ENVIRONMENTAL ASSESSMENT

MAMMAL DAMAGE MANAGEMENT IN MISSISSIPPI

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)
ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)
WILDLIFE SERVICES (WS)

In cooperation with:

TENNESSEE VALLEY AUTHORITY (TVA)

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ACRONYMS

ABC	American Bird Conservancy
AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
DEA	Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FLIR	Forward Looking Infrared
FR	Federal Register
FY	Fiscal Year
GnRH	Gonadotropin-releasing Hormone
IV	Intravenous
IC	Intracardiac
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
MDAC	Mississippi Department of Agriculture and Commerce
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NRP	Natural Resource Plan
NWRC	National Wildlife Research Center
ORV	Oral Rabies Vaccination
PEP	Post - Exposure Prophylaxis
PL	Public Law
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
TNR	Trap, Neuter, Release Program
TVA	Tennessee Valley Authority
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Services
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.1 PURPOSE

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS)[1] program in Mississippi continues to receive requests for assistance or anticipates receiving requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety, associated with nine-banded armadillos (*Dasypus novemcinctus*), Virginia opossum (*Didelphis virginiana*), little brown bat (*Myotis lucifugus*), Southeastern myotis (*Myotis austroripariuis*), Brazilian free-tailed bats (*Tadarida brasiliensis*), silver-haired bats (*Lasionycteris noctivagans*), Eastern pipistrels (*Pipistrellus subflavus*), big brown bats (*Eptesicus fuscus*), evening bats (*Nycticeius humeralis*), Rafinesque's big-eared bats (*Plecotus rafinesquei*), Eastern cottontail rabbits (*Sylvilagus floridanus*), swamp rabbits (*Silvilagus aquaticus*), black bears (*Ursus americanus*), raccoons (*Procyon lotor*), river otters (*Lutra canadensis*), striped skunks (*Mephitis mephitis*), coyotes (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), bobcats (*Felis rufus*), woodchucks (*Marmota monax*), Southern flying squirrels (*Glaucomys volans*), gray squirrels (*Sciurus carolinensus*), fox squirrels (*Sciurus niger*), feral swine (*Sus scrofa*), white-tailed deer (*Odocoileus virginianus*), feral cats (*Felis domesticus*), and feral dogs (*Canis familiaris*). Normally, individual wildlife damage management projects conducted by the WS program could be categorically excluded from further analysis under the National Environmental Policy Act (NEPA), in accordance with APHIS implementing regulations for the NEPA (7 CFR 372.5(c), 60 FR 6000-6003). The Tennessee Valley Authority (TVA) also continues to experience damage and threats of damage associated with mammals at facilities or properties they own or manage in Mississippi. The TVA could request the assistance of WS to manage damage or threats of damage at those facilities and properties.

The purpose of this Environmental Assessment (EA) is to evaluate cumulatively the individual projects conducted by WS to manage damage and threats to agricultural resources, property, natural resources, and threats to humans caused by those mammal species identified previously. This EA will assist in determining if the proposed cumulative management of mammal damage could have a significant impact on the environment based on previous activities conducted by WS and based on the anticipation of receiving additional requests for assistance. Because the goal of WS is to conduct a coordinated program to alleviate mammal damage in accordance with plans, goals, and objectives developed to reduce damage, and because the program's goals and directives[2] are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses would be intended to apply to actions that may occur in any locale and at any time within Mississippi as part of a coordinated program. This EA analyzes the potential effects of mammal damage management when requested, as coordinated between WS, TVA, and the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP).

WS and the TVA are preparing this EA to: 1) facilitate planning, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of proposed activities; and 5) evaluate and determine if there would be any potentially significant or cumulative adverse effects from the proposed program. The analyses contained in this EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, and public involvement.

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[1]The WS program is authorized to protect agriculture and other resources from damage caused by wildlife through the Act of March 2, 1931 (46 Stat. 1468; 7 USC 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USC 426c).

[2]At the time of preparation, WS' Directives could be found at the following web address: http://www.aphis.usda.gov/wildlife_damage/ws_directives.shtml.

The EA evaluates the need for action to manage damage associated with mammals in the State, the potential issues associated with mammal damage management, and the environmental consequences of conducting different alternatives to meet the need for action while addressing the identified issues. The issues and alternatives associated with mammal damage management were initially developed by WS in cooperation with the TVA, and in consultation with the MDWFP. The MDWFP has regulatory authority to manage populations of mammal species in the State. To assist with the identification of additional issues and alternatives to managing damage associated with mammals in Mississippi this EA will be made available to the public for review and comment prior to the issuance a Decision[3].

1.2 NEED FOR ACTION

Some species of wildlife have adapted to and have thrived in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between people and wildlife. Those conflicts often lead people to request assistance with reducing damage to resources and to reduce threats to human safety. WS' programmatic Final Environmental Impact Statement (FEIS) summarizes the relationship of wildlife values and wildlife damage in this way (USDA 1997):

"*Wildlife has either positive or negative values, depending on varying human perspectives and circumstances...Wildlife is generally regarded as providing economic, recreational and aesthetic benefits...and the mere knowledge that wildlife exists is a positive benefit to many people. However... the activities of some wildlife may result in economic losses to agriculture and damage to property...Sensitivity to varying perspectives and values are required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well*."

Both sociological and biological carrying capacities must be considered when resolving wildlife damage problems. The wildlife acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. Biological carrying capacity is the land or habitat's ability to support healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). Those phenomena are especially important because they define the sensitivity of a person or community to a wildlife species. For any given damage situation, there are varying thresholds of tolerance exhibited by those people directly and indirectly affected by the species and any associated damage. This damage threshold determines the wildlife acceptance capacity. While the biological carrying capacity of a habitat may support higher populations of wildlife, in many cases, the wildlife acceptance capacity is lower or has been met. Once the wildlife acceptance capacity is met or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and safety.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 1990, Berryman 1991). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. Those species have no intent to do harm. They utilize habitats (*e.g.*, reproduce, walk, forage) where they can find a niche. If their activities result in lost economic value of

[3]After the development of the EA by WS and consulting agencies and after public involvement in identifying new issues and alternatives, WS will issue a Decision. Based on the analyses in the EA after public involvement, a decision will be made to either publish a Notice of Intent to prepare an Environmental Impact Statement or a Finding of No Significant Impact will be noticed to the public in accordance to NEPA and the Council of Environmental Quality regulations.

resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or pose a threat to human safety, people often seek assistance with resolving damage or reducing threats to human safety. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (*e.g.*, economic, social, aesthetics). Therefore, what constitutes damage is often unique to the individual person and damage occurring to one individual may not be considered damage by another individual. However, the use of the term "*damage*" is consistently used to describe situations where the individual person has determined the losses associated with wildlife is actual damage requiring assistance (*i.e.*, has reached an individual threshold). The term "*damage*" is most often defined as economic losses to resources or threats to human safety; however, "*damage*" could also be defined as a loss in the aesthetic value of property and other situations where the behavior of wildlife was no longer tolerable to an individual person.

The need for action to manage damage and threats associated with mammals in Mississippi arises from requests for assistance[4] received by WS. WS receives requests to reduce and prevent damage from occurring to four major categories: agricultural resources, natural resources, property, and threats to human safety. In addition, the TVA often experiences damage and threats of damage to property and natural resources, electric system operational reliability, as well as threats to human safety at their facilities. WS and the TVA have identified those mammal species most likely to be responsible for causing damage to those four categories in the State based on previous requests for assistance. Table 1.1 lists WS' technical assistance projects involving mammal damage or threats of damage to those four major resource types in Mississippi from the federal fiscal year[5] (FY) 2005 through FY 2011. Technical assistance has been provided by WS to those persons requesting assistance with resolving damage or the threat of damage. Technical assistance provides information and recommendations on activities to alleviate mammal damage that can be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 3 of this EA. Table 1.1 does not include direct operational assistance projects conducted by WS where WS was requested to provide assistance through the direct application of methods.

Table 1.1 – Technical assistance projects conducted by WS from FY 2005 through FY 2011

Species	Projects	Species	Projects
Nine-banded Armadillo	86	**Red Fox**	26
Virginia Opossum	28	**Bobcat**	18
Bat (All species)	183	**Woodchuck**	4
Eastern cottontail	4	**Southern Flying Squirrel**	7
Swamp Rabbit	1	**Gray Squirrel**	12
Black Bear	15	**Fox Squirrel**	7
Raccoon	188	**Feral Swine**	209
River Otter	26	**White-tailed Deer**	49
Striped Skunk	76	**Feral Cat**	8
Coyote	130	**Feral Dog**	19
Gray Fox	15	**TOTAL**	**1,111**

The technical assistance projects conducted by WS are representative of the mammal species that cause damage and threats in Mississippi. As shown in Table 1.1, WS has conducted 1,111 technical assistance projects in Mississippi from FY 2005 through FY 2011 that addressed damage and threats of damage

[4] WS would only conduct mammal damage management after receiving a request for assistance. Before initiating damage management activities, a Memorandum of Understanding, cooperative service agreement, or other comparable document would be signed between WS and the cooperating entity that would list all the methods the property owner or manager would allow WS to use on property they own and/or manage.
[5] The federal fiscal year begins on October 1 and ends on September 30 the following year.

associated with those mammal species addressed in this assessment from FY 2005 through FY 2011. Over 52% of the technical assistance projects conducted by WS from FY 2005 through FY 2011 have involved bats, raccoons, and feral swine. Requests for assistance involving bats are associated with damage to property and threats to human safety. Bats often enter into residences to roost and loaf where accumulations of droppings from the bats can cause damage to insulation and roofing support structures. Bats are also associated with rabies and become a concern when bats enter into the interior of a residence where interactions between bats and people occur. Concern can also be raised from the smell and threats to human safety from accumulations of fecal droppings in residences.

Requests for technical assistance associated with raccoons occur primarily from cooperators concerned with damage or threats of damage to property, agricultural resources, and human safety. Raccoons can cause damage to buildings and other property during attempts to gain entry into those structures. Agricultural damage occurs primarily from consumption of agricultural resources, such as crops and vegetables. Threats to human safety are also of concern to many people requesting assistance since raccoons are often associated with human activities and are known to carry diseases transmissible to people and pets.

Feral swine are a non-native species in Mississippi that cause damage to a wide variety of resources through consumption, trampling, rooting, wallowing, and as a possible reservoir for transmissible diseases. Most requests for technical assistance involve damage to agricultural resources associated with the consumption of crops and to property from animals destroying landscaping.

Table 1.2 lists those mammal species and the resource types that those mammal species can cause damage to in Mississippi. Many of the mammal species can cause damage to or pose threats to a variety of resources. In Mississippi, most requests for assistance received by WS are related to threats associated with those mammal species causing damage or threats of damage to property and human safety.

Table 1.2 – Mammal species that WS routinely receives requests for assistance and the resource type damage by those species

Species	Resource				Species	Resource			
	A	N	P	H		A	N	P	H
Nine-banded Armadillo	X	X	X	X	**Red Fox**	X	X	X	X
Virginia Opossum	X	X	X	X	**Bobcat**	X	X	X	X
Bat (All species)			X	X	**Woodchuck**	X		X	
Eastern Cottontail	X		X		**Southern Flying Squirrel**			X	
Swamp Rabbit	X		X		**Gray Squirrel**			X	
Black Bear	X		X	X	**Fox Squirrel**			X	
Raccoon	X	X	X	X	**Feral Swine**	X	X	X	X
River Otter	X		X		**White-tailed Deer**	X	X	X	X
Striped Skunk	X	X	X	X	**Feral Cat**	X	X	X	X
Coyote	X	X	X	X	**Feral Dog**	X	X	X	X
Gray Fox	X	X	X	X					

[a]A=Agriculture, N =Natural Resources, P=Property, H=Human Safety

More specific information regarding mammal damage to those main categories, including damages or threats that could occur on properties owned or managed by the TVA, are discussed in the following subsections of the EA:

Need for Mammal Damage Management on TVA Properties and Facilities

The TVA owns and manages over 293,000 acres in the Tennessee River system. All of these lands support TVA's goals of power generation and transmission, flood control, and economic development of the Tennessee River Valley. The TVA operates hydroelectric dams, coal-fired power plants, nuclear power plants, solar facilities, wind turbine facilities, and combustion turbine sites in Mississippi. The TVA also owns or maintains electrical power substations, switching stations, and the associated transmission lines and rights-of-way easements in Mississippi. In addition, the TVA operates public recreation areas throughout the Tennessee Valley region, including campgrounds, day-use areas, and boat launching ramps.

Mammal damage and threats of damage occurring at facilities and properties owned or managed by the TVA have occurred primarily to property, human safety, and potential electric system operational reliability. Woodchucks, and armadillos burrowing into earthen levees and dikes used to impound water can compromise the integrity of the structures and threaten the safety of people downstream from those impoundments.

Raccoons, opossums, foxes, coyotes, bobcats, feral cats, and feral dogs all reside on TVA lands. These animals frequently become overpopulated or lose their fear of humans, causing zoonotic disease transmission and aggressive behavior toward humans. Many of these lands are considered public or recreational lands and those individuals using these lands expect the TVA to manage mammal populations and reduce the possibilities of disease transmission and attack by wildlife. Mammals frequently enter substations and power generation facilities and threaten the interruption of power by chewing on various plastic components or climbing into areas of electric current and shorting out electrical circuits.

Need for Mammal Damage Management to Protect Human Health and Safety

Zoonoses (*i.e.*, wildlife diseases transmissible to people) are a major concern of cooperators when requesting assistance with managing threats from mammals. Disease transmission could occur from direct interactions between humans and mammals or from interactions with pets and livestock that have direct contact with wild mammals. Pets and livestock often encounter and interact with wild mammals, which can increase the opportunity of transmission of disease to humans. Table 1.3 shows common diseases affecting humans that can be transmitted by wild mammals in addition to diseases that affect other animals, including domestic species. These include viral, bacterial, mycotic (fungal), protozoal, and rickettsial diseases.

Table 1.3 - Wildlife Diseases in the Eastern United States that Pose Potential Health Risks through Transmission to Humans (Beran 1994, Davidson and Nettles 1997)[†]

Disease	Causative Agent	Hosts[‡]	Human Exposure
Anthrax	*Bacillus antracis*	cats, dogs	inhalation, ingestion
Tetanus	*Clostridium tetani*	mammals	direct contact
Dermatophilosis	*Dermatophilus congolensis*	mammals	direct contact
Leprosy	*Mycobacterium leprae*	armadillo	inhalation, direct contact
Pasteurellaceae	*Haemophilus influenzae*	mammals	bite or scratch
Salmonellosis	*Salmonella* spp.	mammals	ingestion
Yersinosis	*Yersinia* spp.	cats	ingestion
Chlamydioses	*Chlamydophilia felis*	cats	inhalation, direct contact
Typhus	*Rickettsia prowazekii*	opossums	inhalation, ticks, fleas
Sarcoptic mange	*Sarcoptes scabiei*	red fox, coyotes, dogs	direct contact

Disease	Causative Agent	Hosts[‡]	Human Exposure
Trichinosis	*Trichinella spiralis*	raccoons, fox	ingestion, direct contact
Rabies	*Lyssavirus* spp.	mammals	direct contact
Visceral larval	*Baylisascaris procyonis*	raccoons, skunks	ingestion, direct contact
Leptospirosis	*Leptospira interrogans*	mammals	ingestion, direct contact
Echinococcus	*Echinococcus multilocularis*	fox, coyotes	ingestion, direct contact
Toxoplasmosis	*Toxoplasma ondii*	cats, mammals	ingestion, direct contact
Spirometra	*Spirometra mansonoides*	bobcats, raccoons, fox	ingestion, direct contact
Giardiasis	*Giardia lamblia, G. duodenalis*	mammals	ingestion, direct contact

[†]Table 1.3 is not considered an exhaustive list of wildlife diseases that are considered infectious to humans that are carried by wildlife species. The zoonoses provided are the more common infectious diseases for the species addressed in this EA and are only a representation of the approximately 100 to 3,000 zoonoses known to exist.

[‡] The host species provided for each zoonosis includes only those mammalian species addressed in this EA unless the zoonoses listed potentially infects a broad range of mammalian wildlife. Zoonoses infecting a broad range of mammals are denoted by the general term "*mammals*" as the host species. The diseases listed do not necessarily infect only those mammalian species covered under this EA but likely infect several species of mammals or groups of mammals. For a complete discussion of the more prevalent diseases in free-ranging mammals, please refer to Beran (1994) and Davidson and Nettles (1997).

Individuals or property owners that request assistance with mammals frequently are concerned about potential disease risks but are unaware of the types of diseases that can be transmitted by those animals. In those types of situations, assistance is requested because of a perceived risk to human health or safety associated with wild animals living in close association with humans, from animals acting out of character by roving in human-inhabited areas during daylight, or from animals showing no fear when humans are present. Under the proposed action, WS could assist in resolving those types of requests for assistance.

In many circumstances when human health concerns are the primary reason for requesting WS' assistance there may have been no actual cases of transmission of disease to humans by mammals. Thus, the risk of disease transmission would be the primary reason for requesting assistance from WS. Situations in Mississippi where the threat of disease associated with wild or feral mammal populations may include:

- Exposure of residents to the threat of rabies due to high densities of raccoons or from companion animals encountering infected raccoons.
- Exposure of humans to threats of rabies posed by skunks that den under buildings or from companion animals interacting with infected skunks.
- Threats of parasitic infections to humans from *Giardia* spp. resulting from high feral cat populations in a park or recreation area.
- Concern about the threat of histoplasmosis from the disturbance of a large deposit of guano in an attic where a large colony of bats routinely roosts or raise young.
- Accumulated droppings from denning or foraging raccoons and the subsequent exposure of the public to raccoon roundworm in fecal deposits.
- Exposure of domestic livestock to the bacterium, *Brucella suis*, by feral swine. *B. suis* causes swine brucellosis.

The most common disease concern expressed by individuals requesting assistance is the threat of rabies transmission to humans, pets, and companion animals. Rabies is an acute, fatal viral disease of mammals most often transmitted through the bite of a rabid animal that poses an indirect and direct threat to humans. Indirect threats to humans occur from exposure from pets or livestock that have been infected from bites of a rabid animal. Direct threats can occur from handling infected wildlife or from aggressive animal behavior caused by rabies. The disease can be effectively prevented in humans when exposure is identified early and treated while domestic animals and pets can be vaccinated for rabies. However, the abundant and widely distributed reservoir among wild mammals complicates rabies control. The vast

majority of rabies cases reported to the Centers for Disease Control and Prevention (CDC) each year occur in raccoons, skunks (primarily *Mephitis mephitis*), and bats (Order Chiroptera) (CDC 2011).

Over the last 100 years, the vector of rabies in the United States has changed dramatically. About 90% or greater of all animal cases reported annually to CDC now occur in wildlife (Krebs et al. 2000, CDC 2011). Before 1960, the majority of cases were reported in domestic animals. The principal rabies hosts today are wild carnivores and bats. The number of rabies-related human deaths in the United States has declined from more than 100 annually in the early 1900s to an average of one or two people per year in the 1990s. Modern day prophylaxis, which is the series of vaccine injections given to people who have been potentially or actually exposed, has proven nearly 100% successful in preventing mortality when administered promptly (CDC 2011). In the United States, human fatalities associated with rabies occur in people who fail to seek timely medical assistance, usually because they were unaware of their exposure to rabies. Although human rabies deaths are rare, the estimated public health costs associated with disease detection, prevention, and control have risen, exceeding $300 million annually. Those costs include the vaccination of companion animals, maintenance of rabies laboratories, medical costs such as those incurred for exposure case investigations, rabies post-exposure prophylaxis (PEP), and animal control programs (CDC 2011).

Accurate estimates of the aforementioned expenditures are not available. Although the number of PEPs given in the United States each year is unknown, it has been estimated to be as high as 40,000. When rabies becomes epizootic (*i.e.*, affecting a large number of animals over a large area) or enzootic (*i.e.*, present in an area over time but with a low case frequency) in a region, the number of PEPs in that area increases. Although the cost varies, a course of rabies immunoglobulin and five doses of vaccine given over a 4-week period typically exceeds $1,000 (CDC 2011) and has been reported to be as high as $3,000 or more (Meltzer 1996). As epizootics spread in wildlife populations, the risk of "*mass*" human exposures requiring treatment of large numbers of people that contact individual rabid domestic animals infected by wild rabid animals increases. One case in Massachusetts involving contact with, or drinking milk from, a single rabid cow required PEPs for 71 persons (CDC 1999). The total cost of this single incident exceeded $160,000 based on a median cost of $2,376 per PEP in Massachusetts. Likely, the most expensive single mass exposure case on record in the United States occurred in 1994 when a kitten from a pet store in Concord, New Hampshire tested positive for rabies after a brief illness. Because of potential exposure to the kitten or to other potentially rabid animals in the store, at least 665 persons received post-exposure rabies vaccinations at a total cost of more than $1.1 million (Noah et al. 1995). The American Veterinary Medical Association (AVMA) estimated the total cost for this specific incident, including investigation, laboratory testing, and rabies immunoglobulin and vaccines was more than $1.5 million (AVMA 2004).

