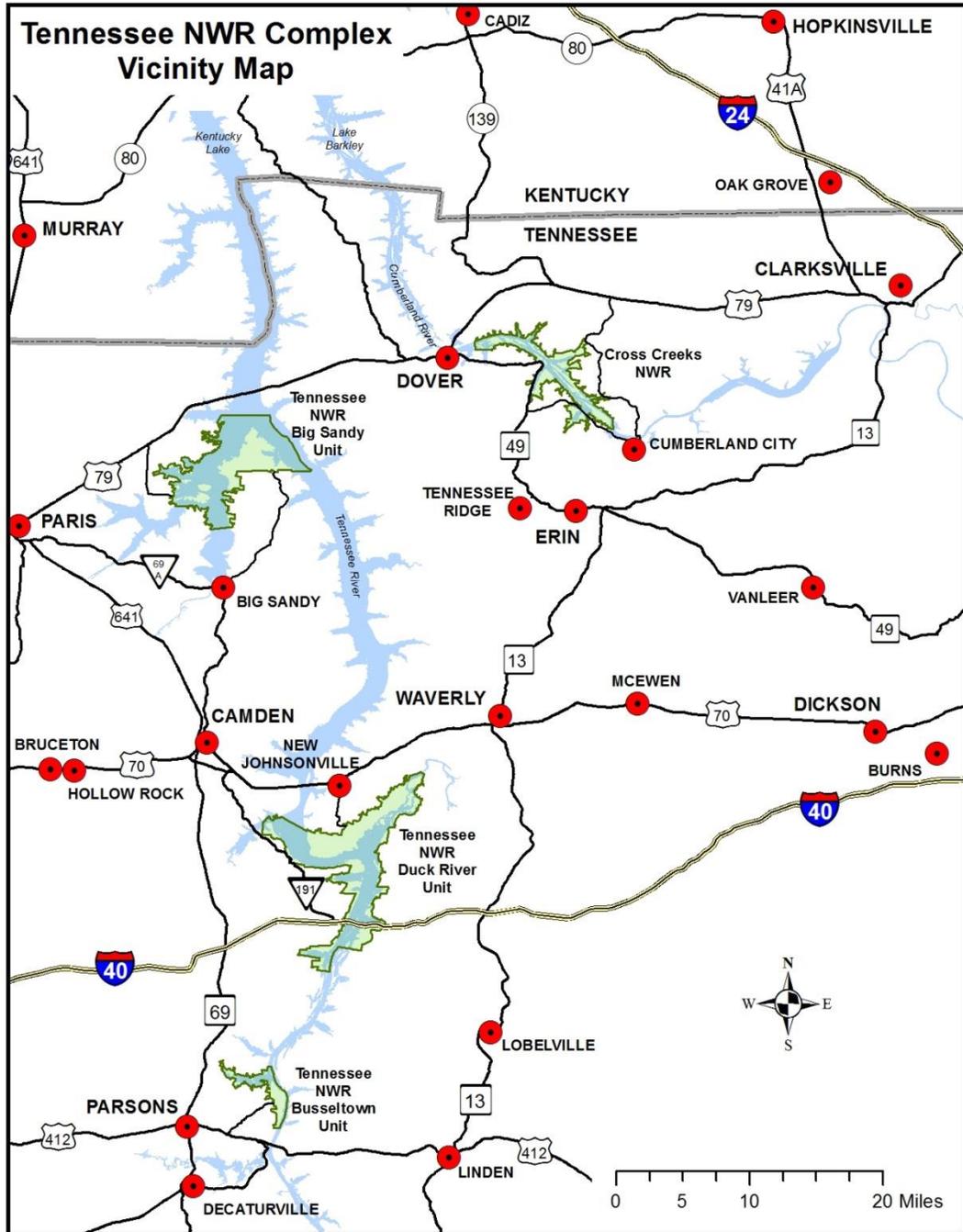
Tennessee National Wildlife Refuge contains 51,358 acres in three separate units; Big Sandy - 21,348 acres, Duck River - 26,738, and Busseltown - 3,272 acres and extends 65 miles along Kentucky Lake in West and Middle Tennessee. The entire refuge consists of approximately 26,000 acres of water, 19,500 acres of woodland, 1,500 acres of wetland plants, and 3,150 acres of agricultural crops.

The primary objective for both refuges is to provide habitat for waterfowl and other migratory birds. Management programs on the Tennessee NWR focus on meeting the habitat needs of 121,000 ducks for 110 days and 16,000 geese for 90 days, while Cross Creeks NWR meets habitat needs for up to 44,000 ducks and 5,000 geese per day for 110 days all of which contribute to achieving the population objectives of the North American Waterfowl Management Plan (NAWMP).

This NAMP was developed to provide a clear, science-based outline for managing the Refuge in this challenging environment. To this end, the NAMP was developed as a first step in closing the gap between the needs of Refuge wildlife and the knowledge of its stewards.

This draft NAMP complies with all applicable laws, regulations, and policies governing the management of National Wildlife Refuge System (See Section A, Chapter II). NAMPs are reviewed every 5 years utilizing peer review recommendations, as appropriate, in the NAMP revision process or when initiating refuge CCPs.

Figure 1. Vicinity Map of Tennessee National Wildlife Refuge Complex.



LEGAL MANDATES

REFUGE PURPOSES

Cross Creeks NWR was established as a result of a transfer of land from the U.S. Army Corps of Engineers (Lake Barkley) to the U.S. Fish and Wildlife Service on November 9, 1962, in Public Land Order 4560 in order to provide mitigation for the flooding of waterfowl habitat on the Kentucky Woodlands National Wildlife Refuge.

Cross Creek NWR was established to provide feeding and resting habitat for migratory birds in the Tennessee-Kentucky portion of the Mississippi Flyway, with an emphasis placed on providing habitat for wintering waterfowl.

“... shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon, ...” 16 U.S.C. § 664 (Fish and Wildlife Coordination Act)

“... suitable for— (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...” 16 U.S.C. § 460k-1 “... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended).

More specifically the objectives of Cross Creeks NWR are:

- To provide habitat for migratory birds, especially waterfowl.
- Provide habitat and protection for threatened and endangered species-gray bat, Indiana bat, northern long-eared bat, and least tern (and the formally listed bald eagle)
- Provide wildlife dependent recreation for the public
- Provide environmental education for students, faculty and the private sector.

The establishing and acquisition authorities for Tennessee NWR include the Migratory Bird Conservation Act (16 U.S.C. 715-715r) and Fish and Wildlife Coordination Act (16 U.S.C. 661-667). These documents state that the refuge:

“... [be] for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.”

“...shall be administered by him [Secretary of the Interior] directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon ...”

In addition, Public Land Order 4560 identified the purposes of the refuge to be “... to build, operate and maintain sub-impoundment structures; produce food crops or cover for wildlife; to regulate and restrict hunting, trapping and fishing and to otherwise manage said lands and impoundment areas for the protection and production of wildlife and fish populations ...” (Public Land Order, 1962).

Specifically, the objectives for Tennessee NWR are:

- To provide habitat for migratory birds, especially waterfowl.
- To provide habitat and protection for threatened and endangered species such as the pink mucket pearlymussel, ring pink mussel, orangefoot pimpleback pearlymussel, rough pigtoe, pigmy madtom, piping plover, least tern, gray bat, Indiana bat and northern long-eared bat.
- To provide recreation and environmental education opportunities for the public.

REFUGE VISION

The Refuge vision was developed for the Comprehensive Conservation Plan for Tennessee NWR (USFWS 2010b):

Tennessee National Wildlife Refuge was established in 1945 to provide an inviolate sanctuary and manage habitat for migratory birds. Over the foreseeable future, Tennessee NWR will continue its emphasis on managing habitat for waterfowl. The refuge will also expand its management activities for other migratory birds, in turn providing habitat for other wildlife. In addition, the refuge will strive to be a model for wise land stewardship, including management for indigenous species of flora and fauna and the control of invasive plants and animals.

Tennessee NWR will also continue to serve the American people by expanding opportunities for appropriate and compatible, wildlife-dependent recreation such as hunting, fishing, wildlife photography and observation, as well as environmental education and interpretation. An adequate law enforcement presence will be provided in order to protect the public and natural and cultural resources. Refuge staff will build on existing partnerships with other agencies and stakeholders in implementing this vision.

Similarly, the vision statement developed for the CCP for Cross Creeks NWR (USFWS 2009) is:

Cross Creeks NWR was established alongside Lake Barkley Reservoir in 1962 on land transferred from the Corps. It was set aside as part of a mitigation agreement between the Service and the Corps for the inundation of wetlands habitat on the former Kentucky Woodlands National Wildlife Refuge after the construction of Barkley Dam and the inundation of Lake Barkley. The establishing purpose of the refuge was to provide an inviolate sanctuary and manage habitat for migratory birds. Subsequent statutes also mandate the refuge to manage wildlife and habitat in general and for public uses.

Over the foreseeable future, Cross Creeks NWR will continue its emphasis on managing habitat for waterfowl. The refuge will also expand its management activities to include other native birds and wildlife species. In addition, the refuge will strive to be a model for wise land stewardship, including management for all indigenous species of flora and fauna and the control of invasive plants and animals.

Cross Creeks NWR will also continue to serve the American people by expanding opportunities for compatible, wildlife-dependent recreation, such as hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. An adequate law enforcement presence will be provided in order to protect the public and natural and cultural resources. Refuge staff will build on existing partnerships with other agencies and stakeholders in implementing this vision.

Chapter II. Policies and Regulations Governing Nuisance Animal Control

CONFORMANCE WITH STATUTORY AUTHORITY

The U.S. Fish & Wildlife Service (Service) is a federal bureau operated under the Department of the Interior (DOI), the Nation's principal conservation agency. The DOI is the principle landowner of most of the nation's public lands and cultural resources. Management responsibilities include fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, managing the NWRS, and providing for the enjoyment of life through outdoor recreation.

The Service is the principal agency responsible for protecting endangered and threatened species, migratory birds, anadromous and interjurisdictional fish, and certain marine mammals. In addition, the Service administers a national network of lands and waters for the management and protection of these resources.

MISSION OF THE U.S. FISH AND WILDLIFE SERVICE

The mission of the Service is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

The Service manages the NWRS, the world's largest collection of lands set aside specifically for the protection of fish and wildlife populations and habitats. More than 550 national wildlife Refuges covering more than 96 million acres provide important habitat for native plants and many species of insects, amphibians, reptiles, fish, birds, and mammals. These Refuges also play a vital role in preserving threatened and endangered species, as well as offering a wide variety of recreational opportunities. Many Refuges have visitor centers, wildlife trails, and environmental education programs. Nationwide, more than 30 million visitors annually hunt, fish, observe and photograph wildlife, or participate in interpretive activities on national wildlife refuges.

MISSION OF THE NATIONAL WILDLIFE REFUGE SYSTEM

The mission of the NWRS, as defined by the National Wildlife Refuge System Improvement Act of 1997, is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

LEGAL POLICY CONTENT

Administration of national wildlife refuges is guided by the mission and goals of the NWRS, congressional legislation, Presidential executive orders, and international treaties. Policies for management options of Refuges are further refined by administrative guidelines established by the Secretary of Interior and by policy guidelines established by the Director of the Fish and Wildlife Service.

The following laws, regulations, and Executive Orders relate to the management of pest and exotic plants and animals on Federal lands:

The Federal Plant Protection Act of 2000 (7 U.S.C. § 7711)

(4) Be subject to remedial measures the Secretary determines to be necessary to prevent the spread of plant pests.

National Environmental Policy Act of 1969

Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice...

The Federal Noxious Weed Act of 1974 (7 U.S.C. §§ 2801-2814)

- (1) Designate an office or person adequately trained in the management of undesirable plant species to develop and coordinate an undesirable plants management program for control of undesirable plants on Federal lands under the agency's jurisdiction;
- (2) Establish and adequately fund an undesirable plants management program through the agency's budgetary process;
- (3) Complete and implement cooperative agreements with State agencies regarding the management of undesirable plant species on Federal lands under the agency's jurisdiction; and
- (4) Establish integrated management systems to control or contain undesirable plant species targeted under cooperative agreements.

Endangered Species Act of 1973 As amended by P.L. 94-325, June 30, 1976; P.L. 94-359, July 12, 1976; P.L. 95-212, December 19, 1977; P.L. 95-632, November 10, 1978; P.L. 96-159, December 28, 1979; P.L. 97-304, October 13, 1982; P.L. 98-327, June 25, 1984; and P.L. 100-478, October 7, 1988; P.L. 107-171, May 13, 2002; P.L. 108-136, November 24, 2003.

(b) To provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in subsection (a) of this section.

Executive Order 13112

- (1) Identify such actions
- (2) Subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to:
 - (i) Prevent the introduction of invasive species;
 - (ii) Detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner;
 - (iii) Monitor invasive species populations accurately and reliably;
 - (iv) Provide for restoration of native species and habitat conditions in ecosystems that have been invaded;
 - (v) Conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and
 - (vi) Promote public education on invasive species and the means to address them;

(3) Not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(4) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

The Refuge Improvement Act of 1997

(A) Provide for the conservation of fish, wildlife, and plants, and their habitats within the System;

(B) Ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans

National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee

4(a)(4)(B) In administering the System, the Secretary shall . . . ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans . . .

The Fish and Wildlife Act of 1956

Authorizes development, advancement, management, conservation, and protection of fish and wildlife resources

Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 r-1)

Integrated pest management is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way to minimize economic, health, and environmental risks

569 FW 1 Integrated Pest Management

(A) Establishes policy, procedures, and responsibilities for pest management activities on and off Service lands. It is consistent with the DOI Integrated Pest Management policy ([517 DM 1](#)) and other applicable authorities;

(B) Adopts Integrated Pest Management (IPM) as our method for making pest management decisions; and

(1) A sustainable approach to managing pests that uses the following kinds of tools in a way that minimizes health, environmental, and economic risks:

(a) Biological (e.g., predators, parasites, and pathogens),

-
- (b) Cultural (e.g., crop rotation, alterations in planting dates, and sanitation),
 - (c) Physical (e.g., barriers, traps, hand-pulling, hoeing, mowing, and tilling), and
 - (d) Chemical (e.g., pesticides, such as herbicides, insecticides, or fungicides).

(2) A science-based, decision-making process that incorporates management goals, consensus building, pest biology, monitoring, environmental factors, and selection of the best available technology to achieve desired outcomes while minimizing effects to non-target species and the environment and preventing unacceptable levels of pest damage.

(C) Provides guidance to employees on how to implement IPM for all pest management activities.

Title 50 CFR Part 31, Section 14 – Official animal control operations.

(a) Animal species which are surplus or detrimental to the management program of a wildlife refuge 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 are damaging or destroying Federal property within a wildlife refuge area may be taken or destroyed by Federal personnel.

Title 50 CFR Part 30, Section 11 – Control of feral animals.

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 regulations.

Title 50 CFR Part 30, Section 12 -Range and Feral Animal Management, Subpart B-Feral Animals, 30.12-Disposition of Feral Animals.

Feral animals taken on wildlife refuge areas may be disposed of by sale on the open market, gift or loan to public or private institutions for specific purposes, and as otherwise provided in section 401 of the act of June 15, 1935 (49 Stat. 383, 16 U.S.C. 715s).

Title 50 CFR Part 28-Enforcement, Penalty, and Procedural Requirements for Violations of Parts 25, 26, and 27, Subpart D-Impoundment Procedures, 28.43-Destruction of dogs and cats.

Dogs and cats running at large on a National Wildlife Refuge and observed by an authorized official killing, injuring, harassing or molesting humans or wildlife may be disposed of in the interest of public safety and protection of the wildlife.

Title 50 CFR Part 26-Public Entry and Use, Subpart B-Public Entry, 26.21- General trespass provision.

(b) No unconfined domestic animals, including but not limited to dogs, hogs, cats, horses, sheep and cattle, shall be permitted to enter upon any national wildlife refuge or to roam at large upon such an area, except as specifically authorized under the provisions of 26.34, 27.91 or 29.2 of this subchapter C.

Chapter III. Refuge Overview

This Tennessee NWR Complex Nuisance Animal Management Plan is a step-down management plan from the CCPs for each of the refuges. For a complete description of the refuge overview, see Section A, Chapter II, Refuge Overview of the Tennessee NWR CCP (USFWS 2010) and the Cross Creeks NWR CCP (USFWS 2009) which are incorporated herein by reference.

Chapter IV. Assessment

COMPATIBILITY WITH REFUGE OBJECTIVES

The objective of this Nuisance Animal Management Plan is tiered to the TNNWRC CCPs and derives specifically from Tennessee NWR CCP (U.S. Fish and Wildlife Service, 2010):

Goal 1: Contribute to healthy and viable native wildlife and fish populations, representative of the Lower Tennessee-Cumberland Ecosystem, with special emphasis on waterfowl and other migratory birds.

Objective 1-15: Nuisance animal species control – When necessary, expand nuisance animal species control using approved techniques to help achieve refuge conservation goals and objectives.

And Cross Creeks NWR CCP (USFWS 2009):

Goal 1: Contribute to healthy and viable native wildlife and fish populations representative of the Lower Tennessee-Cumberland River Ecosystem (LTCE), with special emphasis on migratory birds.

Objective 1-12: Invasive Animal Control – When necessary, control invasive animal species using approved techniques to help achieve refuge conservation goals and objectives.

BIOLOGICAL SOUNDNESS

FERAL HOGS

The purpose of reducing feral swine (*Sus scrofa*) populations is to protect 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. 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 TNNWRC 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 TNNWRC. 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. Feral hogs began appearing at Cross Creeks NWR around 2006 and it is believed that individuals were released by neighbors on the North side of the refuge to increase their hunting opportunities

In 2009, refuge staff began actively trapping and shooting wild hogs as time permitted with several being shot. In 2010, a cooperative agreement with USDA Wildlife Services was established and their agency began assisting with removal of wild hogs. Two permanent corral traps were constructed on the North side of the refuge and trapping efforts yielded around 25 hogs, refuge staff shot an additional 5-6 hogs but the most effective method was aerial gunning that occurred late winter. A helicopter crew shot 32 pigs in approximately 1.5 hours. That year the total kill for refuge staff was 66 pigs killed plus an undetermined number that were killed by hunters. In the 2010-2011 hunting season, wild hogs were removed from the "varmint list" and recreational hunters were no longer able to shoot hogs while involved in other hunting activities. This ruling was part of the statewide effort to eliminate the hunter opportunities that were making illegal releases of wild hogs to propitiate hunting opportunities. Currently, hog hunting is only allowed as an eradication measure on private lands with proper state permits.

BEAVER

Beavers (*Castor Canadensis*) are the largest North American rodent with most adults weighing 35-50 pounds. They are adapted for aquatic environments with webbed feet and the ability to stay submerged for long periods. Beavers build dams to modify their aquatic environment, pooling free flowing water. They eat trees and prefer willow, sweetgum, blackgum, cherry, and pine. Beavers are monogamous and have three or four kittens in spring.

Beavers are native to Tennessee; however, beavers have the potential to significantly adversely affect bottomland hardwood forests by damming sloughs and brakes. Forests inundated into the growing season quickly show signs of stress and trees eventually die. Beavers also kill trees by girdling and felling.

Historically, beaver existed and affected habitat conditions in a large, intact, and resilient landscape in which they served a vital role in promoting habitat diversity. However, increasing beaver populations in conjunction with increasing habitat fragmentation and hydrological alterations (i.e., levees, culverts, canals etc.) due to human expansion have led to a condition where beaver can have a significant negative impact on forest fragments.

Alteration of natural and man-made drainage patterns and damage to timber resources are probably the most commonly-reported problems caused by beaver. Beaver dams impound water that can flood crops, timber, and residential areas; weaken roadbeds and associated structures; and reduce the carrying capacity of ditches, canals, and other water bodies. Beaver have also been known to undermine levees, man-made dams, and roadbeds with their burrows.

Other negative impacts from beaver include changes in distribution of tree species and other flora composition within the immediate area of the impoundment due to ground water level elevation and direct loss of native, bottomland hardwood forest due to year round flooding. Mixed species hardwood forest stands are typically replaced with emergent herbaceous or shrub communities such as buttonbush and black willow within the impounded area following forest stand mortality. Large-scale loss in forested acreage directly impacts habitat availability and the ability to meet objectives set for forest birds and affects the ability of the refuge to achieve major wildlife objectives.

NUTRIA

Nutria (*Myocastor coypus*) are large semi-aquatic rodents indigenous South America and introduced into the United States in 1899 in order to supplement the nation's fur market. Most were raised on commercial fur farms, however with the collapse of the fur market in the 1940's, many nutria were released by fur farmers into numerous watersheds across the country.

Nutria are smaller than beaver but larger than muskrats, with a round, slightly haired tail. Forelegs are small compared to the body size with five toes. Hind feet are large and consist of four webbed toes and one unwebbed toe. Ears are small and the eyes are set high on the head. The nose and mouth can be closed to prevent entry of water and nutria are capable of swimming long distances underwater. Males are slightly larger than females with an average weight of 12.0 pounds.

Nutria breed year round and are extremely prolific. They can reach sexual maturity at 3-9 months depending on habitat quality. Gestation is 130 days and nutria are capable of having 2.5 litters per year. Average litter size is 4.5 young but can range from 1-13. Litter size varies with age of female and quality of habitat. Young nutria are born fully furred with eyes open and begin to feed on vegetation within hours of birth. They will nurse for 7-8 weeks.

Nutria are well adapted for movement on land but are more at home in the water. They are strict vegetarians and consume vegetation on both land and in the water. They consume approximately 25 percent of their body weight daily. Nutria feed predominately on the base of plant stems and dig for roots and rhizomes in the winter, often killing native plants. They construct circular platforms of compacted, coarse emergent vegetation, which they use for feeding, birthing, resting, and grooming. They will also destabilize levees, dikes, and embankments where they construct burrows.

MUSKRAT

The muskrat (*Ondatra zibethicus*) is the largest microtine rodent in the United States. The overall length of adult muskrats is usually from 18 to 24 inches. Large males will sometimes be more than 30 inches. The laterally flattened tail usually accounts for 10-12 inches of the length. The weight of muskrats varies from 1 ½ to 4 pounds for adults. However, most muskrats average 2 ½ pounds. Muskrats in the wild may live up to 4 years. Muskrats are very prolific. Most females produce 5 or 6 litters annually and may have up to 15 young per litter.

Muskrats can live almost any place where water and food are available year-round. Being primarily herbivores, muskrats will eat almost any aquatic vegetation as well as some field crops grown adjacent to suitable habitat. Muskrats are primarily herbivores, but will also feed on crayfish, mussels, turtles, frogs, and fish in areas where vegetation is scarce.

Muskrats are hosts to large numbers of endo- and ectoparasites and serve as carriers for a number of diseases, including tularemia, hemorrhagic diseases, leptospirosis, ringworm disease, and pseudotuberculosis. Most common ectoparasites are mites and ticks.

Damage caused by muskrats is primarily due to their burrowing activity.

RACCOON

Raccoons (*Procyon lotor*) are native to Tennessee as well as a large portion of eastern North America with range expansion into the west continually occurring.

Although raccoons are solitary throughout the year, they may den together during cold weather, but during the breeding season raccoons are polygamous and typically breed in January through February. Females that fail to breed during their first estrus in the spring may breed again 2 to 4 months later. Gestation and litter size - Gestation usually lasts from 63 to 65 days, with reported extremes of 54 and 70 days. Litters of one to eight have been reported, with mean litter sizes ranging from two to five. Generally only one litter is produced per year. Young can begin walking 4 to 6 weeks after birth and can generally walk, run, and climb when they are 7 weeks old. Weaning begins when the young leave the den and begin to forage for themselves. Most are weaned by the time they are 16 weeks old. Most of the litter will disperse during the fall of their first year.

During severe cold weather several will den and feed together on a concentrated food source. Typically this species is nocturnal but it is not unusual to see them foraging throughout the day particularly in the summer when the litter is actively feeding or moving. Life span for raccoons is less than 5 years with an average of 1.5 to 3 years.

Most studies describe preferred habitat for raccoons as water and bottomland hardwood forest but today, this species has adapted to a much wider range that was originally described and as a result many raccoons are well adapted to living on upland sites and in close proximity to humans which have created much of the problems that occur on the TNNWRC. The highest density still occurs where forested areas with numerous den trees along streams are located. Home ranges are typically 0.5 to 2 miles. Dens are typically hollow trees but can also live in abandoned buildings and brush piles

The greatest concern with raccoons is transmission of diseases, such as environmental zoonosis (a disease communicable from animals to humans) and parasites. The most common diseases and well known to impact populations are canine distemper and rabies. At this time raccoons are one of the most frequent nuisance animals reported by wildlife agencies in the U.S.

ARMADILLO

The nine-banded armadillo (*Dasypus novemcinctus*) an opossum-sized animal, with a "shell", which is composed of ossified dermal plates covered by a leathery epidermis (Whitaker, Jr. and Hamilton, Jr. 1998). The armadillo is the only North American mammal that has heavy bony plates (National Audubon Society 2000). Female armadillos produce one litter of young per year, which are genetically identical quadruplets (National Audubon Society 2000).

Originally thought to occur in Central and South America, including Mexico, the nine-banded armadillo has undergone a northward and eastward expansion into the United States since the late-1800s, likely through natural dispersal from Mexico and release of captive armadillos (Layne 2003). Today, the armadillo can be found across the southern portion of the United States with additional dispersal northward and eastward in the United States likely in the future (Layne 2003). Range expansion is likely only limited by the reduced food availability and the colder temperatures experienced during the winter months.

Armadillos do not tolerate extended periods of cold weather, which may limit their expansion northward. Armadillos do not hibernate and must feed every couple of days during winter months since they do not store food nor accumulate efficient amounts of body fat to survive through the winter. The presence of snow or frozen soils limits the availability of food sources, primarily the availability of insects, during winter months. The lack of food available often causes armadillos to starve during winter months. However, in Tennessee, winter temperatures are relatively sufficient to

maintain armadillo populations, though periods of extreme cold or prolonged periods of cold temperatures may temporarily affect populations.

Armadillos occupy and exploit a variety of natural and human-modified terrestrial habitats in the United States and across their range, including those armadillos found Tennessee. The ability of armadillos to exploit a wide variety of habitat types is likely one of the main components facilitating the range expansion of the armadillo into and across the United States (Layne 2003). Habitat suitability is likely more of a function of soil substrate rather than vegetative type due to the foraging and digging behavior of armadillos (Layne 2003).