Raccoons have been associated with the spread of rabies throughout the eastern United States, including States adjacent to Mississippi (Mississippi State Department of Health 2008). Rabies in raccoons was virtually unknown prior to the 1950s. It was first described in Florida and spread slowly during the next three decades into Georgia, Alabama, and South Carolina. It was unintentionally introduced into the Mid-Atlantic States, probably by translocation of infected animals (Krebs et al. 1998). The first cases appeared in West Virginia and Virginia in 1977 and 1978, respectively. Since then, raccoon variant rabies expanded to form the most intensive rabies outbreak in the United States. The variant is now enzootic in all of the eastern coastal states, as well as Alabama, Pennsylvania, Vermont, West Virginia, and most recently, parts of Ohio (Krebs et al. 2000). The raccoon rabies epizootic front reached Maine in 1994, reflecting a movement rate of about 30 to 35 miles per year. The westward movement of the raccoon rabies front has slowed, probably in response to both natural geographic and man-made barriers. The Appalachian Mountains and perhaps river systems flowing eastward have helped confine the raccoon variant to the eastern United States. In addition, the USDA has created an oral rabies vaccine (ORV) "*barrier*" of vaccinated wild animals on the western edge of the Appalachian Mountains (USDA 2005).

If this combined barrier is breached by raccoon variant rabies, research suggests that raccoon populations are sufficient for rabies to spread westward along a front at a rate similar to or greater than the rate at which this rabies strain has spread in the eastern United States (Sanderson and Huber, Jr. 1982, Glueck et al. 1988, Hasbrouck et al. 1992, Mosillo et al. 1999).

Raccoon variant rabies presents a human health threat through potential direct exposure to rabid raccoons, or indirectly through the exposure of pets that have an encounter with rabid raccoons. Additionally, the number of pets and livestock examined and vaccinated for rabies, the number of diagnostic tests requested, and the number of post exposure treatments are all higher when raccoon rabies is present in an area. Human and financial resources allocated to rabies-related human and animal health needs also increase, often at the expense of other important activities and services.

Skunks are also an important wildlife host for the rabies virus in North America and are second only to raccoons in being the most commonly reported rabid wildlife species in the United States (Majumdar et al. 2005). The skunk variant of rabies may be found in the Midwest and California; however, skunks found throughout North America may be infected with different variants of rabies such as the raccoon variant. The distribution of rabies in skunks extends from Georgia to Maine east of the Appalachians, Texas to the Canadian border, and throughout the northern two thirds of California (Majumdar et al. 2005). The fox is one of the four major maintenance hosts for rabies in North America. In the 1950s, rabies in red fox spread throughout Canada, parts of New England, and Alaska. The range has since decreased, but fox rabies persists in Alaska and parts of Texas. Clinical signs of rabies in fox are often manifested as the "*furious*" form of rabies (Majumdar et al. 2005).

In an effort to halt the westward spread of the raccoon variant of the rabies virus and to limit the spread of the canine variant from Texas, WS began participating in the distribution of ORV baits (fishmeal polymer containing Raboral V-RG® vaccine [Merial, Athens, Georgia, USA]). Currently, WS participates in the distribution of ORV baits and the surveillance of wildlife rabies vectors in 26 states. Although raccoon strain rabies is not currently known to occur in Mississippi, the raccoon rabies variant is known to occur in adjacent States. A raccoon in Clarke County, Alabama tested positive for rabies in 2004, which is only 25 miles from Wayne County, Mississippi in the southeastern portion of the State (Mississippi State Department of Health 2008). Most incidents of rabies currently occurring in the State are associated with bats (Mississippi State Department of Health 2008).

Increasing populations of raccoons have been implicated in the outbreak of distemper in certain areas (Majumdar et al. 2005). Distemper has not been identified as transmissible to humans. However, cooperators who feel threatened by the possibility of disease transmission often request assistance after observing sick raccoons on their property. Symptoms of distemper often lead to abnormal behavior in raccoons that are similar to symptoms associated with rabies. Raccoons with distemper often lose their fear of humans and can act aggressively which increases the risk that people, livestock, or companion animals may be bitten. Distemper is also known to occur in coyotes, red fox, and gray fox with symptoms that are similar to those exhibited by animals infected with the rabies virus.

Diseases and parasites affecting feral cats and dogs can have particularly serious implications to human health given the close association of those animals with humans and companion animals. The topic of feral animals and their impacts on native wildlife and human health elicits a strong response in numerous professional and societal groups with an interest in the topic. Feral cats and dogs are considered by most professional wildlife groups to be a non-native species that has detrimental impacts to the native ecosystems especially in the presence of a human altered landscape. However, a segment of society views feral animals to be an extension of companion animals that should be cared for and for which affection bonds are often developed especially when societal groups feed and care for individual feral animals. Of special concern are those cats and dogs considered companion animals that are not confined

indoors at all times but are allowed to range outside the home for extended periods. If interactions occur between companion animals and feral animals of the same species, companion animals could become exposed to a wide-range of zoonoses that could be brought back into the home where direct contact between the companion animal and people increases the likelihood of disease transmission. Feral animals that are considered companion animals are also likely to affect multiple people if disease transmission occurs since those animals are likely to come in direct contact with several members of families and friends before diagnosis of a disease occurs.

Several known diseases that are infectious to humans, including rabies, have been found in feral cats and dogs. A common zoonosis found in cats is ringworm. Ringworm (*Tinea* spp.) is a contagious fungal disease contracted through direct interactions with an infected person, animal, or soil. Other common zoonoses of cats are pasteurella, salmonella, cat scratch disease, and numerous parasitic diseases, including roundworms, tapeworms, and toxoplasmosis.

Most of the zoonoses known to infect cats and dogs that are infectious to humans are not life threatening if diagnosed and treated early. However, certain societal segments are at higher risks if exposed to zoonoses. Women who are pregnant, people receiving chemotherapy for immunologic diseases and organ transplants, and those with weakened immune systems are at increased risk of clinical disease if exposed to toxoplasmosis (AVMA 2004). In 1994, five Florida children were hospitalized with encephalitis that was associated with cat scratch fever (AVMA 2004). The daycare center at the University of Hawaii in Manoa was closed for two weeks in 2002 because of concerns about potential transmission of murine typhus (*Rickettsia typhi*) and flea (*Ctenocephalides felis*) infestations afflicting 84 children and faculty. The fleas at the facility originated from a feral cat colony that had grown from 100 cats to over 1,000, despite a trap, neuter, and release effort (AVMA 2004).

A study in France determined that stray cats serve as major reservoirs for the bacterium *Bartonella* spp. Consequently, stray cats and their fleas (*Ctenocephalides felis*) are the only known vectors for infecting house bound cats and humans with this bacterium. Humans are not infected via the flea, but pet cats often are infected by fleabites. Human infections that may result from exposure of this bacterium via stray cats include cat scratch disease in immunocompetent patients, bacillary angiomatosis, hepatic peliosis in immunocompromised patients, endocarditis, bacteremia, osteolytic lesions, pulmonary nodules, neuroretinitis, and neurologic diseases (Heller et al. 1997). In areas where dog rabies has been eliminated, but rabies in wildlife has not, cats often are the most significant animal transmitting rabies to humans (Vaughn 1976, Eng and Fishbein 1990, Krebs et al. 1996).

Feral swine can pose a threat to human safety from disease transmission, from aggressive behavior, and from being struck by vehicles and aircraft. Feral swine are potential reservoirs for at least 30 viral and bacterial diseases (Davidson and Nettles 1997, Samuel et al. 2001, Williams and Barker 2001, Davidson 2006) and 37 parasites (Forrester 1991) that are transmissible to humans. Brucellosis, salmonellosis, toxoplasmosis, trichinosis, tuberculosis, and tularemia are some of the common diseases that can be carried by feral swine that are also known to infect humans (Stevens 1996, Hubalek et al. 2002, Seward et al. 2004). In addition, feral swine can pose risks to domestic livestock through the potential transmission of diseases between feral swine populations and domestic livestock where interactions may occur. Actual transmission of diseases from feral swine to humans is rare (Amass 1998).

Conflicts involving bats can include property damage, but primarily involve threats to human, pet, and livestock health. The buildup of bat droppings and urine in attics and between walls can result in odor problems and discoloration of walls and ceilings (Agency for Toxic Substances and Disease Registry 1998). In addition to the threat of rabies from direct contact or a bat entering the living area of a home, there are other threats associated with bat colonies including histoplasmosis, fungal spores, and mites.

Bat droppings, particularly when they accumulated for many years, are likely to be contaminated with the fungus, *Histoplasma capsulatum* or with fungi species such as molds, especially in warm, moist conditions. As long as people are not in contact with fungal spores, they are unlikely to be affected by them. When people inhale spores from *H. capsulatum*, they may become ill with a disease known as histoplasmosis. Symptoms of histoplasmosis include some combination of mild, flu-like respiratory illness, a general ill feeling, chest pain, fever, cough, headache, loss of appetite, shortness of breath, joint and muscle pains, chills, and hoarseness. Although there are other, more rare illnesses associated with exposure, the most likely is histoplasmosis. Similarly, mold spores released into the air may result in increases in asthma attacks (Agency for Toxic Substances and Disease Registry 1998).

Bat bugs (*Cimex adjunctus*) are free-living ectoparasites of bats that feed on blood. They will bite humans in the absence of their primary hosts. The main means of dispersal for bat bugs is by clinging to the fur of bats as bats move between locations. Typically, bat bug infestations originate from bat populations established in attics, wall voids, unused chimneys, or uninhabited portions of a house. Bat bugs typically do not wander far from occupied bat roosting sites where they have easy access to food. However, if their normal hosts were eliminated or the area was vacated, bat bugs are known to seek other sources of food and may crawl about and invade living areas within the house (Jones and Jordan 2004). Similarly, bat mites may enter the home and bite people. Although their bite is not particularly harmful, the person may experience an allergic reaction and develop a skin rash in response (Agency for Toxic Substances and Disease Registry 1998).

This discussion on zoonoses is intended to briefly address the more common known zoonoses found in the United States for those species specifically addressed in this EA but is not intended to be an exhaustive discussion of all potential zoonoses. The transmission of diseases from wildlife to humans is neither well documented nor well understood for most infectious zoonoses. Determining a vector for a human infected with a disease known to occur in wildlife populations is often complicated by the presence of the known agent across a broad range of naturally occurring sources. For example, a person with salmonella poisoning may have contracted salmonella bacterium from direct contact with an infected pet but may have also contracted the bacterium from eating undercooked meat or from other sources.

Disease transmission directly from wildlife to humans is uncommon. However, the infrequency of such transmission does not diminish the concerns of those individuals requesting assistance that are fearful of exposure to a diseased animal since disease transmissions have been documented to occur. WS actively attempts to educate the public about the risks associated with disease transmission from wildlife to humans through technical assistance and by providing technical leaflets on the risks of exposure.

In addition to disease transmission threats, requests are also received for assistance from perceived threats of physical harm from wildlife, especially from predatory wildlife. Human encroachment into wildlife habitat increases the likelihood of human-wildlife interactions. Those species that humans are likely to encounter are those most likely to adapt to and thrive in human altered habitat. Several predatory and omnivorous wildlife species thrive in urban habitat due to the availability of food, water, and shelter. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting the act in many areas. The constant presence of human created refuse, readily available water supplies, and abundant rodent populations found in some areas often increases the survival rates and carrying capacity of wildlife species that are adaptable to those habitats. Often the only limiting factor of wildlife species in and around areas inhabited by people is the prevalence of diseases, which can be confounded by the overabundance of wildlife congregated into a small area that can be created by the unlimited amount of food, water, and shelter found within those habitats.

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by people toward many species of wildlife has led to a decline in the fear wildlife have toward people. When

wildlife species begin to habituate to the presence of humans and human activity, a loss of apprehension occurs that can lead to threatening behavior toward humans. This threatening behavior continues to increase as human populations expand and the populations of those species that adapt to human activity increase. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward people, or abnormal behavior. Although wildlife attacking people occurs rarely, the number of attacks appears to be on the increase. Timm et al. (2004) reported that coyotes attacking people have increased in California and the recent, highly publicized coyote attacks, including a fatal attack on a 19-year old woman in Nova Scotia (Canadian Broadcast Company 2009), have only heightened people's awareness of the threat of such encounters.

Black bears occasionally threaten human health and safety. Herrero (1985) documented 500 injuries to humans resulting from encounters with black bears from 1960 to 1980. Of those, 90% were minor injuries (minor bites, scratches, and bruises). Only 23 fatalities were recorded from 1900 to 1980 due to black bear attacks. The number of bear attacks could be considered low considering the geographic overlap of human and black bear populations. Of those fatalities, 90% were likely associated with habituated, food-conditioned bears. For example, black bear attacks have resulted in recent fatalities occurring at the Great Smoky Mountains National Park in 2000 and the Cherokee National Forest in 2006 in Tennessee. Often, wildlife exhibiting threatening behavior or a loss of apprehensiveness to the presence of humans is a direct result and indication of an animal inflicted with a disease. So, requests for assistance are caused by both a desire to reduce the threat of disease transmission and from fear of aggressive behavior either from an animal that is less apprehensive of people or induced as a symptom of disease.

The primary request for assistance to reduce threats to human safety received by WS is to lessen the threat of disease transmission from exposure to wildlife. Since FY 2005, the two wildlife species of most concern to the public in Mississippi, based on requests for assistance received by WS, are skunks and raccoons. Public concerns are due to the high prevalence of zoonotic diseases in the populations of those two species. To a lesser extent is a concern for threats caused by feral cats. Feral cat colonies have been established at several TVA sites and facilities, including public use recreation areas, requiring removal by WS personnel to ensure public health and safety and biological diversity.

As part of the proposed program, WS could provide mammal damage management assistance, upon request, involving those mammal species addressed in this EA that pose a threat to human health and safety to any requester experiencing such a threat throughout Mississippi.

Disease Surveillance and Monitoring

Public awareness and health risks associated with zoonoses (*i.e.*, diseases of animals that can be transmitted to humans) have increased in recent years. Several zoonotic diseases associated with mammals are addressed in this EA. Those zoonotic diseases remain a concern and continue to pose threats to human safety where people encounter mammals. WS has received requests to assist with reducing damage and threats associated with several mammal species in Mississippi and could conduct or assist with disease monitoring or surveillance activities for any of the mammal species addressed in this EA. Most disease sampling would occur ancillary to other wildlife damage management activities (*i.e.*, disease sampling occurs after wildlife have been captured or lethally taken for other purposes). For example, WS may sample deer harvested during the annual hunting season or during other damage management programs for Chronic Wasting Disease or may collect ticks from raccoons that were lethally taken to alleviate damage occurring to property. WS could sample feral swine taken by private landowners or during damage management activities to test for classical swine fever, swine brucellosis, pseudorabies, or other diseases.

Need for Mammal Damage Management at Airports

Airports provide ideal conditions for many wildlife species due to the large open grassy areas adjacent to brushy, forested habitat used as noise barriers. Access to most airport properties is restricted so wildlife living within airport boundaries would be protected during hunting and trapping seasons and would be insulated from many other human disturbances.

The civil and military aviation communities have acknowledged that the threat to human health and safety from aircraft collisions with wildlife is increasing (Dolbeer 2000, MacKinnon et al. 2001, Dolbeer 2009). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety (Thorpe 1996), result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Robinson 1996, Thorpe 1997, Keirn et al. 2010). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995).

Between 1990 and 2010, there were 2,558 reported aircraft strikes involving terrestrial mammals in the United States (Dolbeer et al. 2012). The number of mammal strikes actually occurring is likely to be much greater, since Dolbeer (2009) estimated 39% of civil wildlife strikes are actually reported. Civil and military aircraft have collided with a reported 36 species of terrestrial mammals from 1990 through 2010, including raccoons, gray fox, red fox, cats, coyotes, opossums, and striped skunks. In addition, 13 species of bats have been identified as having been struck by aircraft in the United States (Dolbeer et al. 2012). Of the terrestrial mammals reported struck by aircraft, 33% were carnivores (primarily coyotes), causing nearly $3.2 million in damages (Dolbeer et al. 2012). Deer accounted for 39% of the reported strikes involving terrestrial mammals in the United States causing nearly $31 million in damages (Dolbeer et al. 2012). Data also indicates that a much higher percentage of mammal strikes resulted in aircraft damage compared to bird strikes (Dolbeer et al. 2012). Costs of those collisions vary, but the Federal Aviation Administration (FAA) data reveals that mammal strikes in the United States cost the civil aviation industry approximately 275,290 hours of down time and $41.1 million in direct monetary losses between 1990 and 2010 (Dolbeer et al. 2012).

About 59% of mammal strikes in the United States have resulted in damage compared to 13% for birds from 1990 through 2010 (Dolbeer et al. 2012). In addition to direct damage, an aircraft striking a mammal can pose serious threats to human safety if the damage from the strike causes a catastrophic failure of the aircraft leading to a crash. For example, damage to the landing gear during the landing roll and/or takeoff run can cause a loss of control of the aircraft, causing additional damage to the aircraft and increasing the threat to human safety. Nearly 63% of the reported mammal strikes from 1990 through 2010 occurred at night, with 63% occurring during the landing roll or the takeoff run (Dolbeer et al. 2012).

Between 1990 and 2010, aircraft have struck three coyotes, one domestic dog, one Eastern pipistrelle, one red bat, one red fox, and seven white-tailed deer in Mississippi according to reports filed with the FAA (FAA 2010). Airports in Mississippi have requested assistance to manage the threat to human safety and damage to property caused by mammals present inside the area of operations of the airport. The infrequency of mammal strikes does not lessen the need to prevent threats to human safety and the prevention of damage to property. Preventing damage and reducing threats to human safety is the goal of those cooperators requesting assistance at airports in Mississippi given that a potential strike can lead to the loss of human life and considerable damage to property.

Wildlife populations near or found confined within perimeter fences at airports can be a threat to human safety and cause damage to property when struck by aircraft. Those wildlife confined inside the airport perimeter fence would not be considered distinct populations nor separate from those populations found outside the perimeter fence. Wildlife found within the boundaries of perimeter fences originate from

populations outside the fence. Those individuals of a species inside the fence neither exhibit nor have unique characteristics from those individuals of the same species that occur outside the fence; therefore, those individuals of a species confined inside an airport perimeter fence do not warrant consideration as a unique population under this analysis.

Need for Mammal Damage Management to Alleviate Agricultural Damage

Armadillos, opossum, bears, raccoons, otters, skunks, coyotes, fox, bobcats, woodchucks, feral swine, deer, feral cats, and feral dogs can cause losses or injury to crops, livestock (*e.g.*, sheep, goats, cattle, pigs, horses) and poultry (*e.g.*, chickens, turkeys, geese, ducks) through predation. During 2001, crop and livestock losses from wildlife in the United States totaled $944 million, with field crop losses totaling $619 million, livestock and poultry losses totaling $178 million, and losses of vegetables, fruits, and nuts totaling $146 million. Those losses include destruction of or damage to crops in the field and death or injury to livestock. In 2001, the National Agricultural Statistics Service (NASS) reported that raccoons were responsible for 6%, 3%, and 6% of the total damage to field crops; livestock and poultry; and vegetables, fruits, and nuts, respectively, in the United States (NASS 2002). In addition, white-tailed deer accounted for 58% of the total field crop damage and 33% of vegetable, fruit, and nut damage. Wild pigs accounted for 3% or $18.5 million in damages to field crops (NASS 2002).

In 2010, the NASS (2011) reported cattle and calf losses from animal predation totaled 219,900 head in the United States according to livestock producers. Animal predation represented 5.5% of the total cattle and calf losses reported by livestock producers in 2010 totaling $98.5 million in economic losses. Coyotes were indicated as the primary predator of livestock with 53.1% of cattle and calf losses attributed to coyotes. Livestock losses were also attributed to bobcats, bears, and dogs. Producers spent nearly $188.5 million dollars on non-lethal methods to reduce cattle and calf losses from predation by animals in 2010 (NASS 2011). The primary non-lethal method employed by livestock producers was the use of guard animals with a reported 36.9% of producers using guard animals. Producers also reported using exclusion fencing, frequent checking, and culling as additional employed methods for reducing predation (NASS 2011).

In Mississippi, the NASS (2011) reported 800 cattle and 2,800 calves were killed in 2010 by animal predators. The economic loss from animal predators in Mississippi was estimated at over $1.5 million in 2010 (NASS 2011). Coyotes were attributed to 79.3% of the cattle losses and 65.9% of the calves lost in Mississippi. Dogs accounted for 17.2% of the cattle reported lost while 16.0% of the calves lost were attributed to dogs in the State (NASS 2011). Cattle producers in the United States indicated mountain lions and bobcats[6] caused 7.8% of the cattle and calf losses attributed to animal predators in 2010 (NASS 2011). Bobcats are also known to prey on other livestock. Cattle producers in Mississippi reported using a number of non-lethal methods to reduce losses due to predators. The use of exclusion fencing was reported as being employed by 17.2% of Mississippi cattle producers along with 72.4% reporting the use of guard animals (NASS 2011).

Woodchucks (commonly referred to as groundhogs) can cause damage to field crops, such as row and forage crops, orchards, nursery plants, and commercial gardens. Cottontail rabbits and voles are reported to damage orchard trees by gnawing at the base of the tree. Trees are badly damaged or the bark is girdled and trees die when feeding by rabbits and voles is severe. Similar damage occurs in nurseries, which grow landscape ornamentals and shrubs.

[6]The 2011 NASS cattle loss report groups mountain lion and bobcat predation into one category and does not separate losses attributed to the two species. Mountain lions, given their preference for larger prey, are likely the cause of most of the losses attributed to this category, especially to adult cattle. However, bobcats are known to prey upon calves though infrequently.

River otters and to a lesser extent bears and raccoons may prey on fish and other cultured species at hatcheries and aquaculture facilities (Bevan et al. 2002). River otters may even prey on fish in marine aquaculture facilities (Goldburg et al. 2001).

The domestic cat has been found to transmit *Toxoplasma gondii* to both domestic and wild animal species. Cats have been found to be important reservoirs and the only species known to allow for the completion of the life cycle for the protozoan parasite *T. gondii* (Dubey 1973, Teutsch et al. 1979). Both feral and domiciled cats may be infected by this protozoan, but this infection is more common in feral cats. Fitzgerald et al. (1984) documented that feral cats transmitted *T. gondii* to sheep in New Zealand, resulting in ewes aborting fetuses. The authors also found *Sarcocystis* spp. contamination in the musculature of sheep. Dubey et al. (1995) found cats to be 68.3% positive for seroprevalence of *T. gondii* on swine farms in Illinois and the major reservoir for this disease. The main sources for infecting cats are thought to be birds and mice.

Agricultural damage and threats caused by feral swine in Mississippi occurs to crops, livestock, and other agricultural resources. Damage occurs from direct consumption of agricultural crops and from trampling, rooting, and/or wallowing that are common activities of feral swine (Beach 1993). Rooting is a common activity of feral swine during their search for food where they overturn sod and soil (Stevens 1996). Feral swine also wallow in water and mud to regulate body temperature and to ward off skin parasites.

Damage and threats to livestock associated with feral swine occurs from predation on livestock and the risks associated with disease transfer from feral swine to domestic livestock. Feral swine can also cause damage to other agricultural resources. For example, feral swine can cause damage to pastures and land used for hay by rooting and wallowing, can cause damage to ponds and water sources for livestock, and can cause damage from the consumption of livestock feed. Feral swine feeding activities in agricultural crops can also lead to increased erosion from the removal of vegetation that leaves the soil bare along with the overturning of soil caused by rooting.

In addition, feral swine also damage pastures, land used for hay, and sod farms from rooting and wallowing activities (Beach 1993). Rooting activities can also lead to increased erosion and soil loss. Wallowing and rooting activities in livestock watering areas can lead to a degradation in water quality through an increase in turbidity, by causing algal blooms, by depleting dissolved oxygen, and increasing erosion (Beach 1993). Since feral hogs often travel in family groups, damages from rooting and wallowing can be extensive often encompassing several acres.

Additional risks associated with feral hogs are the potential for disease transmission from feral swine to domestic livestock, especially to domestic swine. Feral swine are potential reservoirs for several diseases that are known to be transmissible between feral swine and domestic livestock (Wood and Barrett 1979, Corn et al. 1986, Beach 1993, Davidson 2006). Corn et al. (1986) found feral swine tested in Texas were positive for pseudorabies, brucellosis, and leptospirosis. A study in Oklahoma found samples from feral swine tested positive for antibodies of porcine parvovirus, swine influenza, and porcine reproductive and respiratory syndrome virus (Saliki et al. 1998). Cholera, trichinosis, and African swine fever are additional diseases that can be transmitted between livestock and feral swine. Disease transmission is likely to occur where domestic livestock and feral swine have a common interface, such as at water sources and livestock feeding areas.

Although several diseases that are carried by swine are also transmissible to other livestock, the primary concern is the potential transmission of diseases from feral swine to domestic swine. Pseudorabies is a viral disease associated with an extremely contagious herpes virus that can have negative effects on reproduction in domestic swine. Brucellosis is a bacterial disease that can also have negative effects on reproduction in swine. Many of the other diseases associated with feral swine also negatively affect the

health and marketability of domestic swine that can lead to economic losses to the livestock producer. The United States is one of the world's largest producers of pork and is the second largest exporter of pork. Pork production in the United States accounts for about 10% of the total world supply. The retail value of pork sold to consumers exceeds $30 billion annually. In addition, the pork industry supports more than 600,000 jobs. An economic analysis estimated that the annual cost of pseudorabies to pork producers in the United States at more than $30 million annually in lost production as well as testing and vaccination costs (USDA 2008).

Although the source of livestock disease outbreaks can be difficult to identify, a risk of transmission and the spreading of diseases to domestic swine and other livestock exists wherever feral swine and domestic livestock interact. A disease outbreak not only has negative economic implications to the individual livestock producer, but also can cause economic losses that can negatively affect the statewide and national swine industry.

In addition to the potential for disease transmission, feral swine are also known to predate on livestock. Feral swine are known to kill calves, kids, lambs, and poultry (Stevens 1996, West et al. 2009). Predation occurs primarily on young livestock but feral hogs can also kill weakened or injured livestock. If feral swine populations continue to increase, WS could be requested to address localized predation associated with feral swine.

Examples of some of the requests for assistance to resolve or alleviate damage to agricultural resources that the WS' program in Mississippi has responded to include:

- Coyotes attacking and killing calves, lambs, chickens, and emus
- Raccoons digging up grass and sod while foraging for insects
- Gray squirrels feeding on strawberries, peaches, and pecans
- Gray fox killing chickens and domestic waterfowl
- Striped skunks killing chickens
- Feral dogs killing goats
- River otter predating on farm raised catfish
- Bobcats predating on farm raised chickens
- Feral swine damaging crops

Need to Resolve Damage Occurring to Natural Resources

Natural resources may be described as those assets belonging to the public and often managed and held in trust by government agencies as representatives of the people. Such resources may be plants or animals, including threatened and endangered (T&E) species; historic properties; or habitats in general. Examples of natural resources in Mississippi are historic structures and places; parks and recreation areas; natural areas, including unique habitats or topographic features; threatened and endangered plants or animals; and any plant or animal populations which have been identified by the public as a natural resource.

Mammals can also cause damage to natural resources. Mammals causing damage are often locally overabundant at the damage site and threaten the welfare of a species population identified as a natural resource. An example of this would be nest predation of a local ground-nesting bird population by mammalian carnivores, such as raccoons, armadillos, opossum, feral swine, feral cats, coyotes, or fox.

Scientists estimate that nationwide cats kill hundreds of millions of birds and more than a billion small mammals, such as rabbits, squirrels, and chipmunks, each year. The American Bird Conservancy (ABC) states that "*cats often kill common* [bird] *species such as cardinals, blue jays, and house wrens, as well as*

rare and endangered species such as piping plovers, Florida scrub-jays, and California least terns" (ABC 2011). Some feral and free-ranging cats kill more than 100 animals each year. For example, at a wildlife experiment station, a roaming, well-fed cat killed more than 1,600 animals over 18 months, primarily small mammals (ABC 2011). Researchers at the University of Wisconsin coupled their four-year cat predation study with the data from other studies, and estimated that rural feral and free-ranging cats kill at least 7.8 million and perhaps as many as 217 million birds a year in Wisconsin (Coleman et al. 1997). In some parts of Wisconsin, feral and free ranging cat densities reached 114 cats per square mile, outnumbering all similar-sized native predators (Coleman et al. 1997). Churcher and Lawton (1989) observed 77 well fed free-ranging cats in a British village for one year. Churcher and Lawton (1989) estimated that 30% to 50% of a cat's catch were birds and that the cats had adversely affected house sparrow populations within the village. Based on information acquired in the study, Churcher and Lawton (1989) estimated that more than 20 million birds are killed by cats in Britain each year with more than 70 million animals overall being taken by cats annually.

The diet of feral and free-ranging cats varies depending on availability, abundance, and geographic location. In a survey of New Zealand scientific literature, Fitzgerald (1990) concluded that prey selection of feral and free-ranging cats is dependent on availability. Fitzgerald (1990) found that cats on the mainland fed most heavily on mammals; whereas, cats on islands fed almost exclusively on birds (particularly seabirds). Feral and free-ranging cats are known to prey on birds as large as mallard ducks (Figley and VanDruff 1982) and young brown pelicans (Anderson et al. 1989) along with mammals as large as hares and rabbits. Many cat populations rely heavily on humans, either for handouts and/or for garbage. Pearson (1971) found that cats were serious predators of California voles and that the greatest pressure on voles occurred when vole numbers were lowest. Liberg (1984) found that cats in southern Sweden fed predominantly on native mammals. Prey use was based more on availability than abundance. Langham (1990) found that mammals made up 74% of diets of New Zealand farmland feral cats, while 24% were birds. Cats fed most heavily on the most abundant species and groups. A study on a southern Illinois farmstead concluded that well-fed cats preferred microtine rodents; however, they also consumed birds (George 1974). Microtine rodents are particularly susceptible to over harvest by cats and other predators (Pearson 1964). Coman and Brunner (1972) found that small mammals were the primary food item for feral cats in Victoria, Australia. Prey selection was directly related to proximity of cats to human habitation. Pearson (1964) found rodents composed a large portion of a cat's diet. Some people view cat predation of rodents as beneficial, but native small mammals are important to maintaining biologically diverse ecosystems. Field mice and shrews are also important prey for birds, such as great horned owls and red-tailed hawks.

Childs (1986) and Childs (1991) found that urban cats use of rats is size limiting. Few rats of reproductive size or age were preyed on by domesticated cats. In rural areas, rats were more vulnerable to cat predation for longer periods. The duration of susceptibility of rats to predation was attributed to abundance of garbage and artificial food sources in the urban environment. Artificial feeding of cats also reduces predation to non-native rodents because of size differences in urban rats. In rural setting, cats can control rat populations for longer durations but ultimate suppression of population growth is achieved via chemicals (poisons). Jackson (1951) found feral and free-ranging cats in Baltimore, Maryland urban areas were insignificant predators of Norway rats (*Rattus norvegicus*). The largest percentage of ingested food was comprised of garbage. It was estimated that a cat in the study area would consume roughly 28 rats per year.

Impacts from cat predation are not always direct, but indirect in the form of competition for food resources. George (1974) speculated that domestic cats were not a direct limiting factor on bird populations. However, the author did find evidence indicating cats indirectly could affect some birds-of-prey by competing for a limited resource (primarily microtine rodents). Feral cat colonies have been

established at several TVA sites and facilities valley-wide, including public use recreation areas, requiring removal by WS personnel to ensure public health and safety and biological diversity.

Reptiles are thought to provide an important food source to cats when birds and mammals are less abundant, and in some situations, cats have been observed to prey on threatened species of reptiles. Domesticated cats have been identified as significant nest and/or hatchling predators of sea turtles. A study on the Aldabra Atoll, Seychelles found feral cats had an adverse effect on green turtle hatchlings. Seabrook (1989) found a positive correlation in cat activity and green turtle nesting at Aldabra Atoll. Cats are known to have contributed to the near extirpation of the West Indian rock iguana (*Cyclura carinata*) on Pine Cay in the Caicos Islands (Iverson 1978).

Cats can adversely affect local wildlife populations, especially in habitat "*islands*", such as suburban and urban parks, wildlife refuges, and other areas surrounded by human development (Wilcove 1985). The loss of bird species from habitat islands is well documented and nest predation is an important cause of the decline of neotropical migrants (Wilcove 1985). A two-year study was conducted in two parks with grassland habitat. One park had no cats but more than 25 cats were being fed daily in the other park. There were almost twice as many birds seen in the park with no cats as in the park with cats. California thrasher and California quail, both ground-nesting birds, were seen during surveys in the no-cat area; whereas, they were never seen in the cat area. In addition, more than 85% of the native seer mice and harvest mice trapped were in the no-cat area; whereas, 79% of the house mice, an exotic pest species, were trapped in the cat area. The researchers concluded, "*Cats at artificially high densities, sustained by supplemental feeding, reduce abundance of native rodent and bird populations, change the rodent species composition, and may facilitate the expansion of the house mouse into new areas*" (Hawkins et al. 1999).

WS could also be requested to provide assistance associated with mammal damage at historical sites within the State. WS has previously been requested to provide assistance associated with woodchucks burrowing into earthen embankments at Civil War national historic sites in Mississippi. Woodchucks can cause extensive damage by burrowing and denning in earthen levees and other mounds. Burrowing activities can threaten the integrity of the earthen embankments. In addition, burrows can be aesthetically displeasing to the public and can cause damage to mowing equipment. In addition, there are thousands of archaeological and historical sites on TVA retained properties, some of which are extremely sensitive that could be disturbed by the burrowing and activities of mammals. Many of those sites, especially earthen mounds, have been damaged by the burrowing of woodchucks and could be damage by similar activities associated with nine-banded armadillos.

Feral swine compete with over 100 species of native wildlife for important and limited natural food supplies. Some species including quail, turkey, endangered sea turtles, and shorebirds are at risk of predation by nest destruction and the consuming of eggs. Feral swine cause damage to natural areas such as parks and wildlife management areas in Mississippi. Those sites suffer erosion and local loss of critical ground plants and roots, as well as destruction of seedlings because of feral swine feeding and rooting (Barrett and Birmingham 1994). Many state and federal natural resource managers are now in the process of controlling hog numbers because of their known impact to endangered plants and animals (Thompson 1977, West et al. 2009).

Feral swine are not native to North America, and many native species have not evolved to deal with swine competition or predation. Feral hogs are known to feed on many smaller animals (some threatened or endangered), disrupt ecosystems via rooting, and feed on rare and endangered plants. Many experts in the fields of botany and herpetology have observed marked declines in some rare species of plants, reptiles, amphibians, and soil invertebrates in areas inhabited by feral swine (Singer et al. 1984). It has been well documented that feral swine disturb large areas of vegetation and soil through rooting, and it is documented that hogs inhabiting coastal, upland, and wetland ecosystems are uprooting, damaging, and

feeding on rare native species of plants and animals (Means 1999). Feral swine can disrupt natural vegetative communities, eliminate rare plants and animals, alter species composition within a forest, including both canopy and low growing species (Lipscomb 1989, Frost 1993), increase water turbidity in streams and wetlands (reducing water quality and impacting native fish), and increase soil erosion and alter nutrient cycling (Singer et al. 1984, DeBenedetti 1986). Kaller and Kelso (2003) found that feral and free-ranging swine were linked to increased levels of fecal coliform and other potentially pathogenic bacteria in several watersheds in Louisiana. Additionally, some species of freshwater mussels and aquatic insects were negatively affected by feral swine (Kaller and Kelso 2006).

Deer overabundance can affect native vegetation and natural ecosystems in addition to ornamental landscape plantings. White-tailed deer selectively forage on vegetation (Strole and Anderson 1992), and thus can have substantial impacts on certain herbaceous and woody species and on overall plant community structure (Waller and Alverson 1997). These changes can lead to adverse impacts on other wildlife species, which depend on these plants for food and/or shelter. Numerous studies have shown that over browsing by deer can decrease tree reproduction, understory vegetation cover, plant density, and diversity (Warren 1991). By one count, 98 species of threatened and endangered plants, many of them orchids and lilies, are disturbed by deer browsing (Ness 2003).

The alteration and degradation of habitat from over-browsing by deer can have a detrimental effect on deer herd health and may displace other wildlife communities (*e.g.*, neotropical migrant songbirds and small mammals) that depend upon the understory vegetative habitat destroyed by deer browsing (Virginia Department of Game and Inland Fisheries 1999). Similarly, deCalesta (1997) reported that deer browsing affected vegetation that songbirds need for foraging surfaces, escape cover, and nesting. Species richness and abundance of intermediate canopy nesting songbirds was reduced in areas with higher deer densities (deCalesta 1997). Intermediate canopy-nesting birds declined 37% in abundance and 27% in species diversity at higher deer densities. Five species of birds were found to disappear at densities of 38.1 deer per square mile and another two disappeared at 63.7 deer per square mile. Casey and Hein (1983) found that three species of birds could no longer be found in a research preserve stocked with high densities of ungulates and that the densities of several other species of birds were lower than in an adjacent area with lower deer density. Waller and Alverson (1997) hypothesize that by competing with squirrels and other fruit-eating animals for oak mast, deer may further affect many other species of animals and insects.

Examples of requests for assistance to resolve or alleviate damage to natural resources that the WS' program in Mississippi has responded to include:

- Alleviating predation of sandhill cranes from bobcats, coyotes, and feral dogs
- Reducing raccoon predation on endangered turtles

Need for Mammal Damage Management to Alleviate Property Damage

Mammals cause damage to a variety of property types in Mississippi each year. Property damage can occur in a variety of ways and can result in costly repairs and clean-up. Mammal damage to property occurs primarily through direct damage to structures. One example of direct damage to property occurs when gray squirrels gnaw on the wiring of vehicles. Accumulations of fecal droppings can cause damage to buildings and other structures. For example, fecal droppings from bats roosting in an attic can cause damage to insulation and support structures. Aircraft striking mammals can also cause substantial damage requiring costly repairs and aircraft downtime. Raccoons, skunks, woodchucks, and armadillos can cause damage to property by digging under porches, buildings, and homes, which can weaken foundations. Armadillos often cause damage to lawns and turf while digging for grubs and insects.

Feral swine can damage landscaping, golf courses, roads, drainage ditches and cause erosion by feeding in these areas. Feral swine dig or root in the ground with their nose in search of desired roots, grubs, earthworms, and other food sources. Feral swine can damage landscaping, golf courses, roads, drainage ditches and cause erosion by feeding in these areas. The rooting and digging activity of feral swine turns sod and grass over which often leaves the area bare of vegetation and susceptible to erosion. Feral swine also pose a threat to property from being struck by motor vehicles and aircraft.

Deer-vehicle collisions are a serious concern nationwide because of losses to property and the potential for human injury and death (Conover et al. 1995, Romin and Bissonette 1996, Conover 1997). The economic costs associated with deer-vehicle collisions include vehicle repairs, human injuries and fatalities, and picking up and disposing of deer (Drake et al. 2005). The Insurance Institute for Highway Safety (2005) estimated that 1.5 million deer-vehicle collisions occur annually in the United States causing approximately 150 fatalities and $1.1 billion in damage to property. In 1995, the damage to vehicles associated with vehicles striking deer was estimated at $1,500 per strike in damages (Conover et al. 1995). Damage costs associated with deer collisions in 2011 were estimated at $3,171 per incident, which was an increase of 2.2% over the 2010 estimate (State Farm Mutual Automobile Insurance 2011*a*). An estimated 13,489 deer-vehicle collisions occurred in Mississippi from July 1, 2010 through June 30, 2011 (State Farm Mutual Automobile Insurance 2011*b*). Based on the average repair costs associated with vehicle strikes estimated at $3,171 in 2010 and the number of strikes that have occurred in the State estimated at 13,489 from July 2010 through June 2011, deer-vehicle collisions resulted in nearly $42.8 million in damage to property in the State.

Incidences of deer-vehicle collisions on highways passing through TVA Dam Reservation properties have been reported to TVA personnel in recent years from public stakeholders. Some of these dam reservation properties have elevated deer populations and WS could be request to provide assistance to reduce local deer populations on TVA properties.

Often, deer-vehicle collisions in which a deer carcass was not recovered or little vehicle damage occurred go unreported. A Cornell University study estimated that the actual number of deer-vehicle collisions could be as high as six times the reported number (Decker et al. 1990).

Deer browsing damages and destroys landscaping and ornamental trees, shrubs, and flowers. As rural areas are developed, deer habitat may actually be enhanced because fertilized lawns, gardens, and landscape plants serve as high quality sources of food (Swihart et al. 1995). Furthermore, deer are prolific and adaptable, characteristics that allow them to exploit and prosper in most suitable habitat near urban areas, including residential areas (Jones and Witham 1990). The succulent nature of many ornamental landscape plants, coupled with high nutrient contents from fertilizers, offers an attractive food. In addition to browsing pressure, male deer damage ornamental trees and shrubs from antler rubbing which results in broken limbs and bark removal. While large trees may survive antler-rubbing damage, smaller trees often die or become scarred to the point that they are not aesthetically acceptable for landscaping.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA evaluates the need for mammal damage management to reduce threats to human safety and to resolve damage to property, natural resources, and agricultural resources on federal, state, tribal, municipal, and private land within the State of Mississippi wherever such management is requested by a cooperator. This EA discusses the issues associated with conducting mammal damage management in the

State to meet the need for action and evaluates different alternatives to meeting that need while addressing those issues.

The methods available for use or recommendation under each of the alternatives evaluated are provided in Appendix B[7]. The alternatives and Appendix B also discuss how methods would be employed to manage damage and threats associated with mammals in the State. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives and the employment of those methods by WS to manage or prevent damage and threats associated with mammals from occurring when requested by the appropriate resource owner or manager. WS' activities that could involve the take of mammals under the alternatives would only occur when agreed upon by the requester and when permitted by the MDWFP, when required, and only at levels permitted.

Federal, State, County, City, and Private Lands

Under two of the alternatives, WS could continue to provide damage management activities on federal, state, county, municipal, and private land in Mississippi when a request is received for such services by the appropriate resource owner or manager. In those cases where a federal agency requests WS' assistance with managing damage caused by mammals, the requesting agency would be responsible for analyzing those activities in accordance with the NEPA. However, this EA could cover such actions if the requesting federal agency determined the analyses and scope of this EA were appropriate for those actions and the requesting federal agency adopted this EA through their own Decision based on the analyses in this EA. Therefore, actions taken on federal lands have been analyzed in the scope of this EA.

Native American Lands and Tribes

The WS program in Mississippi would only conduct damage management activities on Native American lands when requested by a Native American Tribe. Activities would only be conducted after a Memorandum of Understanding (MOU) or cooperative service agreement had been signed between WS and the Tribe requesting assistance. Therefore, the Tribe would determine when WS' assistance was required and what activities would be allowed. Because Tribal officials would be responsible for requesting assistance from WS and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would be anticipated. Those methods available to alleviate damage associated with mammals on federal, state, county, municipal, and private properties under the alternatives analyzed in this EA would be available for use to alleviate damage on Tribal properties when the use of those methods had been approved for use by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would include those activities that could be employed on Native American lands, when requested and when agreed upon by the Tribe and WS.