Armadillos are opportunistic feeders and will often forage by digging and probing the soil, leaf litter, and decaying wood for invertebrates, primarily insects. One study found at least 488 different food items in the stomachs of 281 armadillo with insects and other invertebrates comprising 92% of the stomach contents (Kalmbach 1943). Armadillos are also known to forage on plant material and small vertebrates with food preferences often driven by the availability of food sources (Layne 2003).

CANADA GEESE

The establishment of resident Canada Geese (*Branta canadensis*) began in Tennessee in the early 1960's and was conducted by the Tennessee Wildlife Resources Agency and nearby Tennessee Valley Authority (Land between the Lakes). Prior to this effort a "resident" goose flock was maintained at the Kentucky Woodlands National Wildlife Refuge which had been located downstream from Cross Creeks. This flock was started in the early 1940's. These resident geese were somewhat distinct from other populations of migratory geese in that they spend most of their time in one area sometimes within 100 miles of where they were raised. But like other populations they still have a strong desire to return to the same nesting areas each year.

Typically a "resident bird" will have higher survival than migrants, and they typically will have higher nest production as well. It is not unusual for resident Canada geese to live 15-25 years, in addition they tend to breed earlier in life and lay larger clutches of eggs.

After nesting, geese undergo an annual feather molt, a 4-5 week flightless period. During the molt, crop damage may increase significantly due to the need for increased protein to replace molted feathers. This damage to crops can significantly reduce seed yield to cooperative farmers or crops planted for wintering waterfowl. Some geese, without young, may travel to other more favorable areas for the molting process.

It will be necessary to monitor goose numbers not only on the refuge but also on adjacent public lands, particularly when they start impacting local crops, lawns, etc. At this point both refuges are able to maintain population level through sport hunting so that habitat damage is not a significant issue. On a nationwide basis resident Canada geese are on the increase and control has been implemented in a majority of states. On a legal status The Migratory Bird Treaty Act (16 USC 703-711) protects Canada geese, their nests and eggs; however there is a depredation order to address the increasing resident Canada goose population.

ECONOMIC FEASIBILITY

Financial resources needed to properly implement a nuisance animal 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 nuisance animal management from grants and donations.

RELATIONSHIP WITH OTHER REFUGE PROGRAMS

Nuisance animal 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 nuisance animal management activities on TNNWRC.

RECREATIONAL OPPORTUNITY

Hunters are one of the largest public hunting groups using the TNNWRC. Many public hunters are interested in the taking of some nuisance species. Therefore, public hunting is supported as a recreational tool and a control measure in some cases. The size and accessibility of each refuge 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.

Chapter V. Description of Reduction Programs

This NAMP includes a range of non-lethal and lethal control methods that would be available for implementation on the Tennessee NWR Complex, depending on the abundance, distribution, and extent of impacts by pest species that interfere with achieving management objectives of the Tennessee NWR Complex, as described below. The NAMP will be implemented using an adaptive management approach. Adaptive management is an iterative process of selecting best available management strategies, implementing actions, monitoring and evaluating results, conducting research as needed, determining if objectives have been met, considering other environmental, social, and economic factors that may change over time, and refining strategies as necessary.

Refuge lands include a mosaic of public lands intermixed with private residential and rural areas. To successfully remove substantial threats to wildlife resources posed by nuisance species will require a collaborative public and private effort with USDA Wildlife Services, Tennessee Wildlife Resource Agency, county-contracted animal control service providers, researchers, animal advocacy groups, environmental organizations, and private landowners. The on-refuge control methods outlined herein will largely be implemented by refuge personnel. Contractors and collaborators may assist where practical and appropriate. We do not expect to achieve complete eradication of any existing pest species, especially since sources of nuisance species invasions (escapes, releases, immigration from adjacent areas, continued reproduction of pest species, etc.) will likely endure for some time. However, a concerted and sustained effort to control and reduce the number of nuisance animals on Refuge lands will be needed in order to have substantial benefits for listed and other native species that inhabit the Tennessee NWR Complex.

BEAVER

A multi-faceted program involving several methods of control will prove to be the most practical approach.

Exclusion

Total eradication of beaver from the TNNWRC is not the goal of the control program presented here but rather maintaining populations at a level that minimizes additional habitat conversion and loss of invaluable floodplain hardwoods as well as limiting damage to water management operations. Current acreages of emergent shrub communities provided by existing beaver impoundments and naturally impounded areas are more than adequate to provide this needed habitat component. Even if eradication were proposed, such an effort would be impractical and unsuccessful given the constant influx of new animals from surrounding areas into remote, inaccessible wetland communities that occur throughout both TNNWR and CCNWR. Fencing of small critical areas can sometimes prevent animals which cannot climb from entering areas of protected resources. Fencing of culverts, drain pipes, and other water control structures like that used with a Beaver Deceiver™ can sometimes prevent beavers from building dams which plug these devices. In those applications, however, consideration must be given for water flow so that the fence does not act to catch and hold water-borne debris.

Cultural Methods and Habitat Modification

Because beaver usually alter or modify their aquatic habitat so extensively over a period of time, most practices generally thought of as cultural will have little impact on beavers. Beaver dams should be

removed as early as possible in the growing season each year, generally during mid-May - June. Removal efforts should be delayed until after the possibility of heavy spring rains has passed (typically June). Dam removal will be by hand, explosives, or mechanical means. A wide track bulldozer, excavator and/or backhoe will be used when practical and explosives or hand clearing will be used on areas that are difficult to reach with equipment. Most dams will have to be removed 2-3 times annually due to being rebuilt or at least until all stream flow ceases. Continual destruction of dams and removal of dam construction materials will sometimes cause a colony or individual beaver to move to another site. Structural devices (perforated PVC pipe or similar devices) placed in the drainage channel blocked by the dam may be an alternative to allow water flow through a dam site. Experience has shown this is not cost effective and in most cases, simply does not work because beaver mud-in around the outlet.

Repellents

There are no chemical repellents registered for beavers. Past research efforts have tried to determine the effectiveness of potential repellent materials, however, none were found to be effective, environmentally safe, or practical.

Trapping

The use of traps or shooting is the most effective method of removing beaver from any given area. Shooting is perhaps the best approach since the take of non-target species is minimized. Shooting during high water is the most effective time but unfortunately, flooding along the Tennessee and Cumberland Rivers occurs late in the spring when trees are fully leafed out which reduces visibility and thus, the effectiveness of shooting. Thus, trapping is the most effective and practical method but this effectiveness is totally dependent on the trapper's knowledge of beaver habits, food preferences, ability to read beaver sign, use of proper trap, and trap placement. A variety of trapping methods and types of traps are effective for beavers, depending on the situation. In addition to removal by refuge staff, beaver is classed as a furbearer, as well as a nuisance animal in Tennessee and therefore is legal to take year round. Currently trapping is not an approved public use on the TNNWRC and is only conducted by refuge staff, USDA Wildlife Services personnel, and refuge volunteers. In addition fur prices are currently too low to create much demand for access by trappers.

Primary traps which will be used include the Conibear trap (lethal) 330 is one of the most effective types of traps used on beaver today and when restricted to water sets only, it minimizes take of non-target species. Professional trappers and others who are principally trapping for beaver commonly use it. The 330 Conibear is designed for water use and is equally effective in deep and shallow water.

Double-spring leg hold traps have been used for hundreds of years and are still very effective when properly used by skilled trappers. A # 3 double (long) spring or coil spring type leg-hold trap or larger with a jaw spread up to 8 ½ inches is legal to use on drowning sets. The drowning set is a leg-hold trap attached to a locking slide attached to a slide wire or cable secured at the edge of the water and attached to a weight in the deep water. The water depth should be sufficient to drown a beaver.

Snaring can be a very cost-effective method for capturing beavers and costs far less than other trapping equipment and is more convenient to use in many situations. Any snares that are used should have hard stops on snare cable to eliminate total closure (will allow release of captured non-target species).

Live trapping will not be utilized because relocating beaver would only move this problem to another location and at this time beaver currently occupy all areas of favorable habitat.

Shooting

Removing beaver from specific locations with firearms is very effective. Beaver may be taken by refuge hunters, incidental to take while hunting other species during open hunting seasons. However, few hunters ever kill beaver while hunting other species (i.e. deer, squirrel, turkey). Refuge and/or USDA Wildlife Services personnel will shoot beaver on a selective basis to augment the overall removal effort.

NUTRIA

Conducting population control through a sustained control program should keep the population in check. A multi-faceted program involving several methods can prove to be a practical approach. Currently Nutria have not been observed on or near the TNNWRC but this species is expanding north and east from nearby Arkansas and preparations for control are being proposed.

Exclusion

As with all exotic species, total eradication of the nutria should be the overall goal primarily for the enhancement of the environment; however to totally exclude nutria from all watersheds on the TNNWRC would be impossible. The expected goal would be to keep populations at a minimum.

Cultural Methods and Habitat Modification

Several engineering/maintenance methods and techniques may be used to discourage nutria from using or causing damage to Refuge real property at particular locations. The levee banks where nutrias are actively burrowing should be sloped and the burrows should be filled. However, this practice will only force nutria to shift locations creating additional problems elsewhere. All drainage areas and watercourses that hold water can be used by nutria as travel routes or home sites. Destroying beaver dams to reduce and in some cases eliminate beaver ponds will impact some nutria.

Repellents

No chemical repellents for nutria are currently registered. Other rodent repellents (such as Thiram) may repel nutria, but their effectiveness has not been determined. Use of these without the proper state and federal pesticide registrations is illegal.

Trapping

Trapping is the preferred method of removing nutria from any given area. This is the most effective, practical, and environmentally safe method of nutria control. The effectiveness of any type of trap for nutria control is dependent on the trapper's knowledge of nutria habits, food preferences, ability to read nutria sign, use of proper trap, and trap placement. A variety of trapping methods and types of traps are effective for nutria, depending on the situation.

Trapping of nutria by refuge staff and/or USDA Wildlife Services personnel will be allowed primarily with the use of the Conibear trap (lethal), sizes 330 or 220, which are by far the most effective types

of traps used on nutria today. The Conibear was designed primarily for water use and is equally effective in deep and shallow water.

Double-spring leg-hold traps have been used for hundreds of years and are still very effective when properly used by skilled trappers. A # 2 double long spring trap or coil spring type leg-hold trap with a drowning set can also be an effective tool placed at logs used for sunning. The drowning set is a leg-hold trap attached to a locking slide attached to a slide wire or cable secured near the edge of the water and attached to a weight in the deep water. The water depth needs to be sufficient to drown the nutria.

Snaring can be a very cost-effective method for capturing nutria. Snaring equipment costs far less than other trapping equipment and is more convenient to use in many situations. Snares must be used with great care to avoid capturing non-target species.

Live trapping will not be utilized since this species is exotic and relocating nutria would only move this problem to another location.

Shooting

Nutria will be shot by refuge personnel and/or USDA Wildlife Services personnel opportunistically as part of the overall control program and when they move into this section of Tennessee, refuge hunters should be given the opportunities to harvest nutria incidental while hunting other species open for hunting on the refuge. However, at other refuges where this species occurs few hunters ever kill nutria while hunting other species (i.e. deer, squirrel, turkey).

MUSKRAT

Through a sustained control program, the refuge goal is to reduce populations of muskrat on refuge lands to an acceptable level where minimal damage is occurring to refuge resources. A multi-faceted program involving several methods can prove to be a practical approach. At this time muskrat population levels are not causing unacceptably high resource impacts and no effort will be made toward population reduction. This subject is being covered within this document to provide alternatives to refuge staff in the event unacceptable impacts do develop because of population expansion.

Exclusion

It is impossible to exclude muskrats from the creeks, lakes, sloughs and rivers on the entire Tennessee NWRC.

Cultural Methods and Habitat Modification

The banks of active muskrat burrows should be sloped to cave in the tunnels. This practice will make muskrat move to another location. However, this practice doesn't solve the problem; it only moves the problem to another location. Any drainage that holds water can be used by muskrat as a travel route or home site. Eliminating standing water in drainages will make muskrats move on, but this practice is impossible to do in most areas of the refuge and once again, only moves the problem to another location.

Repellents

No chemical repellents currently are registered for muskrats, and none are known to be effective, practical, and environmentally safe.

Trapping

There have probably been more traps sold for catching muskrats than for any other furbearing species. A number of innovative traps have been constructed for both live trapping and killing muskrats including the barrel trap, box trap, and stovepipe traps. Trapping is the preferred method of removing muskrat from any given area and is the most effective, practical, and environmentally safe method of muskrat control.

Trapping of muskrats by refuge staff and/or USDA Wildlife Services personnel at specific problem sites such as dens in road shoulders or levees will be implemented. The effectiveness of any type of trap for muskrat control is dependent on the trapper's knowledge of muskrat habits, food preferences, ability to read muskrat sign, use of proper trap, and trap placement. A variety of trapping methods and types of traps are effective for muskrat, depending on the situation.

The most effective and commonly used types of traps for muskrats are the Conibear trap (lethal), size 110 or 120, and the #1 ½ or #2 long-spring or coil spring trap.