Period for which this EA is Valid

If the analyses in this EA indicate an Environmental Impact Statement (EIS) is not warranted, this EA would remain valid until WS and the TVA, in consultation with the MDWFP, determined that new needs for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, this analysis and document would be reviewed and supplemented pursuant to the NEPA. Review of the EA would be conducted to ensure that activities conducted under the selected alternative occur within the parameters evaluated in the EA. If the alternative analyzing no

[7]A complete list of chemical and non-chemical methods available for use under the identified alternatives can be found in Appendix B. However, listing methods neither implies that all methods would be used by WS to resolve requests for assistance nor does the listing of methods imply that all methods would be used to resolve every request for assistance.

involvement in mammal damage activities by WS were selected, no additional analyses would occur based on the lack of involvement by WS. The monitoring of activities by WS would ensure the EA remained appropriate to the scope of damage management activities conducted by WS in Mississippi under the selected alternative, including activities conducted on TVA properties, when requested.

Site Specificity

As mentioned previously, WS would only conduct damage management activities when requested by the appropriate resource owner or manager. In addition, WS' activities that could involve the take of mammals under the alternatives would only occur when permitted by the MDWFP, when required, and only at levels permitted.

This EA analyzes the potential impacts of mammal damage management based on previous activities conducted on private and public lands in Mississippi where WS and the appropriate entities entered into a MOU, cooperative service agreement, or other comparable document. The EA also addresses the potential impacts of mammal damage management in areas where additional agreements may be signed in the future. Because the need for action is to reduce damage and because the program's goals and directives would be to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates receiving additional requests for assistance and analyzes the impacts of the efforts to resolve those additional requests as part of the alternatives.

Many of the mammal species addressed in this EA can be found statewide and throughout the year in the State; therefore, damage or threats of damage can occur wherever those mammals occur. Planning for the management of mammal damage must be viewed as being conceptually similar to the actions of other entities whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, and insurance companies. Although some of the locations where mammal damage would occur can be predicted, not all specific locations or times where such damage would occur in any given year can be predicted. In addition, the threshold triggering an entity to request assistance from WS to manage damage associated with mammals is often unique to the individual; therefore, predicting where and when such a request for assistance would be received by WS is difficult. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever mammal damage and the resulting management actions occurs and are treated as such.

Chapter 2 of this EA identifies and discusses issues relating to mammal damage management in Mississippi. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in the State (see Chapter 3 for a description of the Decision Model and its application). Decisions made using the model would be in accordance with WS' directives and Standard Operating Procedures (SOPs) described in this EA as well as relevant laws and regulations.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Mississippi. In this way, WS believes it meets the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with the NEPA and still be able to accomplish its mission.

Summary of Public Involvement

Issues related to mammal damage management as conducted by WS in Mississippi were initially developed by WS in cooperation with the TVA and during consultation with the MDWFP. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document will be noticed to the public for review and comment. The public will be noticed through legal notices published in local print media, through direct mailings to parties that have requested to be notified, or have been identified to have an interest in the reduction of threats and damage associated with mammals in the State, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

WS will provide for a minimum of a 30-day comment period for the public and interested parties to provide new issues, concerns, and/or alternatives. Through the public involvement process, WS will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. New issues or alternatives raised after publication of public notices would be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a final Decision or publication of a notice of intent to prepare an EIS.

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

WS' Programmatic Final Environmental Impact Statement: WS has developed a programmatic FEIS that addresses the need for wildlife damage management in the United States (USDA 1997). The FEIS contains detailed discussions of potential impacts to the human environment from methods that could be used by WS to alleviate wildlife damage. In addition, the FEIS contains risk assessments of many of the methods available to manage damage caused by mammals in the State (USDA 1997).

***WS' Supplemental Environmental Assessment – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Fox, and Coyotes in the United States*:** WS issued an EA that analyzed the environmental effects of WS' involvement in the funding of and participation in Oral Rabies Vaccination programs to eliminate or stop the spread of raccoon rabies in a number of eastern states and gray fox and coyote rabies in Texas (USDA 2005). The EA has been supplemented to analyze changes in the scope and analysis area of the ORV program. The most recent Decision/FONSI was signed in 2010. WS determined the action would not have any significant impact on the quality of the human environment. Pertinent information has been incorporated by reference into this EA.

***TVA's Natural Resource Plan (NRP)*:** TVA has developed an extensive plan to strategically evaluate both renewable and nonrenewable resources and fulfill the responsibilities associated with good stewardship of TVA lands and resources. The NRP is designed to integrate the objectives of six resource areas (biological, cultural, recreation, water, public engagement and reservoir lands planning); provide optimum public use benefit; and balance competing and sometimes conflicting resource uses (TVA 2011*a*).

***TVA's Environment Impact Statement Assessing the Natural Resource Plan*:** TVA has also prepared an EIS to assess the impacts of the NRP and its reasonable alternatives on the environment. It specifically describes the stewardship programs that are ongoing and are being evaluated for future implementation as part of the NRP; and assesses the potential environmental impacts associated with implementing the various alternatives. Pertinent information available in the FEIS has been incorporated by reference into this EA (TVA 2011*b*).

***WS' Environmental Assessment – Reducing Aquatic Rodent Damage Through an Integrated Wildlife Damage Management Program in the State of Mississippi*:** An EA was prepared by WS to evaluate alternatives for the reduction of beaver (*Castor canadensis*), nutria (*Myocastor coypus*), and muskrat (*Ondatra zibethicus*) damage to property, agricultural and natural resources, and threats to public health and safety in the State of Mississippi (USDA 2003). The EA evaluated the need for WS' activities and the relative effectiveness of five alternatives to meet that proposed need, while accounting for the potential environmental effects of those activities. The proposed action in the EA describes an integrated approach to managing damage associated with beaver, nutria, and muskrats in which a variety of methods are used or recommended to reduce damage. After consideration of the analysis contained in the EA and review of public comments, a Decision and FONSI for the EA was issued on June 23, 2003. The Decision and FONSI selected the proposed action to implement an integrated damage management program using multiple methods to adequately address the need for beaver, nutria, and muskrat damage management. After a review of program activities under the proposed action, a new Decision/FONSI was issued on August 24, 2009. Although, beaver, nutria, and muskrats are not directly addressed in this EA, many of the methods available to meet the need for action are similar to methods available under this EA.

***Conservation and Management of Black Bears in Mississippi*:** The MDWFP developed black bear management objectives that included: (1) providing black bear education opportunities to personnel of the MDWFP, (2) training for MDWFP personnel with handling, immobilizing, and data gathering, (3) educating the public, (4) managing human/bear conflicts, (5) outlines priorities for black bear research, and (6) limiting and preventing human-induced mortality of black bears (Young 2006).

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

The authorities of WS and other agencies as those authorities relate to conducting wildlife damage management activities are discussed by agency below:

WS' Legislative Authority

The primary statutory authority for the WS program is the Act of March 2, 1931 (46 Stat. 1468; 7 USC 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 USC 426c). The WS program is the lead federal authority in managing damage to agricultural resources, natural resources, property, and threats to human safety associated with wildlife. WS' directives define program objectives and guide WS' activities in managing wildlife damage.

Tennessee Valley Authority

The TVA is a federal corporation created by an Act of Congress in May 18, 1933 [48 Stat. 58-59, 16 USC Sec. 831, as amended]. The TVA provides electricity to 9 million people, businesses and industries, and manages 293,000 acres of public land and 11,000 miles of reservoir shoreline in the seven-state Tennessee Valley Region (Tennessee, Alabama, Mississippi, Kentucky, Georgia, North Carolina, and Virginia – an area of 80,000 square miles). TVA also provides flood control, navigation, land management, and recreation for the Tennessee River system and works with local utilities and state and local governments to promote economic development across the region.

In Mississippi, the TVA generates electricity at three combustion turbine sites and two solar facilities. The electricity TVA generates is transmitted over 16,000 miles of transmission line across the Valley. TVA also owns or maintains 80 substations and 2,037 circuit miles of transmission lines in Mississippi. The TVA conducts and requests assistance from WS to provide wildlife damage management on land and at facilities owned by the TVA. TVA also makes its public lands available for use for continuation and expansion of the WS Oral Rabies Vaccination program across the Tennessee River Basin and Valley states.

United States Environmental Protection Agency (EPA)

The EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which regulates the registration and use of pesticides.

Mississippi Department of Wildlife, Fisheries, and Parks

The MDWFP authority in wildlife management is given within the Mississippi Code Annotated Section 49-1-1 et seq., the official regulations of the Commission of Wildlife, Fisheries and Parks and applicable federal laws. This legislation covers general provisions; licenses, permits and stamps; wildlife; fish; and wild animals.

Mississippi Department of Agriculture and Commerce (MDAC)

The Pesticide Program of the MDAC enforces state laws pertaining to the use and application of pesticides. Under the Mississippi Pesticide Application Act (Sections 69-23-101 through 69-23-133) this section monitors the use of pesticides in a variety of pest management situations. It also licenses private and commercial pesticide applicators and pesticide contractors. Under the Mississippi Pesticide Law (Section 69-23-1 through 69-23-27) the program licenses restricted use pesticide dealers and registers all pesticides for sale and distribution in the state of Mississippi.

1.6 COMPLIANCE WITH LAWS AND STATUTES

Several laws or statutes would authorize, regulate, or otherwise affect WS' activities under the alternatives. WS would comply with all applicable federal, state, and local laws and regulations in accordance with WS Directive 2.210. Those laws and regulations related to activities conducted to reduce mammal damage in the State are addressed below:

National Environmental Policy Act

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows CEQ regulations implementing the NEPA (40 CFR 1500 et seq.) along with USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process. Those laws, regulations, and guidelines generally outline five broad types of activities to be accomplished as part of any project: public involvement, analysis, documentation, implementation, and monitoring. The NEPA also sets forth the requirement that all major federal actions be evaluated in terms of their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are regulated in part by CEQ through regulations in 40 CFR, Parts 1500-1508. In accordance with CEQ and USDA regulations, APHIS guidelines concerning Implementation of the NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

Pursuant to the NEPA and CEQ regulations, this EA documents the analyses resulting from proposed federal actions, informs decision-makers, and the public of reasonable alternatives capable of avoiding or minimizing adverse impacts, and serves as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into federal agency actions. This EA was prepared by integrating as many of the natural and social sciences as warranted, based on the potential effects of the proposed action. The direct, indirect, and cumulative impacts of the alternatives are analyzed.

Endangered Species Act

Under the ESA, all federal agencies will seek to conserve T&E species and will utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to use the expertise of the USFWS to ensure that "*any action authorized... funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency will use the best scientific and commercial data available*" (Sec.7 (a)(2)). Evaluation of the alternatives in regards to the ESA will occur in Chapter 4 of this EA.

Wildlife Definitions and Interpretations (Mississippi Code Annotated §49-7-1, as amended)

Section 49-7-1 of the Mississippi Code of 1972 defines those mammal species that are considered game species, fur-bearing species, and nuisance animals. Of those species addressed in this EA, game species include white-tailed deer, rabbits, and squirrels while fur-bearing species include opossums, otters, raccoons, and bobcats. Wildlife defined as nuisance animals include fox, skunks, feral swine, and coyotes (Public Notice LE4-3779). Nuisance animals may be taken at any time subject to certain provisions.

National Historic Preservation Act (NHPA) of 1966, as amended

The NHPA and its implementing regulations (36 CFR 800) require federal agencies to initiate the section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under section 106. None of the mammal damage management methods described in this EA that might be used operationally by WS would cause major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor involves the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the alternatives would not generally be the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources were planned under an alternative selected because of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

Noise-making methods, such as firearms, that are used at or in close proximity to historic or cultural sites for the purposes of removing wildlife have the potential for audible effects on the use and enjoyment of historic property. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage problem, which means such use, would be to the benefit of the historic property. A built-in minimization factor for this issue is that virtually all the methods involved would only have temporary effects on the audible nature of a site and could be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Site-specific consultation as required by the Section 106 of the NHPA would be conducted as necessary in those types of situations.

Environmental Justice in Minority and Low Income Populations - Executive Order 12898

Executive Order 12898 promotes the fair treatment of people of all races, income levels, and cultures with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental

effects of federal programs, policies, and activities on minority and low-income persons or populations. All activities are evaluated for their impact on the human environment and compliance with Executive Order 12898.

WS would use only legal, effective, and environmentally safe damage management methods, tools, and approaches. All chemicals used by WS and the TVA would be regulated by the EPA through the FIFRA, by the MDAC, by the Drug Enforcement Agency (DEA), by MOUs with land managing agencies, and by WS' Directives. WS would properly dispose of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the alternatives may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

Protection of Children from Environmental Health and Safety Risks - Executive Order 13045

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. WS and the TVA make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS and the TVA have considered the impacts that this proposal might have on children. The proposed activities would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action. Additionally, the need for action identified a need to reduce threats to human safety, including risks to children; therefore, it would be expected that health and safety risks to children posed by mammals would be reduced under the alternatives.

Invasive Species - Executive Order 13112

Executive Order 13112 establishes guidance to federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm or harm to human health. The Order states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education of invasive species.

The Native American Graves and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act (Public Law 101-106, 25 USC 3001) requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA and its implementing regulations (Public Law 110-426, 7 USC 136 et. seq.) require the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. All chemical methods integrated into the WS' program in Mississippi, including the use of or recommendation of repellents are registered with and regulated by the EPA and the MDAC, and used or recommended by WS in compliance with labeling procedures and requirements.

Occupational Safety and Health Act of 1970

The Occupational Safety and Health Act of 1970 and its implementing regulations (29 CFR 1910) on sanitation standards states that, "*Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected*." This standard includes mammals that may cause safety and health concerns at workplaces.

Federal Food, Drug, and Cosmetic Act (21 USC 360)

This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration.

Controlled Substances Act of 1970 (21 USC 821 et seq.)

This law requires an individual or agency to have a special registration number from the federal DEA to possess controlled substances, including those that are used in wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994

The Animal Medicinal Drug Use Clarification Act (AMDUCA) and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "*veterinarian-client-patient*" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under any alternative where WS could use those immobilizing and euthanasia drugs. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (*i.e.*, a period after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified. WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; P.L. 92-583, October 27, 1972; 86 Stat. 1280).

This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for federal approval, each state's plan was required to define boundaries of the coastal zone, identify uses of the area to be regulated by the state, determine the mechanism (criteria, standards or regulations) for controlling such uses, and develop broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards for requiring that federal actions be conducted in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the federal action involved a permit, license, financial assistance, or a federally authorized activity. As appropriate, a consistency determination would be conducted by WS to assure management actions would be consistent with the State's Coastal Zone Management Program.

1.7 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. The TVA owns and operates numerous electrical power generation sites and transmission structures within Mississippi, including electrical substations and transmission lines. In addition, the TVA manages lands within the State for recreational, natural, and cultural resources. Many of these sites experience damage associated with mammals within the State. The TVA would be the primary decision-maker for mammal damage management activities occurring on sites owned or managed by the TVA. As the authority for the management of mammal populations in the State, the MDWFP was involved in the development of the EA and provided input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The MDWFP is responsible for managing wildlife in the State of Mississippi, including those mammals addressed in this EA. The MDWFP establishes and enforces regulated hunting and trapping seasons in the State. WS' activities to reduce and/or prevent mammal damage in the State would be coordinated with the MDWFP, which ensures WS' actions would be incorporated into population objectives established for mammal populations in the State.

Based on the scope of this EA, the decisions to be made are: 1) should WS, in cooperation with the TVA, conduct mammal damage management to alleviate damage to agriculture, property, natural resources, and threats to human safety, 2) should WS conduct disease surveillance and monitoring in mammal populations when requested by the MDWFP and other agencies, 3) should WS, in cooperation with the TVA, implement an integrated wildlife damage management strategy, including technical assistance and direct operational assistance, to meet the need for mammal damage management in Mississippi, 4) if not, should WS attempt to implement one of the alternatives to an integrated damage management strategy as described in the EA, and 5) would the proposed action or the other alternatives result in adverse impacts to the environment requiring the preparation of an EIS.

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

Chapter 2 contains a discussion of the issues, including issues that will receive detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues that have driven the development of SOPs, and issues that will not be considered in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues. Additional descriptions of the affected environment will be incorporated into the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Damage or threats of damage caused by those mammal species addressed in this EA can occur statewide in Mississippi wherever those mammals occur. However, mammal damage management would only be conducted by WS when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document were signed between WS and a cooperating entity. Most species of mammals addressed in this EA can be found throughout the year across the State where suitable habitat exists for foraging and shelter. Those mammal species addressed in this EA are capable of utilizing a variety of habitats in the State. Since those mammal species addressed in this EA can be found throughout most of the State, requests for assistance to manage damage or threats of damage could occur in areas occupied by those mammal species. Additional information on the affected environment is provided in Chapter 4.

Upon receiving a request for assistance, activities to reduce mammal damage or threats could be conducted on federal, state, tribal, municipal, and private properties in Mississippi. Areas where damage or threats of damage could occur include, but would not be limited to agricultural fields, vineyards,

orchards, farmyards, dairies, ranches, livestock operations, aquaculture facilities, fish hatcheries, grain mills, grain handling areas, railroad yards, waste handling facilities, industrial sites, natural resource areas, park lands, and historic sites; state and interstate highways and roads; railroads and their right-of-ways; property in or adjacent to subdivisions, businesses, and industrial parks; timberlands, croplands, and pastures; private and public property where burrowing mammals cause damage to structures, dikes, ditches, ponds, and levees; public and private properties in rural/urban/suburban areas where mammals cause damage to landscaping and natural resources, property, and are a threat to human safety through the spread of disease. The area would also include airports and military airbases where mammals are a threat to human safety and to property; areas where mammals negatively affect wildlife, including T&E species; and public property where mammals are negatively affecting historic structures, cultural landscapes, and natural resources.

In addition, mammal damage management could occur at facilities owned or managed by the TVA when those mammal species addressed in this assessment cause damage or pose threats of damage to property, natural resources, pose a threat to human safety, or threaten the reliability of electric system transmission. Damage management activities could be conducted at any of the three combustion turbine sites owned by the TVA in Mississippi known as the Caledonia, Southaven, and Kemper sites. The Caledonia Plant occupies 120 acres near Steens, Mississippi. The Southaven Plant occupies 118 acres in Desoto County, Mississippi while the Kemper Plant occupies 197 acres in Kemper County, Mississippi near the City of DeKalb.

The TVA also operates two solar facilities in Mississippi on the campuses of the University of Mississippi in Oxford, Mississippi and a location at Mississippi State University in Starkville, Mississippi. The TVA also owns or manages 76 electrical substations and 2,038 circuit miles of transmission lines in Mississippi.

Activities to reduce damage or threats of damage could also be conducted on recreational, natural, and cultural lands owned or managed by the TVA. The TVA owns 90 miles of public shoreline on Pickwick Reservoir in northeastern Mississippi that provides camping, fishing, boating, swimming, and other recreational opportunities. The TVA also owns and manages 1,700 acres of public land in Mississippi adjacent to Pickwick Reservoir.

Environmental Status Quo

As defined by the NEPA implementing regulations, the "*human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment*" (40 CFR 1508.14). Therefore, when a federal action agency analyzes their potential impacts on the "*human environment*", it is reasonable for that agency to compare not only the effects of the federal action, but also the potential impacts that occur or could occur in the absence of the federal action by a non-federal entity. This concept is applicable to situations involving federal assistance to reduce damage associated with wildlife species.

Unprotected wildlife species, such as most non-native invasive species, are not protected under state or federal law. Most state-resident wildlife species are managed under state authority or law without any federal oversight or protection. In some situations, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), unprotected wildlife species and certain resident wildlife species are managed with little or no restrictions, which allows them to be killed or taken by anyone at any time when they are committing damage. For mammal damage management in Mississippi, the MDWFP has the authority to manage and authorize the taking of mammals for damage management purposes.

When a non-federal entity (*e.g.*, agricultural producers, municipalities, counties, private companies, individuals, or any other non-federal entity) takes an action to alleviate mammal damage or threat, the action is not subject to compliance with the NEPA due to the lack of federal involvement in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed. Therefore, in those situations in which a non-federal entity has decided that a management action directed towards mammals should occur and even the particular methods that should be used, WS' involvement in the action would not affect the environmental status quo since the entity could take the action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requestor had conducted the action in the absence of WS' involvement in the action.

A non-federal entity could lethally take mammals to alleviate damage without the need for a permit when those species are non-native or are unregulated by the MDWFP. In addition, mammals could be removed to alleviate damage during the hunting and/or trapping season, and/or through the issuance of permits by the MDWFP. In addition, most methods available for resolving damage associated with mammals would also be available for public use. Therefore, WS' decision-making ability would be restricted to one of three alternatives. WS could take the action using the specific methods as decided upon by the non-federal entity, provide technical assistance only, or take no action. If no action were taken by WS, the non-federal entity could take the action anyway using the same methods without the need for a permit, during the hunting or trapping season, or through the issuance of a permit by the MDWFP. Under those circumstances, WS would have virtually no ability to affect the environmental status quo since the action would likely occur in the absence of WS' direct involvement.

Therefore, based on the discussion above, it is clear that in those situations where a non-federal entity has obtained the appropriate permit or authority, and has already made the decision to remove or otherwise manage mammals to stop damage with or without WS' assistance, WS' participation in carrying out the action would not affect the environmental status quo.

2.2 ISSUES ASSOCIATED WITH MAMMAL DAMAGE MANAGEMENT ACTIVITIES

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed action. Such issues must be considered in the NEPA decision-making process. Issues related to managing damage associated with mammals in Mississippi were developed by WS in consultation with the MDWFP and the TVA. The EA will also be made available to the public for review and comment to identify additional issues.

The issues as those issues relate to the possible implementation of the alternatives, including the proposed action, are discussed in detail in Chapter 4. The issues analyzed in detail in the EA are the following:

Issue 1 - Effects of Damage Management Activities on Target Mammal Populations

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the populations of target species. Methods available to resolve damage or threats to human safety under the alternatives are categorized into lethal and non-lethal methods.

Non-lethal methods could disperse or otherwise make an area unattractive to target species causing damage, which reduces the presence of those species at the site and potentially the immediate area around the site where non-lethal methods were employed. Lethal methods would be employed to remove a mammal or those mammals responsible for causing damage or posing threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats

were occurring. The number of target species removed from the population using lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individuals involved with the associated damage or threat, and the efficacy of methods employed.

The analysis for magnitude of impact on populations from the use of lethal methods generally follows the process described in WS' programmatic FEIS (USDA 1997). Magnitude is described in WS' programmatic FEIS as "*...a measure of the number of animals killed in relation to their abundance*." Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. WS' take would be monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species populations. Lethal take of mammals by WS under the alternatives would only occur at the request of a cooperator seeking assistance and only after the MDWFP authorized the take, when required.

In addition, many of the mammal species addressed in this EA can be harvested in the State during annual hunting and/or trapping seasons and can be addressed using available methods by other entities in the State when those species cause damage or pose threats of damage when permitted by the MDWFP. Therefore, any damage management activities conducted by WS under the alternatives addressed would be occurring along with other natural process and human-induced events such as natural mortality, human-induced mortality from private damage management activities, mortality from regulated harvest, and human-induced alterations of wildlife habitat.

Methods available under each of the alternatives to resolve damage and reduce threats to human safety would be employed targeting an individual of a mammal species or a group of individuals after applying the WS' Decision Model (Slate et al. 1992) to identify possible techniques. The effects on the populations of target mammal populations in the State from implementation of the alternatives addressed in detail, including the proposed action, are analyzed in Chapter 4. Information on mammal populations and trends are often derived from several sources including the fur harvest reports, damage complaints, ground surveys, aerial surveys, and published literature.

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

The issue of non-target species effects, including effects on T&E species, arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target wildlife. Methods available for use under the alternatives are described in Appendix B.

Concerns have also been raised about the potential for adverse effects to occur to non-target wildlife from the use of chemical methods. Chemical methods considered for use to manage damage or threats associated with those mammal species addressed in this EA include immobilizing drugs, euthanasia chemicals, reproductive inhibitors, fumigants, and taste repellents. Chemical methods being considered for use to manage damage and threats associated with mammals in Mississippi are further discussed in Chapter 4 and Appendix B.

The ESA states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. WS conducts Section 7 consultations with the USFWS to ensure compliance with the ESA and to ensure that *"any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued*

existence of any endangered or threatened species…Each agency shall use the best scientific and commercial data available" [Sec. 7(a)(2)].

As part of the scoping process for this EA, WS consulted with the USFWS pursuant to Section 7 of the ESA to facilitate interagency cooperation between WS and the USFWS. The potential effects of the alternatives on this issue are further discussed in Chapter 4.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

An additional issue often raised is the potential risks to human safety associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. WS' employees would use and recommend only those methods that were legally available under each of the alternatives. Still, some concerns exist regarding the safety of methods available despite their legality and selectivity. As a result, this EA will analyze the potential for proposed methods to pose a risk to members of the public. In addition to the potential risks to the public associated with the methods available under each of the alternatives, risks to WS' employees would also be an issue. WS' employees would potentially be exposed to damage management methods, as well as, subject to workplace accidents. Selection of methods, under the alternatives, would include consideration for public and employee safety.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use or recommendation of chemical methods would include immobilizing drugs, euthanasia chemicals, fumigants, reproductive inhibitors, and repellents.

Immobilizing drugs would include ketamine and telazol, which are anesthetics (*i.e.*, general loss of pain and sensation) used during the capture of wildlife to eliminate pain, calm fear, and reduce anxiety in wildlife when handling and transporting wildlife. Xylazine is a sedative that is often used in combination with ketamine to calm nervousness, irritability, and excitement in wildlife during the handling and transporting of wildlife. Euthanasia chemicals would include sodium pentobarbital, Beuthanasia®-D, Fatal-Plus™ and potassium chloride, which would be administered after an animal has been anesthetized.

Gonacon™ is the only product currently registered as a reproductive inhibitor and is only available to manage local deer populations. However, Gonacon™ is not currently registered for use in the State. If Gonacon™ becomes registered to manage a local deer population, the product would only be available for use by WS, the MDWFP, or agents under their direct supervision. The application of Gonacon™ to manage local deer herds could only occur after a permit had been issued by the MDWFP.

Repellents for many mammal species contain different active ingredients with most ingredients occurring naturally in the environment. The most common ingredients of repellents are coyote urine, putrescent whole egg solids, and capsaicin. Repellents are generally restricted-use products that can only be purchased and applied by licensed applicators. Repellents are generally applied directly to affected resources and elicit an adverse taste response when ingested or cause temporarily sickness (*e.g.*, nausea). Products containing coyote urine or other odors associated with predatory wildlife are intended to elicit a fright response in target wildlife by imitating the presence of a predatory animal (*i.e.*, wildlife tend to avoid areas where predators are known to occur). WS would only employ or recommend for use those repellents that were registered for use pursuant to the FIFRA with the EPA and were registered for use in the State by the MDAC.

Gas cartridges would be available to fumigate burrows and den sites in areas where damages were occurring. Gas cartridges act as a fumigant by producing carbon monoxide gas when ignited. The cartridges contain sodium nitrate, which when burnt, produces carbon monoxide gas. The cartridges would be placed inside active burrows and dens at the entrance, the cartridge would be ignited, and the entrance to the burrow or den would be sealed with dirt, which allows the burrow or den to fill with carbon monoxide.

The issue of the potential for drugs used in animal capture, handling, and euthanasia to cause adverse health effects in humans that hunt and consume the species involved has been raised. Among the species to be captured and handled under the proposed action, this issue is expected to be of concern for wildlife that are hunted and sometimes consumed by people as food. Chemicals methods available for use under the relevant alternatives would be regulated by the EPA through FIFRA, by Mississippi laws, by the DEA, by the United States Food and Drug Administration (FDA), and by WS' Directives.

Most methods available to alleviate damage and threats associated with mammals are considered non-chemical methods. Non-chemical methods may include cultural methods, limited habitat modification, animal behavior modification, and other mechanical methods. Changes in cultural methods could include improved animal husbandry practices, altering feeding schedules, changes in crop rotations, or conducting structural repairs. Limited habitat modification would be practices that alter specific characteristics of a very localized area, such as removing bushes to eliminate shelter locations or planting vegetation that are less palatable to mammals. Animal behavior modification methods would include those methods designed to disperse mammals from an area through harassment or exclusion. Behavior modification methods could include pyrotechnics, propane cannons, barriers, electronic distress calls, effigies, Mylar tape, and lasers. Other mechanical methods could include live-traps, body-gripping traps, cable restraints, cannon nets, shooting, or the recommendation that a local population of mammals be reduced using hunting and/or trapping.

The primary safety risk of most non-chemical methods occurs directly to the applicator or those persons assisting the applicator. However, risks to others do exist when employing non-chemical methods, such as when using firearms, cannon nets, pyrotechnics, or body-gripping traps. Most of the non-chemical methods available to address mammal damage in Mississippi would be available for use under any of the alternatives and could be employed by any entity, when permitted. Risks to human safety from the use of non-chemical methods will be further evaluated as this issue relates to the alternatives in Chapter 4. A complete list of non-chemical methods available to alleviate damage associated with mammals is provided in Appendix B of this EA.

An issue identified is the concern for human safety from not employing methods or not employing the most effective methods to reduce the threats that mammals can pose. The risks to human safety from diseases associated with certain mammal populations were addressed previously in Chapter 1 under the need for action. The low risk of disease transmission from mammals does not lessen the concerns of cooperators requesting assistance to reduce threats from zoonotic diseases. Increased public awareness of zoonotic events has only heightened the concern of direct or indirect exposure to zoonoses. Not adequately addressing the threats associated with potential zoonoses could lead to an increase in incidences of injury, illness, or loss of human life.

Additional concern is raised with inadequately addressing threats to human safety associated with aircraft striking mammals at airports in the State. Mammals have the potential to cause severe damage to aircraft, which can threaten the safety of passengers. Limiting or preventing the use of certain methods to address the potential for aircraft striking mammals could lead to higher risks to passenger safety. This issue will be fully evaluated in Chapter 4 in relationship to the alternatives.

Issue 4 - Effects on the Aesthetic Values of Mammals

One issue is the concern that the proposed action or the other alternatives would result in the loss of aesthetic benefits of target mammals to the public, resource owners, or neighboring residents. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The public share a similar bond with animals and/or wildlife in general and in modern societies, a large percentage of households have indoor or outdoor pets. However, some people may consider individual wild animals and mammals as "*pets*" or exhibit affection toward those animals, especially people who enjoy viewing wildlife. Therefore, the public reaction can be variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). Those include direct benefits related to consumptive and non-consumptive uses, indirect benefits derived from vicarious wildlife related experiences, and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (Bishop 1987). Direct benefits are derived from a personal relationship with animals and may take the form of direct consumptive use (*i.e*., using parts of or the entire animal) or non-consumptive use (*e.g.*, viewing the animal in nature or in a zoo, photographing) (Decker and Goff 1987).

Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Public attitudes toward wildlife vary considerably. Some people believe that all wildlife should be captured and translocated to another area to alleviate damage or threats to protected resources. Some people directly affected by the problems caused by wildlife strongly support removal. Individuals not directly affected by the harm or damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Some people totally opposed to wildlife damage management want WS to teach tolerance for damage and threats caused by wildlife, and that wildlife should never be killed. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. Those human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Some individuals are offended by the presence of overabundant mammal species, such as raccoons, armadillos, gray squirrels, coyotes, or feral species, such as cats or dogs. To such people those species represent pests that are nuisances, which upset the natural order in ecosystems, and are carriers of diseases transmissible to humans or other wildlife. Their overall enjoyment of other animals is diminished by what they view as a destructive presence of such species. They are offended because they feel that those mammal species proliferate in such numbers and appear to remain unbalanced.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate damage management for societal benefits could be compatible with animal welfare concerns, if "*…the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process.*"

According to the AVMA (1987), suffering is described as a "*…highly unpleasant emotional response usually associated with pain and distress.*" However, suffering "*…can occur without pain…*" and "*…pain can occur without suffering…*". Because suffering carries with it the implication of a time frame, a case could be made for "*…little or no suffering where death comes immediately…*" (California Department of Fish and Game 1991). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would "*…probably be causes for pain in other animals…*" (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

Pain and suffering, as it relates to methods available for use to manage mammals has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since *"…neither medical nor veterinary curricula explicitly address suffering or its relief*" (California Department of Fish and Game 1991). Research suggests that some methods, such as restraint in foothold traps or changes in the blood chemistry of trapped animals, indicate "*stress*" (USDA 1997). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The AVMA states "*...euthanasia is the act of inducing humane death in an animal*" and "*... the technique should minimize any stress and anxiety experienced by the animal prior to unconsciousness*" (Beaver et al. 2001). Some people would prefer AVMA accepted methods of euthanasia to be used when killing all animals, including wild and invasive animals. The AVMA states "*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible*" (Beaver et al. 2001).

The decision-making process involves tradeoffs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering. The issue of humanness and animal welfare concerns will be further discussed in Chapter 4. SOPs to alleviate pain and suffering are discussed in Chapter 3.

Issue 6 - Effects of Mammal Damage Management Activities on the Regulated Harvest of Mammals

Another issue commonly identified is a concern that damage management activities conducted by WS would affect the ability of persons to harvest those species during the regulated hunting and trapping seasons either by reducing local populations through the lethal removal of mammals or by reducing the number of mammals present in an area through dispersal techniques. Those species that are addressed in

this EA that also can be hunted and/or trapped during regulated seasons in the State include Virginia opossum, cottontail rabbits, swamp rabbits, raccoons, river otters, striped skunks, coyotes, gray fox, red fox, bobcats, gray squirrels, fox squirrels, and white-tailed deer.

Potential impacts could arise from the use of non-lethal or lethal damage management methods. Non-lethal methods used to reduce or alleviate damage caused by those mammal species are used to reduce mammal densities through dispersal in areas where damage or the threat of damage is occurring. Similarly, lethal methods used to reduce damage associated with those mammals could lower densities in areas where damage is occurring resulting in a reduction in the availability of those species during the regulated harvest season. WS' mammal damage management activities would primarily be conducted on populations in areas where hunting access is restricted (*e.g.*, airports, TVA facilities, and, recreation areas) or has been ineffective. The use of non-lethal or lethal methods often disperses mammals from areas where damage is occurring to areas outside the damage area, which could serve to move those mammal species from those less accessible areas to places accessible to hunters.

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

Additional issues were also identified by WS, the TVA, and the MDWFP during the scoping process of this EA. Those additional issues were considered but detailed analyses will not occur for the reasons provided. The following issues were considered but were not analyzed in detail:

Appropriateness of Preparing an EA (Instead of an EIS) For Such a Large Area

A concern was raised that an EA for an area as large as the State of Mississippi would not meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of federal or other regulatory agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to describe accurately such locations or times in an EA or EIS. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage could occur, the program cannot predict the specific locations or times at which affected resource owners would determine a damage problem has become intolerable to the point that they request assistance from WS. In addition, the WS program would not be able to prevent such damage in all areas where it might occur without resorting to destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and other agencies. Such broad scale population management would also be impractical or impossible to achieve within WS' policies and professional philosophies.

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA was to determine if the proposed action would potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS. This EA addresses impacts for managing damage and threats to human safety associated with mammals in the State to analyze individual and cumulative impacts and to provide a thorough analysis.

In terms of considering cumulative effects, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination were made through this EA that the proposed action or the other alternatives might have a significant impact on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, the WS program in Mississippi would continue to conduct mammal damage management in a very small area of the State where damage is occurring or likely to occur.

WS' Impact on Biodiversity

The WS program does not attempt to eradicate any species of native wildlife in the State. WS operates in accordance with federal and state laws and regulations enacted to ensure species viability. Methods available are employed to target individual mammals or groups of mammals identified as causing damage or posing a threat of damage. Any reduction of a local population or group is frequently temporary because immigration from adjacent areas or reproduction replaces the animals removed. WS operates on a small percentage of the land area of Mississippi and only targets those mammals identified as causing damage or posing a threat. Therefore, mammal damage management activities conducted pursuant to any of the alternatives would not adversely affect biodiversity in the State.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of the NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss would likely be tolerated by cooperators until the damage reaches a threshold where the damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations. For example, aircraft striking mammals can lead to property damage and can threaten passenger safety if a catastrophic failure of the aircraft occurs because of the strike. Therefore, addressing the threats of wildlife strikes prior to an actual strike occurring would be appropriate.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied the plaintiffs' motion for a preliminary injunction. In part, the court determined a need for wildlife damage management could be established if a forest supervisor could show that damage from wildlife was threatened (Civil No. 92-C-0052A January 20, 1993). Thus, there is judicial precedence indicating that it is not necessary to establish a criterion such as a percentage of loss of a particular resource to justify the need for damage management actions.

Mammal Damage Management Should Not Occur at Taxpayer Expense

An issue identified is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based. Funding for damage management activities would be derived from federal appropriations and through cooperative funding. Activities conducted in the State for the management of damage and threats to human safety from mammals would be funded through cooperative service agreements with individual property owners or managers. A minimal federal appropriation is allotted for the maintenance of a WS program in Mississippi. The remainder of the WS program would mostly be fee-based. Technical assistance would be provided to requesters as part of the federally funded activities, but the majority of direct assistance in which WS' employees perform damage management activities would be funded through cooperative service agreements between the requester and WS.

Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce damage and threats to

human safety caused by mammals and that prove to be the most cost effective would likely receive the greatest application. As part of an integrated approach and as part of the WS Decision Model, evaluation of methods would continually occur to allow for those methods that were most effective at resolving damage or threats to be employed under similar circumstance where mammals were causing damage or posing a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. The cost effectiveness of methods and the effectiveness of methods would be linked. The issue of cost effectiveness as it relates to the effectiveness of methods is discussed in the following issue.

Effectiveness of Mammal Damage Management Methods

The effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented. The effectiveness can also be dependent upon how accurately practitioners diagnose the problem, the species responsible for the damage, and how actions were implemented to correct or mitigate risks or damages. To determine that effectiveness, WS must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible. The most effective approach to resolving any wildlife damage problem would be to use an adaptive integrated approach, which may call for the use of several management methods simultaneously or sequentially (Courchamp et al. 2003).

The purpose behind integrated management is to implement methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment[8]. Efficacy is based on the types of methods employed, the application of the method, restrictions on the use of the method(s), the skill of the personnel using the method and, for WS' personnel, the guidance provided by WS' directives and policies.

The goal would be to reduce damage, risks, and conflicts with wildlife as requested and not to reduce/eliminate populations. Localized population reduction could be short-term with new individuals immigrating into the area or born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels does not mean individual management actions were unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on species' populations.

Comments are often received that lethal methods would be ineffective because additional mammals would likely to return to the area. In addition, comments also claim that because mammals return to an area after initial removal efforts were complete, the use of lethal methods gives the impression of creating a financial incentive to continue the use of only lethal methods. Those statements assume mammals only return to an area where damage was occurring if lethal methods were used. However, the use of non-lethal methods would also often be temporary, which could result in mammals returning to an area where damage was occurring once those methods were no longer used. The common factor when employing any method would be that mammals would return if suitable conditions continue to exist at the location where damage was occurring and mammal densities were sufficient to occupy all available habitats to the extent that damage occurs. Therefore, any reduction or prevention of damage from the use of methods addressed in Appendix B would be temporary if habitat conditions continue to exist that attract mammals to an area where damage was occurring.

[8]The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

Therefore, any method that disperses or removes mammals from areas would only be temporary if habitat containing preferred habitat characteristics continues to exist. Dispersing mammals using non-lethal methods addressed in Appendix B often requires repeated application to discourage mammals from returning to locations, which increases costs, moves mammals to other areas where they could cause damage, and would be temporary if habitat conditions that attracted those mammals to damage areas remained unchanged. Dispersing and translocating mammals could be viewed as moving a problem from one area to another, which would require addressing damage caused by those mammals at another location, which increases costs and could be perceived as creating a financial incentive to continue the use of those methods since mammals would have to be addressed annually and at multiple locations. WS' recommendation of or use of techniques to modify existing habitat or making areas unattractive to mammals is discussed in Appendix B. WS' objective would be to respond to requests for assistance with the most effective methods and to provide for the long-term solution to the problem using WS' Decision Model.

Managing damage caused by mammals can be divided into short-term redistribution approaches and long-term population and habitat management approaches. Short-term approaches focus on redistribution and dispersal of mammals to limit use of an area where damage or threats were occurring. Short-term redistribution approaches may include prohibiting feeding, the use of pyrotechnics, propane cannons, effigies, and other adverse noise, erecting access barriers such as fencing, and taste aversion chemicals. Population reduction by limiting survival or reproduction, removing mammals, and habitat modification would be considered long-term solutions to managing damage caused by wildlife.

Redistribution methods would often be employed to provide immediate resolution to damage occurring until long-term approaches can be implemented or have had time to reach the desired result. Dispersing mammals can often be a short-term solution that moves those mammals to other areas where damages or threats could occur. Some short-term methods may become less effective in resolving damage as a mammal population increases, as mammals become more acclimated to human activity, and as mammals become habituated to harassment techniques. Non-lethal methods often require a constant presence at locations when mammals are present and must be repeated every day or night until the desired results are achieved, which can increase the costs associated with those activities. Non-lethal methods may also require constant monitoring and maintenance to insure proper results. For example, fencing could be used to prevent access to a resource; however, constant monitoring of the fencing would be required and necessary repairs completed to ensure the use of fencing would be successful in preventing access to resources. Long-term solutions to resolving mammal damage often require management of the population and identifying the habitat characteristics that attract mammals to a particular location.

Based on the evaluation of the damage situation, the most effective methods would be employed individually or in combination based on prior evaluations of methods or combinations of methods in other damage management situations. Once employed, methods would be further evaluated for effectiveness based on a continuous evaluation of activities by WS. Therefore, the effectiveness of methods would be considered as part of the decision making-process under WS' use of the Decision Model described in Chapter 3 for each damage management request based on the continual evaluation of methods and results.

Mammal Damage Should be Managed by Private Nuisance Wildlife Control Agents

Private wildlife control agents could be contacted to reduce mammal damage for property owners or property managers when deemed appropriate by the resource owner. Some resource owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some resource owners would prefer to enter into an agreement with a government agency. In particular, those persons seeking assistance may prefer to use

WS because of security and safety issues. WS further clarifies interfacing with private business and establishing cooperative projects in WS Directive 3.101.

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to lethally take mammals. As described in Appendix B, the lethal removal of mammals with firearms by WS to alleviate damage or threats could occur using a handgun, rifle, or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996).