Muskrats are probably the easiest aquatic furbearers to trap and are typically a preferred species for beginning trappers. A trap set in the run, on the house, a feed bed or in a den entrance will usually catch a muskrat in 1 or 2 nights. The stovepipe trap is very effective if set correctly and has the potential of catching multiple muskrats nightly depending on the size of trap and number of muskrats using the den.

Shooting

Muskrat may be shot at specific problem locations by refuge personnel and/or USDA Wildlife Services personnel on a selective basis to solve a particular problem such as bank denning in levees or roads. This practice will be expanded if the population begins to cause habitat or real property damage to the point that warrants a population reduction.

RACCOON

There will not be any effort to conduct complete population, but rather controlling or eliminating selected individuals that are creating a specific problem. For example, certain individuals or family groups that are: raiding seed storage areas; denning in buildings and wood duck nest boxes; and raiding and killing waterfowl in traps during duck banding operations.

Exclusion

Exclusion techniques, such as the placement of predator guards on the posts of wood duck boxes, will be utilized when feasible, but are rarely completely foolproof. There will not be an effort for total eradication of raccoons but only to reduce damage to refuge facilities and seed storage bins. Thus, the expected goal would be to remove problem individuals from the population.

Cultural Methods and Habitat Modification

Several engineering/maintenance methods and techniques may be used to discourage raccoons from using or causing damage to Refuge real property at particular locations. Buildings, particularly grains and seed storage areas will need to be properly sealed up. However raccoons creating damage on waterfowl bait sites will be impractical to control with any type of habitat modification or cultural methods.

Repellents

Naphthalend or paradichlorobenzene may be temporarily effective in enclosed areas, otherwise no chemical repellents for raccoons are currently registered. Use of these without the proper state and federal pesticide registrations is illegal.

Trapping

Trapping is the most effective practical and environmentally method of removing raccoon from any given area. The effectiveness of any type of trap for raccoon control is dependent on the trapper's knowledge of raccoon's habits, food preferences, ability to read nutria sign, use of proper trap, and trap placement. A variety of trapping methods and types of traps are effective for raccoon, depending on the situation.

Trapping of raccoons by refuge staff and/or USDA Wildlife Services personnel will be allowed primarily with the use of the Conibear trap (lethal), size 220 which is particularly effective at small entrances where raccoons are entering waterfowl traps, buildings, etc. Although the Conibear was designed primarily for water use, in tight passageways and entrance areas it is also equally effective as in water.

Double-spring leg-hold traps have been used for hundreds of years and are still very effective when properly used by skilled trappers. A # 2 double long spring trap or coil spring type leg-hold trap with a drowning set can also be an effective tool placed at logs used for crossing or resting. The drowning set is a leg-hold trap attached to a locking slide attached to a slide wire or cable secured near the edge of the water and attached to a weight in the deep water. The water depth needs to be sufficient to drown the raccoon.

Snaring can be a very cost-effective method for capturing raccoon. Snaring equipment costs far less than other trapping equipment and is more convenient to use in many situations. Snares must be used with great care to avoid capturing non-target species.

Live trapping will be utilized where necessary and practical with any problem animals being released at a distance greater than 10 miles or euthanized within the trap. Live traps are desirable because non-target species can be released.

Shooting

Raccoons may have to be shot by refuge personnel and/or USDA Wildlife Services personnel opportunistically as part of the overall control program particularly where they are raiding seed storage areas and waterfowl bait sites. Raccoons are very destructive and can kill significant numbers of ducks which are caught in traps during banding operations. Currently TNNWR allows limited raccoon hunting but CCNWR does not. This is due to the long narrow boundary on Cross Creeks that makes illegal boundary encroachment onto neighboring land difficult to enforce.

FERAL SWINE

Due to the reproduction rate of swine and the dense habitat on the refuge, total elimination of feral swine would be an impossible task to perform. Therefore, the only feasible alternative is to attempt to reduce the population to a level that minimizes or reduces damage to local agricultural crops, livestock pastures, reforested lands, waterways, and foods used by native wildlife. A multi-faceted program involving several methods will likely prove to be the most practical approach of reducing the population to an acceptable level.

Currently, the only location on the complex known to have a population of feral swine is CCNWR. Estimates of numbers that should be removed annually from CCNWR to reduce population size to a level that minimizes overall impacts are 'best' guesses. Staff estimates that a minimum of 150 -200 should be removed annually through a combination of methods. Again, this is only an estimate based upon observation and will be adjusted based upon results. Given the fact that feral hogs occur throughout the state, total eradication is likely impossible since animals will continuously move into the area from other occupied habitat.

Control efforts for hogs are extremely time consuming and expensive. Inadequate staffing levels coupled with austere budgets will impact effectiveness of all control efforts but this must become a priority activity at CCNWR to curtail negative impacts to priority wildlife species.

Exclusion

To have feral hogs excluded from the refuge would be an impossible task. The only way to keep hogs from coming onto the refuge would be to build an animal proof fence. To build a fence around the refuge or place an electric fence to keep hogs out would not only be astronomically expensive, but also logistically impossible due to the creeks, rivers and sloughs meandering through the refuge.

Frightening

No methods are effective.

Repellents

No repellents are registered.

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 TNNWRC: 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 TNNWRC. 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 TNNWRC are:

- All individuals engaged in pig trapping on TNNWRC lands will provide timely, up-to-date maps of the locations of traps to the TNNWRC 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 TNNWRC 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.

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- All non-Service personnel implementing this method will operate under a Special Use Permit issued by TNNWRC.
 - 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 TNNWRC 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, Tennessee Wildlife Resources Agency, 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 TNNWRC:

- 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 TNNWRC.
- 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, Tennessee Wildlife Resources Agency, and, if appropriate, with local law enforcement

agencies. Areas to be covered by aerial gunning operations will be closed to public access, and refuge or public roads will 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 TNNWRC.

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 TNNWRC. 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.

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- All research will be conducted under an approved Special Use Permit issued by TNNWRC.
 - 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 TNNWRC Project Leader or his/her designee to ensure their safety and that of the public.

ARMADILLO

Exclusion

Armadillos have the ability to climb and burrow. Fencing or barriers, however, may exclude armadillos under certain conditions. A fence slanted outward at a 40° angle, with a portion buried, can be effective. The cost of exclusion should be compared to other forms of control and the value of the resources being protected.

Cultural Methods and Habitat Modification

Armadillos prefer to have their burrows in areas that have cover, so the removal of brush or other such cover will discourage them from becoming established.

Repellents

None are currently registered or known to be effective

Trapping

Armadillos can be captured in 10 x 12 x 32-inch (25 x 30.5 x 81-cm) live or box traps, such as Havahart, Tomahawk, or homemade types. The best locations to set traps are along pathways to armadillo burrows and along fences or other barriers where the animals may travel.

The best trap is the type that can be opened at both ends. Its effectiveness can be enhanced by using “wings” of 1 x 4-inch (2.5 x 10-cm) or 1 x 6-inch (2.5 x 15-cm) boards about 6 feet (1.8 m) long to funnel the target animal into the trap (Fig. 3). This set does not need baiting. If bait is desired, use overripe or spoiled fruit. Other suggested baits are fetid meats or mealworms.

Other traps that may be used are leghold (No. 1 or 2) or size 220 Conibear® traps. These types should be placed at the entrance of a burrow to improve selectivity. Care should be taken when placing leghold traps to avoid areas used by non-target animals.

Shooting

Shooting is an effective and selective method. The best time to shoot is during twilight hours or at night by spotlight when armadillos are active. A shotgun (No. 4 to BB-size shot) or rifle (.22 or other small caliber) can be used. Good judgment must be used in determining where it is safe to shoot.

CANADA GEESE

Exclusion

None.

Cultural Methods and Habitat Modification

Overall there are five different methods to reduce goose damage which are habitat modification, exclusion, harassment, chemical repellants and lethal control. For all practical purposes on the refuge only exclusion, harassment and lethal control will be considered for use which is addressed below.

One form of exclusion may include use of flagging and pyrotechnics, these two are methods for excluding Canada geese from planted areas. Strips (2 to 3 feet) of 1-inch wide Mylar[®] tape are attached to poles so that they can swing and flutter in the wind. Pyrotechnics are effective in scaring geese for short periods of time. Hazing is not being considered due to the time constraints, these methods may be practical in some parks or public lands with sufficient staff.

Annual **Round Ups** during the months of June and July are conducted each year while geese are flightless due to molting. At this time this is for banding geese in cooperation with the Tennessee Wildlife Resources Agency. In the past translocation was an effective method but today no one wants additional geese to contend with. If numbers are extremely high then euthanasia would be a last resort. After all methods are considered, hunting is still the most effective method not only for providing public recreation but from the standpoint of staff resources and public opinion.

Automatic Exploders are machines that ignite acetylene or propane gas to produce loud explosions at timed intervals. When properly employed, particularly in agricultural damage situations, these machines can scare geese off areas when the landowner is not around to use shell crackers or other pyrotechnics. Best results are achieved when the machine(s) is relocated around the property every 3-5 days. Explosions should be discontinued once geese have left the area.

Flagging Canada geese are reluctant to linger beneath an object hovering above them. Flagging can be made of 3 - 6-foot strips of 1-inch colored plastic tape or 2 x 2-foot pieces of orange construction flagging. Numerous flags may be needed to protect areas. If geese become acclimated, frequent relocation of the materials is recommended.

Mylar Tape is a visual barrier that can be used in conjunction with other exclusion methods. Mylar tape is 1/2 inch wide, red on one side and shiny on the other. The tape reflects sunlight to produce a flashing effect. When a breeze causes the tape to stretch, it pulsates and produces a loud, humming noise that repels birds. To discourage geese from walking up onto lawns from the water, create a fence along the water's edge by stringing one or two strands between two posts and twist the tape two or three times. To ensure maximum reflection and noise production, leave some slack in the tape and twist the material as you string it from stake to stake. When the wind blows, the tape rotates, creating a flash between the red and shiny sides. This unfamiliar flash acts as a visual barrier and makes the geese shy away from the area.

Nest and Egg Destruction - Management of Canada goose nesting through destruction of nests and eggs, or through treatment of eggs, can ease damage problems. Treatment of goose eggs so that they do not hatch will reduce or eliminate the presence of goslings. This will reduce damage such as overgrazing and crop depredation. Control of goose nesting will increase the effectiveness of nonlethal methods, especially use of noise-making devices, since adult geese that are not tending to flightless goslings are more inclined to leave an area when they are harassed.

Two general approaches exist for goose nesting control, and both are allowed under the Depredation Order: destruction and treatment. The selection of approaches will depend on a number of factors, including the location of the nest, overall number of nests, logistics, and capabilities/preferences of the individual conducting the work. It typically takes no more than 5 minutes to destroy or treat a goose nest. In many cases, when a nest is destroyed, geese may reneest in the same or nearby area. For this reason, periodically conduct searches of the property to locate and destroy/treat newly-found nests. Similarly, geese return to traditional nest sites and areas in subsequent years. It is important to monitor and treat goose nests on an ongoing basis.

Destroyed nest material and eggs can be left in the field, buried on site, incinerated, or placed in outgoing trash, in accordance with local ordinances. Nest location will be cleared of all nest materials and covered with objects so that its attractiveness as a nesting area is diminished. Destruction and removal of the nest is intended to cause the pair of geese to abandon the area. However, there are times when the pair does not leave and instead initiates a new nest nearby. If this occurs, destruction of the new nest is necessary. Integrated harassment activities after nest destruction may provide further reinforcement for the geese to leave the area altogether.

Three egg treatment techniques authorized by the Depredation Order are oiling, puncturing, and shaking and are most useful when the presence of adult geese can be tolerated but goslings are not desired. Treated eggs remain in the nest, and geese will continue to tend to the nest and incubate the eggs. Contents of eggs build up with gas and may burst if they are disturbed or knocked together. Nest sites will be marked with flagging tape or other material to facilitate follow-up visits and reduce time spent having to search for previously-treated nests. When eggs fail to hatch, the adult geese gradually cease incubation and will leave the immediate area as the time to molt approaches. This can be hastened toward the end of the nesting season (May) through use of harassment activities. Destroyed nest material and eggs may be left in the field or disposed of by burial, incineration, or placement in outgoing trash, in accordance with local ordinances.

In general, treatment will begin once incubation has begun. If the eggs feel cool to the touch, incubation has not commenced and additional eggs will be laid. In that situation, nest location will be marked and revisited to initiate treatment.

Oiling—Use 100% food-grade corn oil. The oil blocks the pores in the eggs' shell, and prevents further development of the contents. Oil may be applied by a number of methods:

- Dip each egg in oil and wipe to remove excess
- Wipe the eggs with a cloth soaked in oil
- Spray oil on each egg with a hand-held pump action sprayer
- Spray oil on each egg with a pressurized backpack sprayer

Puncturing—To puncture the egg, a long, thin metal probe will be inserted into the pointed end of the egg.

Repellents

Two repellents are currently on the market but are not fully effective and should only be used as part of an integrated program which implements public hunting opportunity first.

Methyl Anthranilate

There are several products using the active ingredient methyl anthranilate (MA) (artificial grape flavoring): ReJeX-It Migrate, GooseChase and Goose-BGone. These products help change the birds' behavior. When applied to grass where geese feed, methyl anthranilate makes the grass unpalatable. Geese may still frequent the treated area, but they will not feed there.

Anthraquinone

Flight Control, a relatively new product containing anthraquinone, repels geese in two ways. First, geese experience a strong, harmless "gut reaction" after eating the grass. Secondly, the grass appears unnatural and uninviting because the anthraquinone brings out the ultraviolet spectrum when applied to turf. Combining the strange look of the grass with the intestinal reaction they experience, geese will look elsewhere to loaf and feed. Flight Control will not wash off after a rain, but needs to be reapplied after mowing. Adding a growth regulator can keep the grass from growing as rapidly. This product is considered to be environmentally safe and does not produce long-term physical effects on the birds that ingest it. Although results may vary, several studies have indicated this product to be very effective.

Trapping

Trapping is not an option at this time, although roundups are covered.

Shooting

Hunting is an effective method for reducing populations and deterring geese from an area. Most states with populations of nuisance Canada geese offer special hunting seasons that target local geese during the fall (typically September 1 to September 15 in Tennessee) which is prior to the typical migratory goose migrations.

At this time it has not been necessary to shoot depredating or problem geese on the refuge but could be an option to save crops. Again the preferred method is to use legal public hunting which coincides with the statewide Tennessee early Canada goose season. Wherever possible, hunting should be encouraged during established hunting seasons in accordance with Federal, State, and local laws and regulations. Hunting in suburban areas is often limited by lack of open space and local ordinances prohibiting discharge of firearms. Where feasible, however, hunting can help slow growth of resident goose flocks. Hunting removes some birds and discourages others from returning to problem areas. Hunting also increases the effectiveness of noisemakers, because geese will learn that loud noises may be a real threat to their survival. Hunting is considered to be the most important management tool for controlling local Canada goose populations.

To hunt waterfowl hunters on the Tennessee Refuge Complex will be required to have a valid Tennessee hunting license (which requires a hunter safety course for those born before January 1, 1969), a Federal Migratory Bird Hunting and Conservation Stamp, a Tennessee Migratory Bird Stamp (includes HIP certification) and a Type 064 Permit. Only non-toxic shot may be used for hunting Canada geese as specified in refuge hunt brochures.

Chapter VI. Measures Taken To Avoid Conflicts with Other Management Objectives

BIOLOGICAL CONFLICTS

Refer to (U.S. Fish and Wildlife Service, 2009, 2010).

PUBLIC USE CONFLICTS

Nuisance animal 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 TNNWRC is expected to be high. 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. 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 TNNWRC 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 staff 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. TNNWRC wildlife and recreational programs are administered utilizing current personnel and funds allocated to the TNNWRC. Hunting 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 nuisance animal damage management actions.

Chapter VII. Conduct of the Plan

FEDERAL REGISTER PUBLICATION

Nuisance animal 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 nuisance animal 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 only tool requiring specific public restrictions is public hunting, which will be regulated by hunting permits issued by TNNWRC. Annually, the TNNWRC sells hunting 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 TNNWRC is published in Title 50 of the Code of Federal Regulations and available on brochures found at <http://www.fws.gov/refuge/tennessee/>.

PUBLIC INVOLVEMENT

During 2009 and 2010, the USFWS completed Comprehensive Conservation Plans (CCP) for Cross Creeks and Tennessee NWRs (U.S. Fish and Wildlife Service, 2009, 2010). This document will be available sometime during 2015. Both documents went through an extensive public scoping and public comment process in which nuisance animals were identified as one of the most problematic management concerns on the Complex. This Nuisance Animal Management Plan is a step-down plan to the 2009 and 2010 CCPs, and its objectives are tiered to the CCPs. This NAMP will go through public comment and review.

SECTION B. DRAFT ENVIRONMENTAL ASSESSMENT

Chapter I. Background

INTRODUCTION

The Tennessee National Wildlife Refuge Complex (TNNWRC) consists of two refuges, Tennessee NWR and Cross Creeks NWR (See Figure 1). Tennessee NWR runs along 65 miles of the Tennessee River, and is comprised of three units: Duck River Unit (26,738 acres), Big Sandy Unit (21,348 acres), and Busseltown Unit (3,272 acres), for a total acreage of 51,358 acres. Cross Creeks NWR stretches 12 miles on either side of the Lake Barkley Reservoir and the Cumberland River between Dover and Cumberland City, Tennessee (USFWS 2004). The Cumberland River creates a north side and a south side of Cross Creeks NWR. The reservoir and refuge are on the middle transition portion of the Cumberland River between Cheatham Dam and Barkley Dam. The Corps operates Lake Barkley “primarily for flood control, hydropower, and navigation, as well as secondary purposes of recreation, water quality, water supply, and fish and wildlife habitat” (USFWS 2006a).

All three units were used extensively for agriculture in the 1800s and early 1900s. The mixture of open water, wetlands, woodlands, croplands, and grasslands creates a mosaic of wildlife-rich habitats. The refuges provide valuable wintering habitat for migrating waterfowl. They also provide habitat and protection for threatened and endangered species such as the gray bat, Indiana bat, northern long-eared bat, least tern, pink mucket pearlymussel, ring pink mussel, orangefoot pimpleback pearlymussel, rough pigtoe, and pigmy madtom.

Prior to the establishment of the refuge, most of the forestlands had been used and altered by Euro-American settlement for well over a hundred years. Forests were cleared for farming, resulting in thousands of acres of agricultural lands. Some of the cleared land was marginal but farmed for years and then grazed. Much of this agricultural land was eventually abandoned, producing various stages of poorly stocked timber stands throughout the refuge. Some of the abandoned fields were planted in pine by the TVA in the 1940s and by the refuge in the 1970s, and a few were planted in oaks in the 1980s and 1990s. Where the topography was not conducive to clearing for agriculture, forest stands were heavily cut for sawtimber and then burned to encourage browse growth for livestock. In the late 1800s, the iron ore industry clearcut forests in the region to produce charcoal. Another factor that has changed the forest characteristics of this region is the impacts of exotic disease-causing fungi and insects (Owen 2002). The most significant of these has been the chestnut blight (*Cryphonectria parasitica*) that has essentially led to the ecological extinction of the American chestnut (*Castanea dentata*). The chestnut was once a dominant species in the Appalachian forests, including the area of the refuge.

One of the most significant factors impacting historic habitat in the Tennessee River Valley, particularly west Tennessee, was the construction of Kentucky Dam on the Tennessee River between 1938 and 1944 which created Kentucky Lake. The terrain of the impoundment area was mostly flat and consisted of vast uncleared swamps and bottom lands, large fields of cultivated bottom lands, and large open lands denuded of topsoil, unproductive, and long ago abandoned. This latter condition of the terrain was most prevalent in the reservoir, especially in the lower portions. The Kentucky Dam project aided in flood control, attracted light industry to the area, improved navigation, provided hydroelectricity, and promoted tourist and recreational activities. River barge traffic increased and a number of port terminals and industrial parks were developed along the River.

The USFWS developed CCPs for the Tennessee NWR (USFWS 2010) and Cross Creeks NWR (USFWS 2009) to guide management and conservation strategies for these refuges over a 15 year planning horizon. The CCPs address issues that threaten the long-term conservation of imperiled species and their habitats, including habitat loss and fragmentation, invasive species, changing public uses and demands, and inadequacy of resources for management and protection. The CCPs lay out broad goals, objectives and strategies to protect and maintain diverse habitats and eliminate adverse human impacts to the extent possible, so that ecosystems, species diversity, and imperiled species are protected or restored. Some species require additional attention and direct intervention to increase their population abundance and distribution and improve their long-term viability. This NAMP is a step-down plan that tiers off the CCPs to specifically address the relevant management objectives and strategies for minimizing current and foreseeable threats from nuisance animals.

PURPOSE AND NEED FOR ACTION

PURPOSE

The purpose of the proposed Nuisance Animal Management Plan is to identify goals and objectives and evaluate and prescribe strategies for mitigating the threats posed by non-native and nuisance animal species and reducing or eliminating the damage to refuge resources. The Nuisance Animal Management Plan is intended to guide the Service's management actions and methods to address non-native and nuisance animal damage to natural resources on refuge lands. The Service believes the management actions described will greatly increase the ability to control non-native and nuisance animal populations and reduce the amount of damage caused by these animals.

NEED

The action is needed because non-native and nuisance wildlife pose an unacceptable and growing threat to refuge resources, the accomplishment of refuge purposes, and the health and safety of the public. The Service believes that developing and implementing an integrated nuisance animal management plan is the best way to address the problems that non-native and nuisance wildlife cause on the TN NWR Complex.

DECISION FRAMEWORK

Based on the analyses in this Environmental Assessment, the Service will select the alternative that best serves the purposes for which the refuges within the TNNWRC were established and supports the mission of the NWRS, and determine if the selected alternative is a major Federal action which significantly negatively affects the quality of the human environment, thus requiring the preparation of an Environmental Impact Statement. The Service identified issues, concerns, and needs through discussions with the public, organizations, agency managers, conservation partners, Tribes, local, state, and federal government agencies, and others. The Service identified priority issues, developed a range of alternatives, evaluated the possible consequences of implementing each of the alternatives, and selected the proposed alternative as the proposed action. The draft plan was developed for implementation based on this recommendation.

Chapter II. Affected Environment

This Tennessee NWR Complex Nuisance Animal Management Plan is a step-down management plan from the CCPs for both Cross Creeks NWR and TN NWR. For a complete description of the affected environment, see Section A, Chapter II, Refuge Overview of the Tennessee NWR CCP (USFWS 2010) and the Cross Creeks NWR CCP (USFWS 2009) which is incorporated herein by reference.

Chapter III. Description of Alternatives

In developing the NAMP, two alternatives were evaluated. Alternative B (Proposed Action) is the proposed alternative for guiding the implementation of nuisance animal management program, stepped down from the overall goals and objectives of the respective Comprehensive Conservation Plans (CCP) for the Tennessee NWR (USFWS 2010) and Cross Creeks NWR (USFWS 2009). These plans all reflect the National Wildlife Refuge System's strong and singular mission of wildlife conservation.

The removal of nuisance species to protect native species and habitat is a widespread practice that is essential for wildlife conservation in human-altered ecosystems. Strategies for controlling pest animals are consistent with standard protocols adopted by local, state and federal agencies involved in wildlife management throughout Tennessee.

A description of the two alternatives follows.

ALTERNATIVE A - NO ACTION (STATUS QUO)

This alternative summarizes the past and current situation and would maintain the status quo. Tennessee NWR's current Animal Management Plan addresses the general control of beavers and muskrats in areas where they are damaging habitat or refuge facilities. The refuge has a contract with the USDA Wildlife Services (WS) to control the population of beavers and muskrats through lethal trapping and shooting and the removal of beaver dams. Most of the work done by WS is focused on problems associated with beavers.

Animal control efforts at Cross Creeks NWR are currently limited to addressing problems beavers cause with water control structures on the south side of the refuge. Beavers frequently clog pipes with debris to the point that they are nonfunctioning. Most of the water control structures on the north side of the refuge are inoperable due to beaver activities. The muskrat is another species that is known to damage refuge infrastructure by burrowing into levees, which can eventually lead to levee failure. If muskrat damage to levees is observed, control efforts for this species should be employed.

Crop depredation by resident Canada geese directly impacts the habitats managed for migratory birds, including competition for the grain planted for and left for waterfowl and over-browsing of natural habitats. The refuge addresses this problem by controlling resident geese populations through hunting.

At banding sites, many predators can become imprinted on these locations as an easy source of food and can render the site useless. Controlling individual marauders may be required.

The nutria is a large rodent native to South America and now naturalized in the southeastern United States. They prefer semi-aquatic habitats and often burrow into riverbanks and levees. Nutria are very prolific and can quickly overpopulate an area. Once nutria are established in an area, they tend to target vegetation essential to maintaining waterfowl populations. There have not been any sightings on the refuge at this time, but nutria have been documented in west Tennessee and in the Tennessee River in northern Alabama. It is anticipated that nutria will eventually occur on the refuge, if they are not already present. When they arrive, steps should be taken to eradicate them from the refuge.

Feral hogs provide popular sport hunting in many parts of the country, although introduction of this large mammal causes significant damage to wildlife habitats. The refuge has received reports that feral hogs have been released on or near the refuge in recent years. Cross Creeks NWR has

experienced damage from a population that largely occurs on private lands adjacent to the refuge. As a result, the refuge should monitor the occurrence of this species on the refuge and, when observed, take immediate actions to eradicate it from the refuge.

ALTERNATIVE B - INTEGRATED MANAGEMENT (PROPOSED ACTION)

This alternative includes a range of non-lethal and lethal methods for controlling nuisance species, including feral hogs, beaver, nutria, muskrat, resident Canada geese, raccoons, and armadillo and consequently reducing the impacts of predation, disease, and sub-lethal effects (exclusion, competition). Animal control is a management tool that addresses issues such as infrastructure damage, habitat damage, and invasive exotic species. The animals that require control can be either native or non-native. Methods can range from relocation using means such as live capture, harassment, and habitat modification, to removal using methods such as capture and euthanasia, shooting, and lethal trapping. Existing problems necessitating animal control on the refuge complex involve beaver, muskrat, feral swine and raccoons at banding sites. Potential problems in the near future may occur from the anticipated arrival of exotic nutria, and armadillo on the refuge's land and waters.