The take of mammals by WS using firearms in the State would occur primarily from the use of rifles. However, the use of shotguns or handguns could be employed to lethally take some species. To reduce risks to human safety and property damage from bullets passing through mammals, the use of rifles would be applied in such a way (*e.g.*, caliber, bullet weight, distance) to ensure the bullet does not pass through mammals. Mammals that are removed using rifles would occur within areas where retrieval of all mammal carcasses for proper disposal is highly likely (*e.g.*, at an airport). With risks of lead exposure occurring primarily from ingestion of bullet fragments, the retrieval and proper disposal of mammal carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a mammal, if misses occur, or if the mammal carcass was not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns occur that lead from bullets deposited in soil from shooting activities could contaminate ground water or surface water from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "*transport*" readily in surface water when soils were neutral or slightly alkaline in pH (*i.e.*, not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot. Stansley et al. (1992) believed the lead contamination near the parking lot was due to runoff from the lot, and not from the shooting range areas. The study also indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead levels in water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around the impact areas were far below the "*action level*" of 15 parts per billion as defined by the EPA (*i.e.*, requiring action to treat the water to remove lead). The study found that the dissolution (*i.e.*, capability of dissolving in water) of lead declines when lead oxides form on the surface areas of the spent bullets and fragments (Craig et al. 1999). Therefore, the transport of lead from bullets or shot distributed across the landscape was reduced once the bullets and shot formed crusty lead oxide deposits on their surfaces, which served to reduce naturally the potential for ground or surface water contamination (Craig et al. 1999). Those studies suggest that, given the very low amount of lead being deposited and the concentrations that would occur from WS' activities to reduce mammal damage

using firearms, as well as most other forms of dry land small game hunting in general, lead contamination of water from such sources would be minimal to nonexistent.

A secondary concern surrounding lead ammunition surrounds the issue of lead deposition in meat, particularly meat that is donated to various charities. Stewart and Veverka (2011) documented that white-tailed deer that were shot with lead ammunition in the head or extreme upper neck in sharpshooting situations showed no deposition of lead fragments in the meat of the animals that would have been processed for human consumption. Lower neck shots do frequently experience lead fragmentation in the loin muscle and the authors recommend removing the loins prior to processing to ensure that these fragments are not ingested. WS' personnel would be trained to shoot and target the head and upper neck of white-tailed deer. Any deer that were shot in the lower neck would not be donated but would be disposed of properly to avoid potential human ingestion of lead fragments.

Since those mammals removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement, WS' assistance with removing those mammals would not be additive to the environmental status quo. The amount of lead deposited into the environment could be lowered by WS' involvement in damage management activities due to efforts by WS to ensure projectiles do no pass through but are contained within the mammal carcass, which limits the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy would increase the likelihood that mammals were lethally removed humanely in situations that ensure accuracy and that misses occur infrequently which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement ensures mammal carcasses lethally removed using firearms would be retrieved and disposed of properly to limit the availability of lead in the environment and ensures mammal carcasses were removed from the environment to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that could be deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from mammal carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water.

A Site Specific Analysis Should be Made for Every Location Where Mammal Damage Management Would Occur

The underlying intent for preparing an EA is to determine if a proposed action might have a significant impact on the human environment. WS' EA development process is issue driven, meaning issues that were raised during the interdisciplinary process and through public involvement that were substantive, were used to drive the analysis and determine the significance of the environmental impacts of the proposed action and the alternatives. Therefore, the level of site specificity must be appropriate to the issues listed.

The analysis in this EA was driven by the issues raised during the scoping process during the development of the EA. In addition to the analysis contained in this EA, WS' personnel use the WS Decision Model (Slate et al. 1992) described in Chapter 3 as a site-specific tool to develop the most appropriate strategy at each location. The WS Decision Model is an analytical thought process used by WS' personnel for evaluating and responding to requests for assistance.

As discussed previously, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis that allows for a better cumulative impact analysis. If a determination were made through this EA that the alternatives developed to meet the need for action could result in a significant impact on the quality of the human environment, then an EIS would be prepared.

CHAPTER 3: ALTERNATIVES

Chapter 3 contains a discussion of the alternatives that were developed to meet the need for action discussed in Chapter 1 and to address the identified issues discussed in Chapter 2. Alternatives were developed for consideration based on the need for action and issues using the WS Decision model (Slate et al. 1992). The alternatives will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences). Chapter 3 also discusses alternatives considered but not analyzed in detail, with rationale. SOPs for mammal damage management in Mississippi are also discussed in Chapter 3.

3.1 DESCRIPTION OF THE ALTERNATIVES

The following alternatives were developed to meet the need for action and address the identified issues associated with managing damage caused by mammals in the State:

Alternative 1 - Continue the Current Adaptive Integrated Mammal Damage Management Program (No Action/Proposed Action)

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, when requested, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by mammals in Mississippi. A major goal of the program would be to resolve and prevent damage caused by mammals and to reduce threats to human safety. To meet this goal, WS would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding was available, operational damage management. Funding could occur through federal appropriations or from cooperative funding. The adaptive approach to managing damage associated with mammals would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by a site-specific evaluation to reduce damage or threats to human safety for each request. City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate non-lethal and lethal techniques.

Under this alternative, WS could respond to requests for assistance by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by mammals, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage. The take of many of the mammal species addressed in this EA can only legally occur through the issuance of a permit by the MDWFP and only at levels specified in the permit, unless those mammal species are afforded no protection in which case no permit for take is required.

Property owners or managers requesting assistance from WS would be provided with information regarding the use of effective and practical non-lethal and lethal techniques. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Property owners or managers may choose to implement WS' recommendations on their own (*i.e.*, technical assistance), use contractual services of private businesses, use volunteer services of private organizations, use the services of WS (*i.e.*, direct operational assistance), take the management action themselves, or take no further action.

WS would work with those persons experiencing mammal damage in addressing those mammals responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as mammals begin to cause damage. Mammal damage that has been

ongoing can be difficult to resolve using available methods since mammals would be conditioned to an area and would be familiar with a particular location. Subsequently, making that area unattractive using available methods could be difficult to achieve once damage was ongoing. WS would work closely with those entities requesting assistance to identify situations where damage could occur and begin to implement damage management activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of damage reduction requested by the cooperating entity.

WS' Decision Model would be the implementing mechanism for a damage management program under the proposed action alternative that would be adapted to an individual damage situation that allows for the broadest range of methods to be used to address damage or the threat of damage in the most effective, most efficient, and most environmentally conscious way available. When WS receives a request for direct operational assistance, WS would conduct site visits to assess damage or threats, would identify the cause of the damage, and would apply the Decision Model described by Slate et al. (1992) and WS Directive 2.201 to determine the appropriate methods to resolve or prevent damage. The use of the Decision model by WS' employees under the proposed action is further discussed below. In addition, preference would be given to non-lethal methods when practical and effective (WS Directive 2.101).

Non-lethal methods that would be available for use by WS under this alternative include, but are not limited to exclusion, cultural methods, minor habitat modifications, supplemental feeding, animal behavior modification (*e.g.*, electronic guards, propane exploders, pyrotechnics, effigies), translocation, foothold traps, cable restraints, cage traps, immobilizing drugs, nets, reproductive inhibitors, reproductive inhibitors, and repellents (see Appendix B for a complete list and description of potential methods). Lethal methods that would be available to WS under this alternative include body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, euthanasia chemicals, and shooting. In addition, target mammal species live-captured using non-lethal methods (*e.g.*, live-traps, immobilizing drugs) could be euthanized. The lethal control of target mammals would comply with WS Directive 2.505.

Listing methods implies neither that all methods would be used or recommended by WS to resolve requests for assistance nor does listing of methods imply that all methods would be used to resolve every request for assistance. The most appropriate response would often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. For example, if an entity requesting assistance had already attempted to alleviate damage using non-lethal methods, WS would not necessarily employ those same non-lethal methods, since those methods were proven ineffective at reducing damage or threats to an acceptable level to the requester.

Many lethal and non-lethal methods are intended to be short-term attempts at reducing damage occurring at the time those methods are employed. Long-term solutions to managing mammal damage would include limited habitat manipulations and changes in cultural practices, which are addressed further below and in Appendix B.

Non-lethal methods can disperse or otherwise make an area unattractive to mammals causing damage; thereby, reducing the presence of mammals at the site and potentially the immediate area around the site where non-lethal methods were employed. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model, especially when the requesting entity had used non-lethal methods previously and found those methods to be inadequate to resolving the damage or threats of damage. Non-lethal methods would be used to exclude, harass, and disperse target wildlife from areas where damage or threats were occurring. When effective, non-lethal methods would disperse mammals from an area resulting in a

reduction in the presence of those mammals at the site where those methods were employed. For any management methods employed, the proper timing would be essential in effectively dispersing those mammals causing damage. Employing methods soon after damage begins or soon after threats were identified, increases the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods would be necessary to be effective in achieving expedient resolution of mammal damage.

Under the proposed action alternative, WS could employ only non-lethal methods when determined to be appropriate for each request for assistance to alleviate damage or reduce threats of damage using the WS Decision Model. In many situations, the cooperating entity has tried to employ non-lethal methods to resolve damage prior to contacting WS for assistance. In those cases, the methods employed by the requester were either unsuccessful or the reduction in damage or threats had not reached a level that was tolerable by the requesting entity. In those situations, WS could employ other non-lethal methods, attempt to apply the same non-lethal methods, or employ lethal methods. In many situations, the implementation of non-lethal methods such as exclusion-type barriers would be the responsibility of the requestor, which means that, in those situations, WS only function would be to implement lethal methods, if determined to be appropriate using the WS Decision Model.

Lethal methods could be employed to resolve damage associated with those mammals identified by WS as responsible for causing damage or threats to human safety under this alternative; however, WS would only employ lethal methods after receiving a request for the use of those methods. The use of lethal methods would result in local population reductions in the area where damage or threats were occurring since mammals would be removed from the population. Lethal methods would often be employed to reinforce non-lethal methods and to remove mammals that were identified as causing damage or posing a threat to human safety. The use of lethal methods would result in local reductions of mammals in the area where damage or threats were occurring. The number of mammals removed from the population using lethal methods under the proposed action would be dependent on the number of requests for assistance received, the number of mammals involved with the associated damage or threat, and the efficacy of methods employed.

Often of concern with the use of lethal methods is that mammals that were lethally taken would only be replaced by other mammals either during the application of those methods (*e.g.*, mammals that relocate into the area) or by mammals the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). As stated previously, the use of lethal methods would not be used as population management tools over broad areas. The use of lethal methods would be intended to reduce the number of mammals present at a specific location where damage was occurring by targeting those mammals causing damage or posing threats. Since the intent of lethal methods would be to manage only those mammals causing damage and not to manage entire mammal populations, those methods would not be ineffective because mammals return.

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing mammal damage. The use of those methods would be intended to reduce damage occurring at the time those methods were employed but do not necessarily ensure mammals would not return once those methods were discontinued. Long-term solutions to resolving mammal damage would often be difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as fencing, or other practices that would not be costly or difficult to implement such as closing garbage cans. When addressing mammal damage, long-term solutions generally involve modifying existing habitat or making conditions to be less attractive to mammals. To ensure complete success, alternative sites in areas where damage was not likely to occur would often be required to achieve complete success in reducing damage and to avoid moving the problem from one area to another. Modifying a site to be less attractive

to mammals would likely result in the dispersal of those mammals to other areas where damage could occur or could result in multiple occurrences of damage situations.

WS may recommend mammals be harvested during the regulated hunting and/or trapping season for those species in an attempt to reduce the number of mammals causing damage. Managing mammal populations over broad areas could lead to a decrease in the number of mammals causing damage. Establishing hunting or trapping seasons and the allowed take during those seasons is the responsibility of the MDWFP. WS does not have the authority to establish hunting or trapping seasons or to set allowed harvest numbers during those seasons.

A complete list of chemical and non-chemical methods available for use under the identified alternatives, except the alternative with no damage management (Alternative 3), can be found in Appendix B. However, listing methods neither implies that all methods would be used by WS to resolve requests for assistance nor does the listing of methods imply that all methods would be used to resolve every request for assistance. As part of an integrated approach, WS may provide technical assistance and direct operational assistance to those persons experiencing damage associated with mammals.

Technical Assistance Recommendations

Under the proposed action, WS would provide technical assistance to those persons requesting assistance with managing damage as part of an integrated approach. Technical assistance would occur as described in Alternative 2 of this EA. From FY 2005 through FY 2011, WS conducted 1,111 technical assistance projects that involved mammal damage to agricultural resources, property, natural resources, and threats to human safety (see Table 1.1).

Operational Damage Management Assistance

Operational damage management assistance would include damage management activities that were directly conducted by or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and there was a written MOU, cooperative service agreement, or other comparable document signed between WS and the entity requesting assistance. The initial investigation by WS' personnel would define the nature, history, and extent of the problem; species responsible for the damage; and methods available to resolve the problem. The professional skills of WS' personnel could be required to effectively resolve problems, especially if chemical methods were necessary or if the problems were complex.

Educational Efforts

Education is an important element of activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations, WS provides lectures, courses, and demonstrations to producers, homeowners, state and county agents, colleges and universities, and other interested groups. WS frequently cooperates with other entities in education and public information efforts. Additionally, technical papers have been and would continue to be presented at professional meetings and conferences so that other wildlife professionals and the public were periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

Research and Development

The National Wildlife Research Center (NWRC) functions as the research unit of WS by providing scientific information and the development of methods for wildlife damage management, which are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate methods and techniques for managing wildlife damage. For example, research biologists from the NWRC were involved with developing and evaluating the reproductive inhibitor known under the trade name of Gonacon™. Research biologists with the NWRC have authored hundreds of scientific publications and reports based on research conducted involving wildlife and methods.

WS' Decision Making Procedures

WS' personnel would use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992). WS' personnel would assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation would be incorporated into a damage management strategy. After this strategy was implemented, monitoring would be conducted and evaluation would continue to assess the effectiveness of the strategy. If the strategy were effective, the need for further management would be ended. In terms of the WS Decision Model, most efforts to resolve wildlife damage consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS.

Community-based Decision Making

WS could receive requests for assistance from community leaders and/or representatives. In those situations, the WS program in Mississippi under this alternative would follow the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997) when receiving a request for assistance from a community leader or representative. Within this management model, WS could provide technical assistance regarding the biology and ecology of mammals and effective, practical, and reasonable methods available to the local decision-maker(s) to reduce damage or threats. This could include non-lethal and lethal methods. WS and other state and federal wildlife management agencies may facilitate discussions at local community meetings when resources are available. Resource owners and others directly affected by mammal damage or conflicts in the State have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Under a community based decision-making process, WS would provide information, demonstration, and discussion on available methods to the appropriate representatives of the community for which services were requested to ensure a community-based decision was made. By involving decision-makers in the process, damage management actions could be presented to allow decisions on damage management to involve those individuals that the decision-maker(s) represents. As addressed in this EA, WS would provide technical assistance to the appropriate decision-maker(s) to allow for information on damage management activities to be presented to those persons represented by the decision-maker(s), including demonstrations and presentation by WS at public meetings to allow for involvement of the community. Requests for assistance to manage damage caused by mammals often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives of the community, the decision-maker(s) would be able to provide the information to local

interests either through technical assistance provided by WS or through demonstrations and presentation by WS on damage management activities. This process would allow decisions on damage management activities to be made based on local input. The community leaders could implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Community Decision-Makers

The decision-maker for the local community would be elected officials or representatives of the communities. The elected officials or representatives are popularly elected residents of the local community or appointees who oversee the interests and business of the local community. This person or persons would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision-making. Identifying the decision-maker for local business communities can be more complex because building owners may not indicate whether the business must manage wildlife damage themselves, or seek approval to manage wildlife from the property owner or manager, or from a governing Board. WS could provide technical assistance and make recommendations for damage reduction to the local community or local business community decision-maker(s). Direct assistance could be provided by WS only if requested by the local community decision-maker, funding is provided, and if the requested direct control was compatible with WS' recommendations.

Private Property Decision-Makers

WS could also receive requests for assistance from private property owners. In the case of private property owners, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs or does not occur on property they own or manage. Due to privacy issues, WS cannot disclose cooperator information to others. Therefore, in the case of an individual property owner or manager, the involvement of others and to what degree others are involved in the decision-making process would be a decision made by that individual. Direct control could be provided by WS if requested, funding was provided, and the requested management was in according with WS' recommendations.

Public Property Decision-Makers

Request for WS' assistance could originate from public property owners or managers. The decision-maker for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals, and legal mandates for the property. WS could provide technical assistance to this person and recommendations to reduce damage. Direct control could be provided by WS if requested, funding provided, and the requested actions were within the recommendations made by WS.

Alternative 2 – Mammal Damage Management by WS through Technical Assistance Only

Under this alternative, WS would provide those cooperators requesting assistance with technical assistance only. Similar to Alternative 1, WS could receive requests for assistance from community representatives, private individuals/businesses, or from public entities. Technical assistance would provide those cooperators experiencing damage or threats associated with mammals with information, demonstrations, and recommendations on available and appropriate methods available. The implementation of methods and techniques to resolve or prevent damage would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that are of limited availability for use by private entities (*e.g.*, loaning of propane cannons). Technical

assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies would be described to the requester for short and long-term solutions to managing damage; these strategies would be based on the level of risk, need, and the practicality of their application. WS would use the Decision Model to recommend those methods and techniques available to the requester to manage damage and threats of damage. Those persons receiving technical assistance from WS could implement those methods recommended by WS, could employ other methods not recommended by WS, could seek assistance from other entities, or take no further action.

Under a technical assistance only alternative, WS would recommend an integrated approach similar to the proposed action alternative (Alternative 1) when receiving a request for assistance; however, WS would not provide direct operational assistance under this alternative. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Recommendation of methods and techniques by WS to resolve damage would be based on information provided by the individual seeking assistance using the WS Decision Model. In some instances, wildlife-related information provided to the requestor by WS would result in tolerance/acceptance of the situation. In other instances, damage management options would be discussed and recommended. Only those methods legally available for use by the appropriate individual would be recommend or loaned by WS. Similar to Alternative 1, those methods described in Appendix B would be available to those persons experiencing damage or threats associated with mammals in the State except for immobilizing drugs, euthanasia chemicals, and reproductive inhibitors. Immobilizing drugs and euthanasia chemicals would only be available to WS or appropriately licensed veterinarians. Under this alternative, the reproductive inhibitor available under the trade name of Gonacon™ would only be available for use by the MDWFP. At the time this EA was developed, Gonacon™ was not registered for use in the State.

The WS program in the State regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing mammal damage. Technical assistance includes collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator has attempted to resolve the problem. WS then provides information on appropriate methods that the cooperator may consider to resolve the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues. Between FY 2005 through FY 2011, WS has conducted 1,111 technical assistance projects that involved mammal damage to agricultural resources, property, natural resources, and threats to human safety.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or private businesses. Those persons experiencing damage or are concerned with threats posed by mammals could seek assistance from other governmental agencies, private entities, or conduct damage management on their own. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent mammal damage as permitted by federal, state, and local laws and regulations or those persons could take no action.

Alternative 3 – No Mammal Damage Management Conducted by WS

This alternative would preclude all activities by WS to reduce threats to human health and safety, and to alleviate damage to agricultural resources, property, and natural resources. WS would not be involved with any aspect of mammal damage management in the State. All requests for assistance received by WS to resolve damage caused by mammals would be referred to the MDWFP, other governmental agencies, and/or other private entities.

Despite no involvement by WS in resolving damage and threats associated with mammals in the State, those persons experiencing damage caused by mammals could continue to resolve damage by employing those methods legally available since the take of mammals to alleviate damage or threats can occur despite the lack of involvement by WS. The take of mammals by other entities could occur through the issuance of permits by the MDWFP, when required, and during the hunting or trapping seasons. Landowners, agricultural leaseholders and their designated agents can lethally take coyotes, fox, skunks, and feral swine at any time when those species are causing damage in accordance with appropriate regulations (MDWFP 2012). All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of immobilizing drugs and euthanasia chemicals. Gonacon™ would not be used by WS under this alternative but would be available to the MDWFP, if registered for use in the State. Immobilizing drugs and euthanasia chemicals can only be used by WS or appropriately licensed veterinarians.

Therefore, under this alternative, those persons experiencing damage or threats of damage could contact WS but WS would immediately refer the requester to the MDWFP and/or other entities, the requester could contact other entities for information and assistance with managing damage, could take actions to alleviate damage without contacting any entity, or could take no action.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

In addition to those alternatives analyzed in detail, several additional alternatives were identified by WS and the TVA. However, those alternatives will not receive detailed analyses for the reasons provided. Those alternatives considered but not analyzed in detail include:

Non-lethal Methods Implemented Before Lethal Methods

This alternative would require that non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce damage and threats to safety from mammals in the State. If the use of non-lethal methods fails to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the request. This alternative would not prevent the use of lethal methods by other entities or by those persons experiencing mammal damage but would only prevent the use of those methods by WS until non-lethal methods had been employed.

Those persons experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS. Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the presence or absence of non-lethal methods can be evaluated. The proposed action (Alternative 1) and the technical assistance only alternative (Alternative 2) are similar to a non-lethal before lethal alternative because WS would use or recommend non-lethal methods before lethal methods (WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in the EA.

Use of Non-lethal Methods Only by WS

Under this alternative, WS would be required to implement non-lethal methods only to resolve damage caused by mammals in the State. Only those methods discussed in Appendix B that are considered non-lethal would be employed by WS. No lethal take of mammals would occur by WS. The use of lethal methods could continue to be used under this alternative by other entities or by those persons

experiencing damage by mammals. The non-lethal methods used or recommended by WS under this alternative would be identical to those non-lethal methods identified in any of the alternatives.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS could refer requests for information regarding lethal methods to the MDWFP, local animal control agencies, or private businesses or organizations. Under this alternative, however, property owners/managers might be limited to using non-lethal methods only as they may have difficulty obtaining permits for lethal methods.

Property owners or managers could conduct management using any method that was legal. Property owners or managers might choose to implement WS' non-lethal recommendations, implement lethal methods, or request assistance from a private or public entity other than WS. Property owners/managers frustrated by the lack of WS' assistance with the full range of mammal damage management techniques may try methods not recommended by WS or use illegal methods (*e.g.*, poisons). In some cases, property owners or managers may misuse some methods or use some methods in excess of what is necessary, which could then become hazardous and pose threats to the safety of humans and non-target species.

The proposed action, using an integrated damage management approach, incorporates the use of non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage from mammals those methods would be used or recommended under the proposed action. Since non-lethal methods would be available for use under the alternatives analyzed in detail, this alternative would not add to the analyses. Those mammals that could be lethally removed by WS under any of the alternatives could be removed by those persons experiencing damage or threats even if WS was not involved.

Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce threats and damage associated with mammals. However, non-lethal methods can be effective in preventing damage in certain instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Non-lethal methods have been effective in alleviating mammal damage. For example, the use of one-way exclusion devices can be effective at allowing bats to exit a structure but prevent re-entry. Once bats have exited the structure, structural repairs could be completed to permanently prevent re-entry of bats. In those situations where damage could be alleviated using non-lethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Trap and Translocate Mammals Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Mammals would be live-captured using immobilizing drugs, live-traps, cannon nets, or rocket nets. All mammals live-captured through direct operational assistance by WS would be translocated. Translocation sites would be identified and have to be approved by the MDWFP and/or the property owner where the translocated mammals would be placed prior to live-capture and translocation. The translocation of mammals could only occur under the authority of the MDWFP. The translocation of mammals by WS would only occur as directed by the MDWFP. When requested by the MDWFP, WS could translocate mammals or recommend translocation under any of the alternatives analyzed in detail, except under the no involvement by WS alternative (Alternative 3). However, other entities could translocate mammals under Alternative 3.

The translocation of mammals that have caused damage or pose threats of damage to other areas following live-capture generally would not be effective or cost-effective. Translocation is generally

ineffective because problem mammal species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in mammal damage problems at the new location. In addition, hundreds of mammals would need to be captured and translocated to solve some damage problems (*e.g.*, deer confined within a perimeter fence); therefore, translocation would be unrealistic. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of the stress to the translocated animal, the potential for spreading diseases, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988). Since WS does not have the authority to translocate mammals in the State unless permitted by the MDWFP, this alternative was not considered in detail.

Reducing Damage by Managing Mammal Populations through the Use of Reproductive Inhibitors

Under this alternative, the only method that would be available to resolve requests for assistance by WS would be the recommendation and the use of reproductive inhibitors to reduce or prevent reproduction in mammals responsible for causing damage. Reproductive inhibitors are often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et al. 1997). Use and effectiveness of reproductive control as a population management tool for wildlife is limited by population dynamic characteristics (*e.g.*, longevity, age at onset of reproduction, population size, and biological/cultural carrying capacity), habitat and environmental factors (*e.g.*, isolation of target population, cover types, and access to target individuals), socioeconomic, and other factors.

Reproductive control for wildlife could be accomplished through either sterilization (permanent) or contraception (reversible). Sterilization could be accomplished through: 1) surgical sterilization (vasectomy, castration, and tubal ligation), 2) chemosterilization, and 3) through gene therapy. Contraception could be accomplished through: 1) hormone implantation (synthetic steroids such as progestins), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily).

Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species.

Currently, reproductive inhibitors are not available for use to manage most mammal populations. Given the costs associated with live-capturing and performing sterilization procedures on mammals and the lack of availability of chemical reproductive inhibitors for the management of most mammal populations, this alternative was not evaluated in detail. If a reproductive inhibitor becomes available to manage a large number of mammal populations that proves to be effective in reducing localized mammal populations, the use of the inhibitor could be evaluated under the proposed action as a method available that could be used in an integrated approach to managing damage. This EA would be reviewed and supplemented to the degree necessary to evaluate the use of the reproductive inhibitor as part of an integrated approach described under the proposed action. Currently, the only reproductive inhibitor that is registered with the EPA is Gonacon™, which is registered for use on white-tailed deer only. However, Gonacon™ is not currently registered for use in the State. Reproductive inhibitors for the other mammal species addressed in this EA do not currently exist.

Compensation for Mammal Damage

The compensation alternative would require WS to establish a system to reimburse persons impacted by mammal damage and to seek funding for the program. Under such an alternative, WS would continue to provide technical assistance to those persons seeking assistance with managing damage. In addition, WS would conduct site visits to verify damage. Evaluation of this alternative indicates that a compensation only alternative has many drawbacks. Compensation would: 1) require large expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation, 2) compensation most likely would be below full market value, 3) give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies, and 4) not be practical for reducing threats to human health and safety.

Short Term Eradication and Long Term Population Suppression

An eradication alternative would direct all WS' program efforts toward total long-term elimination of mammal populations wherever a cooperative program was initiated in Mississippi. Eradication of native mammal species is not a desired population management goal of State agencies or WS. Eradication as a general strategy for managing mammal damage was not considered in detail because State and federal agencies with interest in, or jurisdiction over, wildlife oppose eradication of any native wildlife species and eradication is not acceptable to most people.

Suppression would direct WS' program efforts toward managed reduction of certain problem populations or groups. In areas where damage can be attributed to localized populations of mammals, WS could decide to implement local population suppression using the WS' Decision Model. However, it is not realistic or practical to consider large-scale population suppression as the basis of the WS' program. Problems with the concept of suppression are similar to those described above for eradication. Typically, WS' activities in Mississippi would be conducted on a very small portion of the sites or areas inhabited or frequented by problem species.

Bounties

Payment of funds (bounties) for killing some mammals suspected of causing economic losses have not been supported by state fish and game agencies, such as the MDWFP, as well as most wildlife professionals for many years (Latham 1960, Hoagland 1993). WS concurs with those agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties. Bounties are often ineffective at controlling damage over a wide area, such as the entire State. The circumstances surrounding the take of animals are typically arbitrary and completely unregulated because it is difficult or impossible to assure animals claimed for bounty were not taken from outside the area where damage was occurring. In addition, WS does not have the authority to establish a bounty program.

Trap-Neuter-Release Program for Feral and Free Ranging Cats and/or Dogs

This topic has undergone considerable debate in animal welfare and scientific communities for a number of years. The debate focuses on whether controlling feral, free-ranging, or invasive animal populations through Trap-Neuter-Release (TNR) programs are effective and alleviate problems (*i.e.*, diseases, predation, agricultural damage, and human safety).

Theoretically, TNR would work if all animals of one sex or both were sterilized. However, the probability of controlling invasive species in the wild with this technique is not currently reasonable; especially, with the animals being self-sufficient and not relying on humans to survive. Additionally,

some individuals within a population can be trap-shy. Capturing or removing trap-shy individuals often requires implementing other methods.

In addition, the National Association of State Public Health Veterinarians and the AVMA oppose TNR programs based on health concerns and threats (AVMA 2003). Of major concern would be the potential for disease and parasite transmission to humans from direct contact during sterilization or the risk of exposure after the animal was released. Once live-captured, performing sterilization procedures during field operations on anesthetized animals would be difficult. Sanitary conditions would be difficult to maintain when performing surgical procedures in field conditions. To perform operations under appropriate conditions, live-captured animals would need to be transported from the capture site to an appropriate facility, which increases the threat from handling and transporting. A mobile facility could be used; however, a mobile facility would still require additional handling and transporting of the live-captured animals to the facility. Once the surgical procedure was completed, the animal would have to be held to ensure recovery and transported back to the area where capture occurred.

TNR programs are often not as successful as desired and needed to reduce immediate threats posed by wildlife, especially when human safety is a concern (AVMA 2003, Barrows 2004, Levy and Crawford 2004, Jessup 2004, Winter 2004, AVMA 2009). Feral animals subjected to a TNR program would continue to cause the same problems[9] they caused before the TNR program was initiated because of slow attrition. TNR programs can take a decade or longer to reduce target species populations (Barrows 2004, Winter 2004); especially, when acute issues need rapid solutions (Levy and Crawford 2004, Stoskopf and Nutter 2004). Several studies report that target species' populations often remain stable or increase following TNR programs due to immigration and reproduction from other members of the groups (Castillo and Clarke 2003, Levy and Crawford 2004, Winter 2004) with little to no resolution of threats to human safety or damages (Barrows 2004, Slater 2004, Winter 2004).

Other concerns arise when considering the legality of TNR programs given the documented damage caused by target species, especially to native wildlife (Barrows 2004, Levy and Crawford 2004, Jessup 2004). Some people have questioned whether TNR programs are violating the Migratory Bird Treaty Act and the ESA because released animals may continue to kill migratory birds and/or endangered species (Barrows 2004, Levy and Crawford 2004, Jessup 2004). Because of the continued threat to human safety created by TNR programs and the continued threat to T&E wildlife and native wildlife in general, this alternative will not be considered further.

3.3 STANDARD OPERATING PROCEDURES FOR MAMMAL DAMAGE MANAGEMENT

SOPs improve the safety, selectivity, and efficacy of activities intended to resolve wildlife damage. The WS program in Mississippi uses many such SOPs. Those SOPs would be incorporated into activities conducted by WS under the appropriate alternatives when addressing mammal damage and threats in the State.

Some key SOPs pertinent to resolving mammal damage in the State include the following:

- The WS Decision Model, which is designed to identify effective strategies to managing wildlife damage and their potential impacts, would be consistently used and applied when addressing mammal damage.

[9] Brickner (2003), Levy et al. (2003), Barrows (2004), and Jessup (2004) reported that sterilized cats that do not spend any time on courting and mating are left with more time to hunt than non-sterilized cats and therefore, continue to remain as potential reservoirs of animal and human disease, a social nuisance, and continue to hunt and kill protected species.

- EPA-approved label directions would be followed for all pesticide use. The registration process for chemical pesticides is intended to assure minimal adverse effects occur to the environment when chemicals are used in accordance with label directions.

- Immobilizing and euthanasia drugs would be used according to the DEA, FDA, and WS' directives and procedures.

- All controlled substances would be registered with the DEA or the FDA.

- WS' employees would follow approved procedures outlined in the WS' Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson et al. 2001).

- WS' employees that use controlled substances would be trained to use each material and would be certified to use controlled substances.

- WS' employees who use pesticides and controlled substances would participate in State-approved continuing education to keep current of developments and maintain their certifications.

- Pesticide and controlled substance use, storage, and disposal would conform to label instructions and other applicable laws and regulations, and Executive Order 12898.

- Material Safety Data Sheets for pesticides and controlled substances would be provided to all WS' personnel involved with specific damage management activities.

- All personnel who use firearms would be trained according to WS' Directives.

- The use of non-lethal methods would be considered prior to the use of lethal methods when managing mammal damage.

- The take of mammals by WS under the proposed action alternative would only occur when authorized by the MDWFP, when applicable, and only at levels authorized.

- Management actions would be directed toward localized populations, individuals, or groups of target species. Generalized population suppression across Mississippi, or even across major portions of Mississippi, would not be conducted.

- Non-target animals live-captured in traps would be released unless it is determined that the animal would not survive and/or that the animal could not be released safely.

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

Several additional SOPs are applicable to the alternatives and the issues identified in Chapter 2 including the following:

Issue 1 - Effects of Damage Management Activities on Target Mammal Populations

- Lethal take of mammals by WS would be reported and monitored by WS and the MDWFP to evaluate population trends and the magnitude of WS' take of mammals in the State.

- WS would only target those individuals or groups of target species identified as causing damage or posing a threat to human safety.

- The WS' Decision Model, designed to identify the most appropriate damage management strategies and their impacts, would be used to determine strategies for resolving mammal damage.

- WS would monitor activities to ensure those activities do not adversely affect mammal populations in the State.

- Preference would be given to non-lethal methods, when practical and effective.

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

- When conducting removal operations via shooting, identification of the target would occur prior to application.

- As appropriate, suppressed firearms would be used to minimize noise impacts.

- Personnel would use lures, trap placements, and capture devices that would be strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.

- Any non-target animals captured in cage traps, nets, or any other restraining device would be released whenever it is possible and safe to do so.

- Live-traps would be checked at least once every 24 hours or in accordance with Mississippi laws and regulations. This would help ensure non-target species were released in a timely manner.

- Carcasses of mammals retrieved after damage management activities have been conducted would be disposed of in accordance with WS Directive 2.515.

- WS has consulted with the USFWS and the MDWFP to evaluate activities to resolve mammal damage and threats to ensure the protection of T&E species. WS would abide by those recommendations made by the USFWS during consultation to ensure activities were not likely to adversely affect T&E species.

- WS would monitor activities conducted under the selected alternative, if activities are determined to have no significant impact on the environment and an EIS is not required, to ensure those activities do not negatively impact non-target species.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

- Damage management activities would be conducted professionally and in the safest manner possible. Whenever possible, damage management activities would be conducted away from areas of high human activity. If this is not possible, then activities would be conducted during periods when human activity is low (*e.g.*, early morning).

- Shooting would be conducted during times when public activity and access to the control areas was restricted. Personnel involved in shooting operations would be fully trained in the proper and safe application of this method.

- All personnel employing chemical methods would be properly trained and certified in the use of those chemicals. All chemicals used by WS would be securely stored and properly monitored to ensure the safety of the public. WS' use of chemicals and training requirements to use those chemicals are outlined in WS Directive 2.401 and WS Directive 2.430.

- All chemical methods used by WS or recommended by WS would be registered with the EPA, DEA, FDA, and/or the MDAC, as appropriate.

- WS would adhere to all established withdrawal times for mammals when using immobilizing drugs for the capture of mammals that are agreed upon by WS, the MDWFP, and veterinarian authorities. Although unlikely, in the event that WS was requested to immobilize mammals either during a time when harvest of those mammal species is occurring or during a time where the withdrawal period could overlap with the start of a harvest season, WS would euthanize the animal or mark the animal with ear tags labeled with a "*do not eat*" warning and appropriate contact information.

- Carcasses of mammals retrieved after damage management activities would be disposed of in accordance with WS Directive 2.515.

Issue 4 - Effects on the Aesthetic Values of Mammals

- Management actions to reduce or prevent damage caused by mammals would be directed toward specific individuals identified as responsible for the damage, identified as posing a threat to human safety, or identified as posing a threat of damage.

- All methods or techniques applied to resolve damage or threats to human safety would be agreed upon by entering into a cooperative service agreement, MOU, or comparable document prior to the implementation of those methods.

- Preference would be given to non-lethal methods, when practical and effective.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

- Personnel would be well trained in the latest and most humane devices/methods for removing mammals causing damage.

- Live-traps would be checked at least once every 24 hours or in accordance with Mississippi laws and regulations. This would help ensure non-target species were released in a timely manner.

- When deemed appropriate using the WS' Decision Model, WS' use of lethal methods would comply with WS' directives (WS Directive 2.505, WS Directive 2.430).

- The NWRC is continually conducting research to improve the selectivity and humaneness of wildlife damage management devices used by personnel in the field.

- The use of non-lethal methods would be considered prior to the use of lethal methods when managing mammal damage.

Issue 6 - Effects of Mammal Damage Management Activities on the Regulated Harvest of Mammals

- Management actions to reduce or prevent damage caused by mammals in the State would be directed toward specific individuals identified as responsible for the damage, identified as posing a threat to human safety, or identified as posing a threat of damage.

- WS' activities to manage damage and threats caused by mammals would be coordinated with the MDWFP.

- WS' lethal take (killing) of mammals would be reported to and monitored by the MDWFP to ensure WS' take has been considered as part of management objectives for those mammal species in the State.

- WS would monitor activities to ensure those activities do not adversely affect mammal populations in the State.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2. The alternatives discussed in Chapter 3 were developed in response to the issues identified in Chapter 2 as well as to meet the need for action discussed in Chapter 1. This chapter analyzes the environmental consequences of each alternative as that alternative relates to the issues identified. The following resource values in the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, critical habitats (areas listed in T&E species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Those resources will not be analyzed further.

The activities proposed in the alternatives would have a negligible effect on atmospheric conditions, including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur because of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action/no action alternative (Alternative 1) serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS, the MDWFP, the MDAC, and the TVA.

Issue 1 - Effects of Damage Management Activities on Target Mammal Populations

A common issue is whether damage management actions would adversely affect the populations of target mammal species, especially when lethal methods were employed. WS would maintain ongoing contact with the MDWFP to ensure activities occurred within management objectives for those species. WS would submit activity reports to the MDWFP. The MDWFP would monitor the total take of mammals from all sources and would factor in survival rates from predation, disease, and other mortality data. Ongoing contact with the MDWFP would assure local, state, and regional knowledge of wildlife

population trends would be considered. As discussed previously, the analysis for magnitude of impact from lethal take can be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest trend data. Information on mammal populations and trends are often derived from several sources, including published literature and harvest data.

Methods available to address mammal damage or threats of damage in the State that would be available for use or recommendation under Alternative 1 (proposed action/no action alternative) and Alternative 2 (technical assistance only alternative) would either be lethal methods or non-lethal methods. Many of the methods would also be available to other entities under Alternative 3 (no involvement by WS alternative). The only methods that would not be available for use by other entities under Alternative 2 and Alternative 3 would be immobilizing drugs and euthanasia chemicals. Gonacon™ would not be available for use by private individuals but would be available for use by the MDWFP and/or their designated agents, if registered. Under Alternative 2, WS could recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance. Alternative 1 would address requests for assistance received by WS through technical and/or operational assistance where an integrated approach to methods would be employed and/or recommended. Non-lethal methods that would be available to WS under Alternative 1 would include, but would not be limited to exclusion, cultural methods, minor habitat modifications, supplemental feeding, animal behavior modification (*e.g.*, electronic guards, propane exploders, pyrotechnics, effigies), translocation, foothold traps, cable restraints, cage traps, immobilizing drugs, nets, reproductive inhibitors, reproductive inhibitors, and repellents (see Appendix B for a complete list and description of potential methods).

Non-lethal methods that would be available under all of the alternatives can disperse or otherwise make an area unattractive to mammals causing damage; thereby, reducing the presence of mammals at the site and potentially the immediate area around the site where non-lethal methods were employed. Non-lethal methods would be given priority by WS when addressing requests for assistance under Alternative 1 and Alternative 2 (see WS Directive 2.101). However, non-lethal methods would not necessarily be employed or recommended to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if a cooperator requesting assistance had already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods since their use had already been proven ineffective in adequately resolving the damage or threat.

Many non-lethal methods would be used to exclude, harass, and disperse target wildlife from areas where damage or threats were occurring. When effective, non-lethal methods would disperse mammals from the area resulting in a reduction in the presence of those mammals at the site where those methods were employed. However, mammals responsible for causing damage or threats would be dispersed to other areas with minimal impact on those species' populations. Non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods would generally be regarded as having minimal impacts on overall populations of wildlife since individuals of those species were unharmed. The use of non-lethal methods would not have adverse impacts on mammal populations in the State under any of the alternatives.

The continued use of non-lethal methods often leads to the habituation of mammals to those methods, which can decrease the effectiveness of those methods. For any management methods employed, the proper timing would be essential in effectively dispersing those mammals causing damage. Employing methods soon after damage begins or soon after threats were identified would increase the likelihood that those damage management activities would achieve success in addressing damage. Therefore, the

coordination and timing of methods would be necessary to be effective in achieving expedient resolution of mammal damage.

In addition to non-lethal methods that would be used to disperse, exclude, or harass wildlife, another non-lethal method that could be available under the alternatives would be the reproductive inhibitor commonly known as Gonacon™. The reproductive inhibitor Gonacon™ is currently not registered for use in Mississippi. However, it is discussed in this assessment to evaluate the potential use of the chemical if it becomes registered for use in the future. Gonacon™ has been classified as a restricted-use pesticide by the EPA. Restricted-use pesticides can only be purchased and/or applied by those persons who have successfully completed an applicators course to use restricted-use pesticides. The MDAC administers training and testing required for applicators to purchase and apply restricted-use pesticides in the State. Gonacon™ could be employed by WS and the MDWFP, if registered for use in the State, under Alternative 1. Only the MDWFP or their designated agents could use Gonacon™ if Alternative 2 or Alternative 3 were selected.

In addition to non-lethal methods, lethal methods would also be available for use under all the alternatives by WS and/or by other entities. Lethal methods that would be available to address mammal damage include body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, shooting, euthanasia chemicals. In addition, target mammal species live-captured using non-lethal methods (*e.g.*, live-traps, immobilizing drugs) could be euthanized. All of those methods would be available for use by WS or for recommendation by WS under Alternative 1. Lethal methods would be employed by WS under Alternative 1 to resolve damage only after receiving a request for the use of those methods. Those same methods would also be available for WS to recommend and for other entities to use under Alternative 2. Under Alternative 3, those same lethal methods would continue to be available for use by other entities despite the lack of involvement by WS in damage management activities.

When live-captured target animals are to be lethally taken under Alternative 1, take would occur pursuant to WS Directive 2.505 and WS Directive 2.430. Under alternative 2, WS would recommend the use of methods to lethally take live-captured or restrained target animals in accordance with WS Directive 2.505. No assistance would be provided by WS under Alternative 3; however, many of those methods available to lethally take live-captured or restrained animals would continue to be available for use by other entities under Alternative 3.