Under Alternative B, when necessary, control certain wildlife species using approved techniques to help achieve refuge conservation goals and objectives. This Alternative will also reduce the impact that beavers, muskrats, nutria, feral hogs, armadillo, and resident Canada geese are having on the habitat and water management capabilities using a combination of techniques. Alternative B will explore opportunities to utilize qualified volunteers and/or contracted services to provide control, control problem wildlife individuals that have become imprinted on banding sites and other areas where wildlife may be concentrated and made vulnerable by active management, and eradicate feral hogs and nutria as they are encountered on refuge property.

The Service will also actively promote innovative partnership and educational efforts to reduce human-induced pressures on native and endangered species.

ALTERNATIVES CONSIDERED BUT DISMISSED FROM FURTHER EVALUATION

LIVE CAPTURE AND TRANSLOCATION OF NUISANCE ANIMALS TO OTHER NATURAL AREAS

The live capture and translocation of nuisance species to other natural areas was considered as an alternative to the proposed action. Translocation of nuisance species to other areas is not practical or economically feasible given that there are no other areas that would benefit from receiving them. Suitable habitat is often fully occupied, and the translocated animal is at a disadvantage when establishing a new territory and the exchange of disease is a threat. For these reasons, the live capture and translocation of nuisance animals to other natural areas was dismissed from further evaluation.

NON-LETHAL-ONLY CONTROL

Non-lethal control of nuisance animals has been proposed for use where lethal methods are not feasible or to supplement lethal control methods. Methods include the use of fertility control, construction and maintenance of fencing, the use of repellents, the application of diversionary feeding, and translocation of animals (Massei et al., 2011). The Service has determined that none of these methods alone is currently feasible for control of nuisance populations on TNNWRC.

Chapter IV. Environmental Consequences

INTRODUCTION

Chapter IV contains the evaluation of the potential environmental consequences, or effects of the Alternatives. The environmental issues identified and described in detail in Chapter II, Affected Environment, are discussed for each of the alternatives identified in Chapter III, Alternatives. The direct, indirect, and cumulative effects are identified where applicable.

EFFECTS COMMON TO ALL ALTERNATIVES

ENVIRONMENTAL JUSTICE

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed by President Bill Clinton on February 11, 1994, to focus federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in federal programs substantially affecting human health and the environment, and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment. This assessment has not identified any adverse or beneficial effects for either alternative unique to minority or low-income populations in the affected area. Neither alternative will disproportionately place any adverse environmental, economic, social, nor health impacts on minority or low-income populations.

SUMMARY OF EFFECTS

PUBLIC HEALTH AND SAFETY

No Action Alternative

Under this alternative, there is a slightly elevated risk to public health due to nuisance animals. Feral hogs and raccoons are well-known to carry diseases (Witner et al. 2003), some of which are transmittable to humans (USDA 2005).

Proposed Action Alternative

Under this alternative, there is a slightly less risk to public health due to nuisance animals because hog, raccoon, armadillo, nutria, muskrat, armadillo, and resident Canada geese population levels would be decreased.

REFUGE PHYSICAL ENVIRONMENT

No Action Alternative

Refuges physical environment would have increased negative impacts under this alternative. Native plants would be overgrazed by nutria, killed by beavers and trampled and rooted up by feral hogs. Erosion and lower water quality are caused by hog rooting and wallowing, excessive rooting by armadillos and excessive numbers of resident Canada geese during summer months.

Proposed Action Alternative

The physical environment of TNNWRC refuges would be improved under this alternative. Decreased populations of hogs, beavers, armadillo, resident Canada geese, muskrat, raccoon, and nutria would lessen impacts to native plants, soils and water quality. Negligible impacts could occur to vegetation from trapping; however, benefits from reducing these populations would far outweigh any negative effects from trapping.

CULTURAL RESOURCES

No Action Alternative

Cultural resources, known and unknown, have a greater risk of being threatened under this alternative. Feral hogs are well-known for their rooting and wallowing activities which could disturb buried artifacts.

Proposed Action Alternative

Cultural resources, known and unknown, would be better protected from the wallowing of hogs when populations decline. Methods used to control hogs, beavers, resident Canada geese, armadillo, muskrat, raccoon, and nutria would have no negative impacts on cultural resources.

IMPACTS TO HABITAT

No Action Alternative

Under this alternative, feral hog, armadillo, resident Canada geese, beaver and nutria populations would be allowed to increase unchecked. Feral hogs are capable of breeding at six months of age but 8 to 10 months is normal, depending on habitat quality. Gestation is about 115 days with an average litter size of 4-6. They are capable of having two litters per year with young born throughout the year with peak production in the early spring (Hellgren 1999). Feral hogs, nutria, and armadillo destroy native plants when rooting and wallowing, cause soil erosion, and decrease water quality (USDA 2015). Feral hogs are often the single greatest vertebrate modifiers of natural plant communities (Stone and Keith 1987). Negative impacts to habitat will continue and increase under this alternative due to increased and unchecked nuisance animal populations.

Beaver populations, uncontrolled, persistently dam free flowing streams, creeks and bayous inundating forests causing trees to be killed. These beaver “ponds” can kill thousands of acres of bottomland hardwood forest. Nutria overgraze native vegetation causing a reduction in vegetation diversity and sometimes the elimination of plant communities (Burnam and Mengak 2007). Under this alternative, beaver, muskrat, and nutria numbers would be allowed to increase unchecked causing negative impacts to habitat. Muskrat and beaver often burrow into levees causing erosion and lack of control of certain individuals will cause damage to adjacent habitats and infrastructure.

Resident Canada geese, left unchecked, can cause significant impacts to agricultural and moist soil habitats that are managed as forage for migrant and wintering waterfowl. Resident geese browse on newly sprouted crops and moist soil plants, potentially destroying the food productivity of these habitats.

Proposed Action Alternative

Under this alternative, methods to control hogs, beavers, armadillo, resident Canada geese, muskrat, and nutria would decrease their populations and thereby reduce negative impacts to habitat on the TNNWRC. The biological integrity of the refuges would be protected. The amount of trampling of vegetation due to persons conducting control measures by implementing this alternative would be small and negligible compared to the consequences of letting these nuisance wildlife populations grow unchecked.

IMPACTS TO HUNTED WILDLIFE

No Action Alternative

Under this alternative, feral hog and resident Canada geese populations would continue to increase. Hogs compete with native game species, such as squirrels, waterfowl, turkeys and deer, for acorns and other mast. Hogs, nutria, and armadillo root and wallow, destroying native ground cover which provides food for turkeys, deer, and migratory waterfowl. Hogs and raccoons have been documented to depredate turkey and quail nests and hogs can kill deer fawns (Seward *et al.* 2004). Raccoons are a problem with depredating wood duck boxes, as well as harassing and killing ducks during banding operations. Decreased food availability and depredation of game species and their nests would have negative impacts to hunted wildlife.

Proposed Action Alternative

Under this alternative, native game species would benefit from a reduction in nuisance animal populations. Food competition between hogs, raccoons, and resident Canada geese and native wild game would be reduced. Depredation of bird nests and deer fawns would be decreased under this alternative. Harassment and killing ducks by raccoons during banding operations would be reduced.

IMPACTS TO NON-HUNTED WILDLIFE

No Action Alternative

Under this alternative, nuisance animal populations would continue to increase. Studies have shown feral hogs are opportunistic and will eat anything, including reptiles and amphibians, bird nests, small birds, and small mammals (Taylor 1999). Increasing hog populations would have negative impacts to non-hunted wildlife through depredation. Another negative impact hogs, nutria, and armadillo have on non-hunted wildlife occurs when they destroy vegetation by rooting and wallowing. The same negative impact occurs when beavers kill stands of trees and nutria and resident Canada geese overgraze vegetation. Non-hunted wildlife would be adversely affected from degradation of their habitat due to destruction of native plants.

Proposed Action Alternative

Under this alternative, non-hunted wildlife would benefit from ecologically healthier habitats due to less destruction of vegetation. Also depredation of non-hunted wildlife by hogs and raccoons would decrease.

Under this alternative, control measures used to decrease hog, beaver, armadillo, raccoon, resident Canada geese, muskrat, and nutria populations would have small and negligible negative impacts to non-hunted wildlife compared to the consequences of letting these populations grow unchecked. Traps are checked daily and non-targets, although rarely captured, would be released unharmed. Beaver and nutria trapping would be performed by a knowledgeable trapper setting species-specific traps causing take of non-target species to be at non-significant levels. Take of non-target species is generally limited to muskrat, otter, turtles, and mink, all of which may inhabit the same habitats as nutria, raccoon, muskrat, and beaver and may occasionally use the same travel ways. None of these species are considered to be at risk of eradication on the refuge. Take of non-target species would be monitored and trapping suspended if take of non-target species exceeds refuge thresholds.

IMPACTS TO ENDANGERED AND THREATENED SPECIES

No Action Alternative

The No Action Alternative would have negligible effects on the threatened and endangered species that occur on the refuge complex. Other species described in Appendix B would not be impacted.

Proposed Action Alternative

An Intra-service Section 7 Evaluation associated with this assessment was conducted, and it was determined that the proposed action is not likely to adversely affect threatened and endangered species that occur on the Complex (Appendix B).

IMPACTS TO REFUGE FACILITIES (ROADS, TRAILS, PARKING LOTS, LEVEES)

No Action Alternative

Refuge roads would be negatively impacted by the rooting and wallowing of hogs. Beavers negatively impact refuge roads when they dam culverts causing the roads to flood. Nutria, beavers, muskrat, and armadillo can destabilize levees when they burrow into them. Resident Canada geese can overgraze levee vegetation causing excess erosion to occur. Under this alternative these species would not be controlled, their populations would thereby increase and consequently facilities would be negatively impacted.

Proposed Action Alternative

Refuge facilities in the form of roads and levees would be better protected under this alternative. Methods to control hogs, beavers, armadillo, resident Canada geese, raccoon, muskrat, and nutria would decrease their populations thereby reducing negative impacts to facilities.

IMPACTS TO WILDLIFE-DEPENDENT RECREATION

No Action Alternative

Under this alternative, no impacts would occur to environmental education, interpretation, wildlife photography, wildlife observation or fishing. In the above sections negative impacts associated with growing populations of nuisance animals were explained for the No Action Alternative. As a result, deer, squirrel, turkey and waterfowl hunting would be negatively affected under this alternative.

Proposed Action Alternative

Under this alternative, decreased populations of nuisance animals would positively benefit game species. Hogs compete with native game species, such as squirrels, waterfowl, turkeys and deer, for acorns and other mast. Hogs root and wallow destroying native ground cover which provides food for turkeys, deer, and waterfowl. Hogs have been documented to depredate turkey and quail nests and kill deer fawns (Seward *et al.* 2004). The taking of raccoon, resident Canada geese, and hogs achieved under this alternative would consequently benefit the wildlife-dependent recreation of hunting.

CUMULATIVE IMPACTS ANALYSIS

ANTICIPATED DIRECT AND INDIRECT IMPACTS OF PROPOSED ACTION ON WILDLIFE SPECIES

Migratory Birds

Migratory birds would not be negatively impacted from control measures of hogs, beavers, raccoons, armadillo, resident Canada geese, muskrat, and nutria; therefore, cumulative negative impacts to migratory birds are not foreseen.

Positive cumulative impacts would occur to migratory birds under the proposed action. Hogs and raccoons are known to eat bird nests and birds (Taylor 1999). Hogs and armadillo root, wallow and destroy native vegetation that migratory birds use for nesting structure, cover, and food. Beavers kill thousands of acres of trees by damming streams causing a loss of habitat for many species of migratory birds. Nutria and resident Canada geese overgraze vegetation often changing the composition of native plants; thus affecting migratory bird nesting structure and food availability.

Over time, the biological integrity of the refuge would increase and the overall value of habitat to migratory birds would be improved.

Resident Game

Deer

Negative impacts to deer from hog shooting and trapping would be negligible. Deer are rarely captured in live traps set for hogs; however, when this occurs, the deer are released unharmed.

Positive cumulative impacts would occur to deer under the proposed action. Hogs compete with deer for food, particularly mast. Also, when hogs and nutria destroy vegetation, they destroy plants that deer browse. Beavers kill thousands of acres of trees by damming streams causing a loss of habitat for deer. Nutria and resident Canada geese overgraze vegetation often changing the composition of native plants; thus affecting food availability for deer. The proposed action would decrease nuisance animal populations for the long-term thereby benefiting deer.

Wild Turkey

Wild turkeys would not be negatively impacted from control measures of controlling hogs, beavers, armadillo, raccoons, muskrat, and nutria; therefore, cumulative negative impacts to turkeys are not predicted to occur.

Positive cumulative impacts would occur to turkeys under the proposed action. Turkeys depend on mast during fall and winter for food. Hogs and raccoons compete with turkeys for mast. Hogs and raccoons also depredate turkey nests. The proposed action would decrease nuisance animal populations for the long-term, thereby benefitting turkeys.

Small Game (Squirrel, Rabbit, and Quail)

Small game such as quail, and rabbits would not be negatively impacted from control measures of hogs, beavers, raccoons, armadillo, resident Canada geese, muskrat, and nutria; therefore, cumulative negative impacts to these species are not expected.

Beaver, armadillo, and raccoon populations would be decreased to a sustainable level. Beaver, armadillo, and raccoon populations would not be at risk over the long term due to their prolific reproductive output.

Non-hunted Wildlife

The cumulative effects of disturbance to non-hunted wildlife under the proposed action are expected to be negligible. Disturbance to wildlife by proposed control efforts would be less than that caused by hunters, anglers and non-consumptive users. Disturbance would be short term and very localized.

Positive cumulative effects of the proposed action would include increased habitat quality, decreased predation by hogs and raccoons on ground nesting species, increased fecundity due to decreased competition for native foods and enhanced potential for increased population levels.

Endangered Species

There will be no cumulative effects of the proposed action on threatened and endangered species.

Refer Appendix B for more information.

ANTICIPATED DIRECT AND INDIRECT IMPACTS OF PROPOSED ACTION ON REFUGE PROGRAMS, FACILITIES, AND CULTURAL RESOURCES

Wildlife-Dependent Recreation

Wildlife-dependent recreation should experience no cumulative negative impacts. On the contrary, positive cumulative effects would be expected. Game species would have less depredation from nuisance animals causing positive long term effects on reproduction and population size. Game species would have less competition for food again causing positive long term effects on game populations. All other forms of wildlife-dependent recreation would not be cumulatively impacted by the proposed action.

Refuge Facilities

The Service defines facilities as: “Real property that serves a particular function(s) such as buildings, roads, utilities, water control structures, raceways, etc.” Refuge facilities in the form of roads and levees would be better protected under this alternative. Methods to control hogs, beavers, armadillo, raccoon, resident Canada geese, muskrat, and nutria would decrease their populations thereby reducing negative long term impacts to facilities.

Cultural Resources

The proposed action does not pose any threat to historic properties on and/or near the Refuge. In fact, nuisance animal control methods meets only one of the two criteria used to identify an “undertaking” that triggers a federal agency’s need to comply with Section 106 of the National Historic Preservation Act. These criteria, which are delineated in 36 CFR Part 800, state:

- 1- an undertaking is any project, activity, or program that can alter the character or use of an archaeological or historic site located within the “area of potential effect;” and
- 2- the project, activity, or program must also be either funded, sponsored, performed, licensed, or have received assistance from the agency.

Consultation with the pertinent State Historic Preservation Office and federally recognized Tribes are, therefore, not required.

ANTICIPATED IMPACTS OF PROPOSED ACTION ON REFUGE ENVIRONMENT AND COMMUNITY

The refuge expects no sizeable adverse impacts of the proposed action on the refuge environment which consists of soils, vegetation, air quality, water quality and solitude. Some disturbance to surface soils and vegetation would occur in the immediate area of trapping; however impacts would be minimal. Reducing the hog, beaver, armadillo, raccoon, resident Canada geese, muskrat, and nutria populations benefit vegetation.

The refuge expects no impacts to air and water quality. Existing State water quality criteria and use classifications are adequate to achieve desired on-refuge conditions; thus, implementation of the proposed action would not impact adjacent landowners or users beyond the constraints already implemented under existing State standards and laws.

The refuge would work closely with State, Federal, and private partners to minimize impacts to adjacent lands and its associated natural resources; however, no indirect or direct impacts are anticipated.

OTHER PAST, PRESENT, PROPOSED, AND REASONABLY FORESEEABLE ANIMAL MANAGEMENT AND ANTICIPATED IMPACTS

Cumulative effects on the environment result from incremental effects of a proposed action when these are added to other past, present, and reasonably foreseeable future actions. While cumulative effects may result from individually minor actions, they may, viewed as a whole, become substantial over time. The proposed management plan has been designed so as to be sustainable through time. Changes in refuge conditions, such as sizeable increases in refuge acreage, would still not change the anticipated impacts of the management plan.

Chapter V. Consultation and Coordination

OVERVIEW

This chapter summarizes the consultation and coordination that has occurred to date in identifying the issues, alternatives, and proposed alternative, which are presented in this NAMP. It lists the meetings that have been held with the various agencies, organizations, and individuals who were consulted in the preparation of the NAMP.

Assistance provided to this refuge by other offices or agencies has been technical in nature and has emphasized proper control techniques. All control methods implemented will be by the refuge staff or contract trappers.

Reviewing animal control plans and environmental assessments from other National Wildlife Refuges provided some information regarding past successful control techniques.

Wildlife Services of the U.S. Department of Agriculture, Jackson, TN provided information on trapping techniques and trapping successes on other NWR's. Tennessee Wildlife Resources Agency provided information on legal trapping procedures and seasons and species of concern.

Appendix A. Literature Cited

The Final CCPs for the Tennessee NWR (USFWS 2010) and Cross Creeks NWR (USFWS 2009), Appendix A, Literature Cited Section and all other original Appendices are incorporated herein by reference and any additions are provided below.

Canada Goose damage website; Colorado State University.

<http://icwdm.org/handbook/birds/CanadaGeese/AqCrops.aspx>

Canada Goose Management Website. University of Nebraska-Lincoln, NRES 348 Wildlife Damage Management class, Spring Semester, 2010. Scott Hygnstrom, Instructor; Stephen Vantassel, Webmaster. <http://icwdm.org/handbook/Birds/CanadadGeese/Default.aspx>

Maryland Canada Geese; controlling conflicts with resident Canada geese in Maryland. Maryland Dept. of Natural Resources.

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Timm, Robert M. 1983. Prevention and Control of Wildlife Damage. Great Plains Agriculture Council. Wildlife Resources Committee. Nebraska Cooperative Extension Service.

White River National Wildlife Refuge Animal Damage Plan.

Burnam, J. and M.T. Mengak. 2007. Managing wildlife damage: nutria (*Myocastor coypus*). Warnell School of Forestry and Natural Resources, University of Georgia, WMS-07-12.

Heartfield, L., and G.R. Dennis Price. 1982. A cultural resources reconnaissance of the D'Arbonne National Wildlife Refuge, Ouachita and Union Parishes, Louisiana. Northeast Louisiana University, College of Pure and Applied Sciences, Research Institute, Monroe.

Hellgren, G. 1999. Reproduction of feral swine. Proceedings of the first national feral swine conference. Ft. Worth, Texas.

Pirtle, E.C., M.E. Roelke, and J. Brady. 1986. Antibodies against pseudorabies virus in the serum of a Florida black bear cub. *Journal of the American Veterinary Medical Association* 189: 1164.

Seward, N.W., K.C. VerCauteren, G.W. Witmer, and R.M. Engeman. 2004. Feral swine impacts on agriculture and the environment. *Sheep & Goat Research Journal*. Lincoln, NE., 40 pp.

Stone, G.W., J.M. Grymes, III, K.D. Robbins, S.G. Underwood, G.D. Steyer, and R.A. Muller. 1993. A chronologic overview of climatological and hydrological aspects associated with Hurricane Andrew and its morphological effects along the Louisiana coast, USA. *Shore and Beach* 61(2): 2-12.

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Witmer, G.W., R.B. Sanders, and A.C. Taft. 2003. Feral swine—are they a disease threat to livestock in the United States? USDA National Wildlife Research Center—Staff Publications. Paper 292. http://digitalcommons.unl.edu/icwdm_usdanwrc/292

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- U.S. Department of Agriculture. 2005. Feral/wild pigs: potential problems for farmers and hunters. Agriculture Information Bulletin No. 799.
- U.S. Fish and Wildlife Service. 2009. Cross Creeks National Wildlife Refuge Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Atlanta, GA, 196 pp.
- U.S. Fish and Wildlife Service. 2010. Tennessee National Wildlife Refuges Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Atlanta, GA, 266 pp.
- Van der Leek, M.L., H.N. Becker, E.C. Pirtle, P. Humphrey, C.L. Adams, B.P. All, G.A. Erickson, R.C. Belden, W.B. Frankenberger, and E.P.J. Gibbs. 1993. Prevalence of pseudorabies (Aujeszky's disease) virus antibodies in feral swine in Florida. *Journal of Wildlife Diseases* 29(3): 403-409.
- Zanin, E., I. Capua, C. Casaccia, A. Zuin, and A. Moresco. 1997. Isolation and characterization of Aujeszky's disease (pseudorabies) virus in captive brown bears from Italy. *Journal of Wildlife Diseases* 33(3):632-4.

Appendix B. Region 4 Intra-Service Section 7 Biological Evaluation Form

Originating Person: Robert Wheat

Telephone Number: 731-642-2091

E-Mail: robert_wheat@fws.gov

Date: September 30, 2015

PROJECT NAME:

Nuisance Animal Management Plan for Tennessee National Wildlife Refuge Complex

I. Service Program:

Ecological Services

Federal Aid

Clean Vessel Act

Coastal Wetlands

Endangered Species Section 6

Partners for Fish and Wildlife

Sport Fish Restoration

Wildlife Restoration

Fisheries

Refuges/Wildlife

II. State/Agency: N/A

III. Station Name: Tennessee National Wildlife Refuge Complex

IV. Description of Proposed Action (attach additional pages as needed):

Implement the Nuisance Animal Management Plan for Tennessee NWRC by adopting the proposed alternative. This plan directs the management of nuisance animals on Tennessee NWR and Cross Creeks NWR.

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map:

B. Complete the following table:

SPECIES/CRITICAL HABITAT	STATUS ¹
Pink mucket pearly mussel	E
Orangefoot pimpleback mussel	E
Pygmy madtom	E
Rough pigtoe mussel	E
Ring pink mussel	E
Least tern	T
Piping plover	E
Indiana bat	E
Gray bat	E
Northern long-eared bat	T

¹STATUS: E=endangered, T=threatened, PE=proposed endangered, PT=proposed threatened, CH=critical habitat, PCH=proposed critical habitat, C=candidate species

VI. Location (attach map): map attached

- A. Ecoregion Number and Name:** Tennessee River/Cumberland River Ecosystem
- B. County and State:** Henry, Benton, Humphreys, Stewart, and Decatur Counties in Tennessee
- C. Section, township, and range (or latitude and longitude):** Henry County-Paris, TN; Benton County-Camden, TN; Humphreys County-New Johnsonville, TN; and Decatur County-Parsons, TN. Latitude 35.96487 Longitude -87.96399.
- D. Distance (miles) and direction to nearest town:** Henry County-Paris, TN: Britton Ford/Sulphur Well portion of refuge is located ~4 miles east of the Paris, TN refuge headquarters. Benton County-Camden, TN: Eagle Creek and Birdsong are located ~7 miles southeast of Camden. Humphreys County-New Johnsonville, TN: Duck River

Unit is located ~5 miles south of the refuge sub-headquarters. Decatur County-Parsons, TN: Busseltown unit is located ~9 miles northeast of Parsons.

Cross Creeks NWR stretches 12 miles on either side of the Lake Barkley Reservoir and the Cumberland River between Dover and Cumberland City. The river creates a north side and a south side of the refuge. Cross Creeks NWR is 8,862 acres in size. The reservoir and refuge are on the middle transition portion of Cumberland River between the Cheatham Dam and Barkley Dam.

- E. Species/habitat occurrence:** Species occur in main stream of Kentucky Lake and Lake Barkley, which could change due to annual flooding. Ecological Services' Office will contact the refuge if more information is needed.

VII. Determination of Effects:

Explanation of effects of the action on species and critical habitats in item V. B (attach additional pages as needed):

Pink mucket pearly mussel, Orangefoot pimpleback mussel, Rough pigtoe mussel, Ring pink mussel, and the Pygmy madtom fish - These mussels and fish are found in Kentucky Lake and not in impounded waters of the refuge. These species should not be negatively impacted by implementation of the proposed alternative.

Least tern and Piping plover – The least tern has been documented occasionally on the refuge in recent years. The piping plover has not been recently documented on the refuge. Both species migrate through the area during the spring and fall. These species are not established species on the refuge and are a rarity. These species should not be negatively affected by any aspect of the proposed action.

Northern long-eared bat, Indiana bat and Gray bat – None of these species have not been documented to occur on the refuge; however, the appropriate habitat does occur. These species will not be negatively affected by any aspect of the proposed action.

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Orangefoot pimpleback mussel	None.
Pygmy madtom	None.
Rough pigtoe mussel	None.
Ring pink mussel	None.
Least tern	None.
Piping plover	None.

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Indiana bat	None.
Gray bat	None.
Northern long-eared bat	None.

A. Explanation of actions to be implemented to reduce adverse effects:

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Orangefoot pimpleback mussel	None.
Pygmy madtom	None.
Rough pigtoe mussel	None.
Ring pink mussel	None.
Least tern	None.
Piping plover	None.
Indiana bat	None.

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Gray bat	None.
Northern long-eared bat	None.

As stated above, nothing in the proposed alternative would negatively affect these species. All nuisance animal management would be beneficial to most wildlife including these species.

VIII. Effect Determination and Response Requested:

SPECIES/ CRITICAL HABITAT	DETERMINATION ¹			RESPONSE ¹ REQUESTED
	NE	NA	AA	
Pink mucket pearly mussel		X		Concurrence
Orangefoot pimpleback mussel		X		Concurrence
Pygmy madtom		X		Concurrence
Rough pigtoe mussel		X		Concurrence
Ring pink mussel		X		Concurrence
Least tern		X		Concurrence
Piping plover		X		Concurrence
Indiana bat		X		Concurrence

SPECIES/ CRITICAL HABITAT	DETERMINATION ¹			RESPONSE ¹ REQUESTED
	NE	NA	AA	
Gray bat		X		Concurrence
Northern long-eared bat		X		Concurrence

¹DETERMINATION/RESPONSE REQUESTED:

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a "Concurrence".

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation". Response Requested for proposed or candidate species is "Conference".

signature (originating station)

date

title

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence _____ Nonconcurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

Signature

date

Title

office

Appendix C. Appropriate Use Forms

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Tennessee NWR _____

Use: Nuisance Animal Management _____

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes X No** ____

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____

Appropriate X _____

Refuge Manager: _____

Date: _____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use. If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence. If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: _____

Date: _____

A compatibility determination is required before the use may be allowed.

FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Cross Creeks NWR _____

Use: Nuisance Animal Management _____

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	YES	NO
(a) Do we have jurisdiction over the use?	X	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	X	
(c) Is the use consistent with applicable executive orders and Department and Service policies?	X	
(d) Is the use consistent with public safety?	X	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	X	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	X	
(g) Is the use manageable within available budget and staff?	X	
(h) Will this be manageable in the future within existing resources?	X	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	X	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	X	

Where we do not have jurisdiction over the use ["no" to (a)], there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ["no" to (b), (c), or (d)] may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. **Yes X No ___**

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate _____ **Appropriate** X _____

Refuge Manager: _____ Date: _____

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use. If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence. If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor: _____ Date: _____

A compatibility determination is required before the use may be allowed.

Appendix D. Compatibility Determination

TENNESSEE NATIONAL WILDLIFE REFUGE COMPATIBILITY DETERMINATION

Uses: Nuisance Animal Management

Refuge Name: Tennessee National Wildlife Refuge Complex – Tennessee National Wildlife Refuge Benton, Decatur, Henry, Humphreys Counties, Tennessee.

Date Established: 1945.

Establishing and Acquisition Authorities: Migratory Bird Conservation Act, Refuge Recreation Act, Executive Order 9670.

Refuge Purpose: “... as a refuge and wildlife management area for migratory birds and other wildlife ...” (Executive Order 9670, dated Dec. 28, 1945)

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. § 715d (Migratory Bird Conservation Act)

“... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...” 16 U.S.C. § 460k-1 “... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” 16 U.S.C. § 460k-2 (Refuge Recreation Act (16 U.S.C. § 460k-460k-4), as amended).

National Wildlife Refuge System Mission: The mission of the Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997, is:

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

Other Applicable Laws, Regulations, and Policies:

Antiquities Act of 1906 (34 Stat. 225)

Migratory Bird Treaty Act of 1918 (15 U.S.C. 703-711; 40 Stat. 755)

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715r; 45 Stat. 1222)

Migratory Bird Hunting Stamp Act of 1934 (16 U.S.C. 718-178h; 48 Stat. 451)

Criminal Code Provisions of 1940 (18 U.S.C. 41)

Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; 54 Stat. 250)

Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41; 62 Stat. 686)

Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j; 70 Stat. 1119)

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4; 76 Stat. 653)

Wilderness Act (16 U.S.C. 1131; 78 Stat. 890)

Land and Water Conservation Fund Act of 1965

National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.; 80 Stat. 915)

National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, 668ee; 80 Stat. 927)

National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq.; 83 Stat. 852)

Use of Off-road Vehicles on Public Lands (Executive Order 11644, as amended by Executive Order 10989)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.; 87 Stat. 884)
Refuge Revenue Sharing Act of 1935, as amended in 1978 (16 U.S.C. 715s; 92 Stat. 1319)
National Wildlife Refuge Regulations for the Most Recent Fiscal Year (50 CFR Subchapter C; 43 CFR 3101.3-3)
Emergency Wetlands Resources Act of 1986 (S.B. 740)
North American Wetlands Conservation Act of 1990
Food Security Act (Farm Bill) of 1990 as amended (HR 2100)
The Property Clause of the U.S. Constitution Article IV 3, Clause 2
The Commerce Clause of the U.S. Constitution Article 1, Section 8
The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57, USC668dd)
Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System, March 25, 1996
Title 50, Code of Federal Regulations, Parts 25-33
Archaeological Resources Protection Act of 1979
Native American Graves Protection and Repatriation Act of 1990

Public Review and Comment: The compatibility determination for Tennessee National Wildlife Refuge will be available for public review and comment in conjunction with the public comment period for the refuge's Draft Nuisance Animal Management Plan and Environmental Assessment (Draft NAMP/EA).

Description of Use: *Nuisance Animal Management*

This alternative includes a range of non-lethal and lethal methods for controlling nuisance species, including feral hogs, beaver, nutria, muskrat, resident Canada geese, raccoons, and armadillo and consequently reducing the impacts of predation, disease, and sub-lethal effects (exclusion, competition). Animal control is a management tool that addresses issues such as infrastructure damage, habitat damage, and invasive exotic species. The animals that require control can be either native or non-native. Methods can range from relocation using means such as live capture, harassment, and habitat modification, to removal using methods such as capture and euthanasia, shooting, and lethal trapping. Existing problems necessitating animal control on the refuge complex involve beaver, muskrat, feral swine and raccoons at banding sites. Potential problems in the near future may occur from the anticipated arrival of exotic nutria, resident Canada geese, and armadillo on the refuge's land and waters.

Under Alternative B, when necessary, control certain wildlife species using approved techniques to help achieve refuge conservation goals and objectives. This Alternative will also reduce the impact that beavers, muskrats, nutria, feral hogs, raccoons, armadillo, and resident Canada geese are having on the habitat and water management capabilities using a combination of techniques. Alternative B will explore opportunities to utilize qualified volunteers and/or contracted services to provide control, control problem wildlife individuals that have become imprinted on banding sites and other areas where wildlife may be concentrated and made vulnerable by active management, and eradicate feral hogs and nutria as they are encountered on refuge property.

The Service will also actively promote innovative partnership and educational efforts to reduce human-induced pressures on native and endangered species.

Availability of Resources:

Staff and resources are adequate to administer this program. Staff time will be required for several components of the nuisance animal control program. Primarily, this involves maintenance of water control structures, removal of beaver dams, and trapping of nuisance animals. Actual time investments may vary significantly from year-to-year as wildlife populations and activities fluctuate.

Anticipated Impacts of the Use:

Short-term impacts:

The take of nuisance animals will involve the use of vehicles, ATVs, or foot travel into target areas, setting of traps or snares, and discharge of firearms, which will result in short-term disturbances similar to those associated with other refuge approved uses (e.g., hunting, fishing, and birding).

This program has the potential to decrease nuisance animal populations and reduce damage to refuge habitats and infrastructure. The refuge will spend less time and expense on the repair of infrastructure and can redirect these resources to other habitat restoration and management activities. Damage to infrastructure and habitat will be reduced.

Long-term impacts:

Degraded habitats will return to a more normal hydrologic regime and will be reclaimed by native vegetation. This will result in increased benefits to trust resources and associated wildlife-dependent recreation.

The refuge expects no sizeable adverse impacts of the proposed action on the refuge environment which consists of soils, vegetation, air quality, water quality and solitude. Some disturbance to surface soils and vegetation would occur in the immediate area of trapping; however impacts would be minimal. Reducing the hog, beaver, muskrat, armadillo, raccoon, resident Canada geese and nutria populations benefit vegetation.

Cumulative Impacts: No cumulative impacts are anticipated.

Determination (check one below):

Use is Not Compatible

Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- The refuge will receive no economic gain from any of its nuisance animal control practices.
- For native nuisance species (beaver, raccoon, muskrat, and resident Canada geese) eradication is not the goal, just the removal of individuals causing damage to habitat, infrastructure, or jeopardizing the waterfowl banding program.
- This management action does not allow trapping by the general public.
- All trapping will abide by Tennessee Wildlife Resources Agency guidelines or otherwise by direct state approval.
- Waterfowl sanctuaries are closed to all public entry.
- Traps must be checked daily during daylight hours.
- A written report of total harvest (target and non-target species) must be reported to the refuge manager following the end of the trapping season.

Justification: Nuisance animal management is a longstanding activity in the southeastern United States. This activity is compatible with the purposes for which the refuge was established, providing both wildlife-dependent recreational activity and serving as a scientifically accepted wildlife population control and a habitat management and protection tool. Overall, the populations of nuisance animals are increasing and expanding northward and this management plan will assist in reducing overpopulated species to acceptable population levels.

NEPA Compliance for Refuge Use Description: *Place an X in appropriate space.*

- Categorical Exclusion without Environmental Action Statement
- Categorical Exclusion and Environmental Action Statement
- Environmental Assessment and Finding of No Significant Impact
- Environmental Impact Statement and Record of Decision

Mandatory 10-Year Re-evaluation Date: _____

Cross Creeks National Wildlife Refuge Compatibility Determination

Uses: Nuisance Animal Management

Refuge Name: Cross Creeks National Wildlife Refuge

Date Established: January 31, 1967

Establishing and Acquisition Authority: Cross Creeks NWR, in Stewart County, Tennessee, was established as mitigation for the loss of Kentucky Woodland NWR, Golden Pond, Kentucky. The loss was due to the U.S. Army Corps of Engineers' Lake Barkley Project, Public Law 780, Senate Document #81, September 3, 1954. The Memorandum of Understanding between the Fish and Wildlife Service and the Corps of Engineers, dated November 9, 1962, authorized the development of Cross Creeks NWR and administration was delegated to the Fish and Wildlife Service. Public Land Order 4560, dated January 31, 1967, transferred all lands from the Corps of Engineers to the Fish and Wildlife Service.

Refuge Purposes: For lands acquired under the Migratory Bird Conservation Act (16 U.S.C. 715 – 715r), as amended, the purpose of the acquisition is: "...for the purpose as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. 715d)

"...shall be administered by him (Secretary of the Interior) directly or in accordance with cooperative agreements ...and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon..." (Fish and Wildlife Coordination Act, 16 U.S.C. 661 – 667e, as amended)

National Wildlife Refuge System Mission:

The mission of the Refuge System, as defined by the National Wildlife Refuge System Improvement Act of 1997, is:

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

Other Applicable Laws, Regulations, and Policies:

Antiquities Act of 1906 (34 Stat. 225)

Migratory Bird Treaty Act of 1918 (15 U.S.C. 703-711; 40 Stat. 755)

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715r; 45 Stat. 1222)

Migratory Bird Hunting Stamp Act of 1934 (16 U.S.C. 718-178h; 48 Stat. 451)

Criminal Code Provisions of 1940 (18 U.S.C. 41)

Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; 54 Stat. 250)

Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41; 62 Stat. 686)

Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j; 70 Stat. 1119)

Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4; 76 Stat. 653)

Wilderness Act (16 U.S.C. 1131; 78 Stat. 890)

Land and Water Conservation Fund Act of 1965

National Historic Preservation Act of 1966, as amended (16 U.S.C. 470, et seq.; 80 Stat. 915)

National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668dd, 668ee; 80 Stat. 927)

National Environmental Policy Act of 1969, NEPA (42 U.S.C. 4321, et seq; 83 Stat. 852)
Use of Off-Road Vehicles on Public Lands (Executive Order 11644, as amended by Executive Order 10989)
Endangered Species Act of 1973 (16 U.S.C. 1531 et seq; 87 Stat. 884)
Refuge Revenue Sharing Act of 1935, as amended in 1978 (16 U.S.C. 715s; 92 Stat. 1319)
National Wildlife Refuge Regulations for the Most Recent Fiscal Year (50 CFR Subchapter C; 43 CFR 3101.3-3)
Emergency Wetlands Resources Act of 1986 (S.B. 740)
North American Wetlands Conservation Act of 1990
Food Security Act (Farm Bill) of 1990 as amended (HR 2100)
The Property Clause of The U.S. Constitution Article IV 3, Clause 2
The Commerce Clause of The U.S. Constitution Article 1, Section 8
The National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57, USC668dd)
Executive Order 12996, Management and General public Use of the National Wildlife Refuge System. March 25, 1996
Title 50, Code of Federal Regulations, Parts 25-33
Archaeological Resources Protection Act of 1979
Native American Graves Protection and Repatriation Act of 1990

Public Review and Comment: The compatibility determination for Cross Creeks National Wildlife Refuge will be available for public review and comment in conjunction with the public comment period for the refuge's Draft Nuisance Animal Management Plan and Environmental Assessment (Draft NAMP/EA).

Description of Use: *Nuisance Animal Management*

This alternative includes a range of non-lethal and lethal methods for controlling nuisance species, including feral hogs, beaver, nutria, muskrat, resident Canada geese, raccoons, and armadillo and consequently reducing the impacts of predation, disease, and sub-lethal effects (exclusion, competition). Animal control is a management tool that addresses issues such as infrastructure damage, habitat damage, and invasive exotic species. The animals that require control can be either native or non-native. Methods can range from relocation using means such as live capture, harassment, and habitat modification, to removal using methods such as capture and euthanasia, shooting, and lethal trapping. Existing problems necessitating animal control on the refuge complex involve beaver, muskrat, feral swine and raccoons at banding sites. Potential problems in the near future may occur from the anticipated arrival of exotic nutria, resident Canada geese, and armadillo on the refuge's land and waters.

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Cumulative Impacts: No cumulative impacts are anticipated.

Determination (check one below):

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