The use of lethal methods by any entity could result in local population reductions in the area where damage or threats were occurring since target individuals would be removed from the population. Lethal methods could be employed or recommended to remove mammals that have been identified as causing damage or posing a threat to human safety. Therefore, the use of lethal methods could result in local reductions of mammals in the area where damage or threats were occurring. The number of mammals removed from the population by WS using lethal methods under Alternative 1 would be dependent on the number of requests for assistance received, the number of mammals involved with the associated damage or threat, and the efficacy of methods employed. The number of mammals removed by other entities under Alternative 2 and Alternative 3 would be unknown but would likely be similar to the take that could occur under Alternative 1.

Most lethal methods are intended to reduce the number of mammals present at a location since a reduction in the number of mammals at a location could lead to a reduction in damage, which would be applicable whether using lethal or non-lethal methods. The intent of non-lethal methods would be to harass, exclude, or otherwise make an area unattractive to mammals, which disperses those mammals to other areas leading to a reduction in damage at the location where those mammals were dispersed. Similarly, the use of a reproductive inhibitor would be to reduce a local population of target mammals,

which could reduce the damage occurring since fewer individuals in a localized population can lead to more tolerable damage levels. The intent of using lethal methods would be similar to the objective trying to be achieved when using non-lethal methods, which would be to reduce the number of mammals in the area where damage was occurring; thereby, reducing the damage occurring at that location.

Often of concern with the use of lethal methods is that mammals that were lethally taken would only be replaced by other mammals either during the application of those methods (*e.g.*, mammals that relocate into the area) or by mammals the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). As stated previously, WS would not use lethal methods during direct operational assistance as population management tools over broad areas. Lethal methods would be employed under Alternative 1 to reduce the number of mammals present at a location where damage was occurring by targeting those mammals causing damage or posing threats. Since the intent of using lethal methods would be to manage those mammals causing damage and not to manage entire mammal populations, those methods would not be ineffective because mammals could be replaced by other mammals later.

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing mammal damage. Those methods would be employed to reduce damage occurring at the time those methods were employed but do not necessarily ensure mammals would not return once those methods were discontinued or after the reproductive season (when young disperse and occupy vacant areas). Long-term solutions to resolving mammal damage can often be difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as fencing, or other practices such as structural repairs. When addressing mammal damage, long-term solutions generally involve modifying existing habitat or making conditions to be less attractive to mammals. To ensure complete success, alternative sites in areas where damage was not likely to occur would often times be required to achieve complete success in reducing damage and to avoid moving the problem from one area to another. Modifying a site to be less attractive to mammals would likely result in the dispersal of those mammals to other areas where damage could occur or could result in multiple occurrences of damage situations.

WS may recommend under Alternative 1 and Alternative 2 that property owners or managers, that request assistance, allow mammals to be harvested during the regulated hunting and/or trapping season for those species in an attempt to reduce the number of mammals causing damage on their properties. Managing localized mammal populations by allowing hunting and/or trapping could lead to a decrease in the number of mammals causing damage. Establishing hunting and trapping seasons and the allowed take during those seasons is the responsibility of the MDWFP. WS does not have the authority to establish hunting or trapping seasons or to set allowed harvest numbers during those seasons. However, the harvest of those mammals during hunting and/or trapping seasons in the State would be occurring in addition to any take that could occur by WS under the alternatives or recommended by WS. In addition, mammals could also be lethally removed by other entities to alleviate damage or threats of damage under all the alternatives. The total number of individuals from each species that were lethally removed by other entities to alleviate damage or threats of damage is currently not available.

As discussed previously, the analysis to determine the magnitude of impact from lethal take can be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest trend data. The issue of the potential impacts of conducting the alternatives on the populations of those mammal species addressed in this assessment is analyzed for each alternative below.

Alternative 1 - Continue the Current Adaptive Integrated Mammal Damage Management Program (No Action/Proposed Action)

Under the proposed action, WS would continue to provide both technical assistance and direct operational assistance to those persons requesting assistance with managing damage and threats associated with mammals in the State. WS could employ those methods described in Appendix B in an adaptive approach that would integrate methods to effectively reduce damage and threats associated with mammals in the State.

WS' take that could occur to alleviate damage or threats of damage under the proposed action would be monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take was maintained below the level that would cause undesired adverse effects to the viability of native species' populations. The potential impacts on the populations of target mammal species from the implementation of the proposed action are analyzed for each species below.

Nine-banded Armadillo Population Information and Effects Analysis

The nine-banded armadillo is easily recognized due to its unique appearance. An opossum sized animal, the armadillo has 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). 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 often causes armadillos to starve during winter months.

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 Mississippi. Layne (2003) summarizes the natural habitat types occupied by armadillos throughout their range as "*...pine-oak woodlands, oak-elm woodlands, pine forests, mixed pine-hardwood forests, bottomland forests, riparian woodlands, mesic hardwood forests, scrub, chaparral-mixed grass, inland and coastal prairies, salt marsh, coastal dunes, and coastal strand*." Human-modified habitats where armadillos can be found which has been summarized by Layne (2003) included "*...pastures, parkland, cemeteries, golf courses, citrus groves, pine plantations, plant nurseries, cut-over pineland, and various croplands*." 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).

The other limiting factor in armadillo expansion and for maintaining populations is the presence of sandy or clay soils. Armadillos are prolific diggers and damages attributed to armadillos are often associated with their digging behavior. Armadillos will dig out shelters and dig while rooting out invertebrates in the soil and leaf litter. This digging and rooting behavior are the most common complaints from resource owners in Mississippi. Damage to landscaping is the most common resource type being damaged by armadillos. Sandy soils are conducive to digging and armadillos can be found in those areas in Tennessee where sandy soils are present.

Female armadillos produce one litter of young per year, which are identical quadruplets (National Audubon Society 2000). Population estimates for armadillos in the United States range from 30 to 50 million armadillos (Gilbert 1995). However, population estimates in Mississippi are not currently available. Therefore, a population estimate will be derived based on the best available information for armadillos to provide an indication of the magnitude of take proposed by WS to alleviate damage and threats of damage. In Mississippi, winter temperatures are relatively sufficient to maintain armadillo populations. Periods of extreme cold or prolonged periods of cold temperatures may temporarily reduce local populations. Armadillos can be found statewide across Mississippi throughout the year in suitable habitat (Layne 2003).

Population densities for armadillos are reported to range from 0.004 to 1.4 armadillos per acre with an average of 0.25 armadillos per acre (Mengak 2005). The land area of Mississippi has been estimated at 46,923.27 mi^2 (United States Census Bureau 2011), which is approximately 30,030,893 acres. Using a population density estimated at 0.004 to 1.4 armadillos per acre, the statewide population could range from approximately 120,000 armadillos to approximately 42 million armadillos. With an average of 0.25 armadillos per acre, the statewide population could be estimated at 7.5 million armadillos. As stated previously, the actual number of armadillos in the State is currently unknown. Under a worst-case scenario, if armadillos occupied only 50% of the land area of Mississippi, the lowest population could be estimated at 60,000 armadillos. Armadillos can be found in a variety of habitats, including urban areas, throughout the State; therefore, armadillos likely occupy more than 50% of the land area in the State. However, armadillos occupying only 50% of the land area will be used to provide a minimum population estimate to determine the magnitude of the proposed take by WS to alleviate or prevent nest predation.

Since FY 2006, the WS program in Mississippi has lethally removed 290 armadillos to alleviate damage and threats of damage, which is an average of 49 armadillos removed annually. The lethal removal of armadillos has occurred primarily from the use of firearms. The highest level of take occurred during FY 2010 when 119 armadillos were lethally removed using firearms. Of those armadillos lethally removed by WS, five were unintentionally removed during other damage management activities. The unintentional take of armadillos will be discussed in this analysis to ensure a cumulative evaluation occurs. The number of armadillos lethally removed by other entities to alleviate damage is currently unknown.

Based on previous requests for assistance received by WS and in anticipation of additional requests for assistance, WS could lethally remove up to 150 armadillos annually in the State as part of efforts to alleviate and prevent damage. Given the range of population estimates in the State, the take of 150 armadillos by WS annually would represent 0.1% of the statewide population based on a population estimated at 120,000 armadillos if the overall population remains at least stable. Under the worst-case scenario with a population estimated at 60,000 armadillos statewide, take of up to 150 armadillos would represent 0.2% of the estimated population. Although the number of armadillos lethally taken by other entities in the State to alleviate damage is unknown, the cumulative take of armadillo, including the

proposed take of up to 150 armadillos annually by WS, is likely of low magnitude when compared to the actual statewide population of armadillos.

Virginia Opossum Population Information and Effects Analysis

Opossums are the only marsupials (*i.e.*, possess a pouch in which young are reared) found north of Mexico (Seidensticker et al. 1987). They frequent most of the eastern and central United States, except Minnesota, northern Michigan, and New England, extending west to Wyoming, Colorado, and central New Mexico (National Audubon Society 2000). Opossums are also found in parts of the southwestern United States, California, Oregon, and Washington (Jackson 1994). Adults range in size from less than 1 kg (2.2 lbs) to about 6 kg (13 lbs), depending on sex and time of year. They grow throughout life (Seidensticker et al. 1987). They have a fairly broad range of pelage colors, but are usually considered as "*gray*" or "*black*" phase. Their fur is grizzled white above; long white hairs cover black tipped fur below. They climb well and feed on a variety of foods, including carrion, which forms much of its diet. In addition, opossums eat insects, frogs, birds, snakes, small mammals, earthworms, and berries and other fruits; persimmons, apples, and corn are favorite foods (National Audubon Society 2000). They use a home range of 4 to 20 hectares (10 to 50 acres), foraging throughout this area frequently (Jackson 1994), but concentrating on a few sites where fruits abound, when they are in season (Seidensticker et al. 1987).

The reproductive season of the Virginia opossum typically occurs from December to February, depending on latitude (Gardner 1982). Gestation is short (average of 12.8 days) with 1 to 17 young born in an embryonic state, which climb up the mothers belly to the marsupium (pouch), attach to teats, and begin to suckle (Gardner 1982, National Audubon Society 2000). Those young remain in the pouch for about two months. After two months, the young begin to explore and may be found traveling on their mother's back with their tails grasping hers (Whitaker, Jr., and Hamilton, Jr. 1998). Opossums live for only one to two years, with as few as 8% of a population of those animals surviving into the second year in a study in Virginia conducted by Seidensticker et al. (1987). In that five-year study, it was also observed that there was a wide variation in opossum numbers, in what was considered excellent habitat for the species. Those variations were observed seasonally and in different years. However, the mean density during the study was 10.1 opossum per square mile with a range of 1.3 opossum per square mile to 20.2 opossum per square mile (Seidensticker et al. 1987). This was comparable to other opossum population densities in similar habitats in Virginia. Verts (1963) found a density estimate of 10.1 opossum per square mile in farmland areas in Illinois, while Wiseman and Hendrickson (1950) found a density of 6.0 opossum per square mile in mixed pasture and woodlands in Iowa. However, VanDruff (1971) found opossum densities in waterfowl nesting habitat as high as 259 opossum per square mile.

Opossum are common throughout Mississippi in appropriate habitat. Population estimates for opossum in the State are not available. Therefore, a population estimate will be derived based on the best available information for opossum to provide an indication of the magnitude of take proposed by WS to alleviate damage and threats of damage. The land area of Mississippi covers 46,923 square miles. If opossum were only found on 50% of the land area using a mean density of 10.1 opossum per square mile found by Seidensticker et al. (1987) in Virginia, the population would be estimated at nearly 237,000 opossum. Using the range of opossum found by Seidensticker et al. (1987) estimated at 1.3 opossum per square mile to 20.2 opossum per square mile and only 50% of the land area of the State being occupied by opossum, the statewide population would range from a low of 30,500 opossum to a high of nearly 474,000 opossum. Opossums can be found in a variety of habitats, including urban areas, so opossum occupying only 50% of the land area of the State would be unlikely, since opossums can be found almost statewide. However, opossum occupying only 50% of the land area was used to provide a minimum population estimate to determine the magnitude of the proposed take by WS to alleviate or prevent damage.

Opossums are considered a furbearing species in the State and can be harvested during annual hunting and trapping seasons. During the development of the EA, opossums could be harvested during hunting and trapping season with no limit on the number that could be taken during those seasons. In addition, opossums can be lethally taken when causing damage or posing a threat of damage when permitted by the MDWFP. Hunt and Hutt (2010) estimated the number of opossum harvested in the State during the 2008-2009 trapping season was 7,758 opossum compared to an estimated harvest of 5,235 opossum during the 2009-2010 trapping season. The number of opossum harvested during the annual trapping season conducted from the 2005-2006 season to the 2009-2010 season has been estimated at 30,472 opossum (Hunt and Hutt 2010), which is an average of 6,095 opossum harvested annually. The lowest take level occurred during the 2009-2010 trapping season when 5,235 opossum were harvested while the highest level of take during the trapping season occurred during the 2008-2009 season when 7,758 opossum were harvested (Hunt and Hutt 2010). The current number of opossum harvested during the annual hunting season and for damage management purposes is unknown within the State.

As part of damage management activities conducted by WS in the State, 175 opossum have been lethally taken from FY 2006 through FY 2011. The highest level of take occurred in FY 2006 when 143 opossum were lethally removed. Based on previous requests for assistance received by WS and in anticipation of additional requests for assistance, WS could lethally remove up to 150 opossum annually in the State as part of efforts to reduce damage and threats of damage. Given the range of population estimates in the State, the take of 150 opossum by WS annually would represent from 0.03% to 0.5% of the estimated statewide population if the overall population remains at least stable.

As stated previously, the average number of opossums taken during the annual trapping season in the State since the 2005-2006 season has been 6,095. When WS' take of up to 150 opossums is combined with the average number of opossum lethally taken during the trapping season since the 2005-2006 season, the cumulative take would represent 20.5% of the lowest population estimate of 30,472 opossum. If WS' take were combined with the lowest level of opossum take during the trapping that occurred during the 2009-2010 season, the cumulative take would represent 17.7% of the lowest population estimate. If the highest level of take during the trapping season were combined with WS' take, the cumulative take would represent 25.9% of the lowest population estimate.

The MDWFP allows an unlimited number of opossum to be harvested during the annual hunting and trapping season in the State, which provides an indication the population of opossum is not likely to decline from overharvest. The permitting of the take by the MDWFP ensures take would occur within population objectives established by the Department. Although the number of opossum lethally taken in the State during the annual hunting season and for damage management is unknown, the cumulative take of opossum, including the proposed take of up to 150 opossum annually by WS, would be of a low magnitude when compared to the actual statewide opossum population.

Bat Population Information and Effects Analysis

The WS program in Mississippi occasionally receives requests for assistance associated with bats. Those requests have been primarily associated with bats that have entered inside buildings or with bats that have been found in public areas where people may encounter bats. Of the 15 species of bats found in Mississippi, WS has previously addressed requests for assistance and anticipates future requests for assistance associated with eight species of bats (see Table 4.1). Those species of bats can be found in buildings and other man-made structures. WS has previously addressed requests for assistance associated with bats by providing recommendations through technical assistance and on occasion, through direct operational assistance.

Most requests for WS' operational assistance would likely occur in relation to bats inhabiting human-occupied buildings. WS has previously and anticipates continuing to recommend and provide assistance using only non-lethal methods to alleviate damage and threats of damage associated with bats. WS has addressed previous requests for assistance through the recommendation or direct application of structural repairs and exclusionary methods. Exclusion has occurred previously using one-way bat exclusion devices that allow bats to exit a building but prevents re-entry. WS has also worked with cooperators to identify access points that require repair to prevent bats from further accessing buildings. Under the proposed action alternative, WS would continue to assist property owners with the implementation of exclusionary devices and to identify structural repairs required to prevent bat entry.

Bat species that may be removed include the little brown bat, southeastern myotis, Brazilian free-tailed bat, silver-haired bat, eastern pipistrelle, big brown bat, evening bat, and Rafinesque's big-eared bat. Bat species that are listed by the USFWS pursuant to the ESA and by the Mississippi Museum of Natural Science are not generally associated with man-made structures. For that reason, it is unlikely that those species listed as threatened or endangered by the USFWS and/or the Mississippi Museum of Natural Science would be encountered during activities to address bats in the State. No threatened or endangered species have been encountered by WS during previous activities to alleviate damage or threats associated with bats. If the need arises, WS would consult with a qualified biologist to positively identify bats prior to removing them in order to eliminate any chance of addressing a T&E species.

In most cases, a single bat found in a building would be provided an escape route (*e.g.*, opening a door or window) or would be live captured and released outside on site if there was no possibility of an exposure to people or pets. If the bat appeared sick, acted unusually, or if there was a known bite or possible exposure to people or pets, the bat would be euthanized and submitted for rabies testing. Those bats euthanized by WS for disease testing would likely be euthanized and submitted for testing by other entities in the absence of WS' involvement given the risk to human safety associated with exposure. Therefore, take by WS for disease testing would not be additive to take that would likely occur in the absence of involvement by WS.

Table 4.1 – Bats in Mississippi that are associated with requests for assistance received by WS[1]

Common Name	Conservation Status[2]	Roost Preferences
Little Brown Bat	Special Concern	caves, mines, buildings
Southeastern Myotis	Special Concern	caves, buildings, hollow trees
Brazilian Free-tailed Bat	Common	buildings, caves
Silver-haired Bat	Special Concern	loose tree bark, buildings, rock crevices
Eastern Pipistrelle	Common	trees, caves, mines, rock crevices
Big Brown Bat	Common	attics, barns, man-made structures, caves, mines
Evening Bat	Common	tree cavities, buildings
Rafinesque's Big-eared Bat	Special Concern	buildings, bridges, caves, cisterns, hollow trees

[1]Adapted from Mississippi Museum of Natural Science (2008)

[2]Species of special concern are determined by the United States Fish and Wildlife Service

No lethal take of bats has occurred by WS from FY 2006 through FY 2011 and WS does not anticipate using lethal methods to address damage or threats of damage associated with bats, unless human exposure has occurred or human exposure was suspected. In those cases, an individual bat would likely be live-captured and euthanized for testing because bats are known to carry rabies. Based on previous requests for assistance received by WS and in those cases where exposure may require a bat be tested, WS does not anticipate live capturing and euthanizing more than five bats total annually, consisting of the little brown bat, southeastern myotis, Brazilian free-tailed bat, silver-haired bat, eastern pipistrelle, big brown bat, evening bat, and Rafinesque's big-eared bat. If a threatened or endangered bat were encountered, WS

would contact the USFWS and/or the Mississippi Museum of Natural Science to determine the appropriate action.

WS would continue to provide escape routes or live-capture and release bats in those instances where no human or pet exposure could be assured. When considering the use and/or recommendation of exclusionary methods and structural repairs, WS would also consider the potential for maternal colonies to be present in buildings and other structures to ensure those damage management activities employed or recommended would not result in the abandonment of young if adults were excluded from returning to maternal colonies. Bats typically give birth from May through July and weaning occurs in July and August. Young bats grow rapidly and are able to fly generally within three weeks. When providing direct operational assistance to cooperators, WS would attempt to survey the roosting colony for the presence of young. If young were present or if observance of the roosting colony was not possible, WS would not conduct direct operational assistance from May through August. Similarly, property owners requesting technical assistance would also be advised about the possibility of a maternal colony being present from May through August. Recommendations would be for property owners to conduct structural repairs and exclusion activities during those months when young would be able to exit the structure or would not be present.

In those cases where human exposure occurred or human exposure was suspected, those bats euthanized by WS for disease testing would likely be euthanized and submitted for testing by other entities in the absence of WS' involvement given the risk to human safety associated with exposure. Therefore, take by WS would not be additive to take that would likely occur in the absence of involvement by WS. The lethal take of up to five individuals from a single species is unlikely; however, if the take of five individuals of a single species occurred, the take would be of a low magnitude. Previous requests for assistance have been associated with colonies of bats that consisted of several hundred individuals. Although unlikely, if five individuals were removed from a colony of 100 bats, the removal would represent 5% of that local colony. Most incidents involving exposure or suspected exposure involve a single bat that has entered inside the living space of a residence. Therefore, the lethal removal of five bats from a single colony is unlikely.

On occasion, WS could be requested to retrieve a dead bat for disease testing. In those cases, WS' activities would not result in additional mortality since the carcass of the bat would be retrieved and WS' activities would not have resulted in the lethal take of the bat; therefore, the environmental status quo would remain unchanged by WS' retrieval of the bat.

Regionally, some bats species are being adversely affected by the fungal disease known as white-nose syndrome, an emerging disease causing unprecedented morbidity and mortality among bats in eastern North America. The disease is characterized by cutaneous infection of hibernating bats by the psychrophilic fungus *Geomyces destructans*. However, WS' limited lethal take of bats would not adversely affect overall populations of bat species in the State. Impacts to bats would be minimal because any bat removal would be localized and limited in scope. In addition, euthanizing and submitting bats for testing would likely occur in the absence of WS' participation due to the risks to human safety.

Eastern Cottontail Population Information and Effects Analysis

There are nine species of cottontail rabbits in North America, north of Mexico. The eastern cottontail is the most abundant and widespread of all those species. The eastern cottontail is approximately 37 to 48 cm (15 to 19 inches) in length and weighs 0.9 to 1.8 kg (2 to 4 lbs). Males and females are basically the same size and color. Cottontails do not distribute themselves evenly across the landscape, but tend to concentrate in favorable habitats such as brushy fence rows or field edges, gullies filled with debris, brush piles, areas of dense briars invaded with Japanese honeysuckle, or landscaped backyards where food and

cover are suitable. Rabbits are rarely found in dense forest or open grasslands, but fallow crop fields may provide suitable habitat. Within these habitats, they spend their entire lives in an area of 10 acres or less. Occasionally they may move a mile or so from summer range to winter cover or to a new food supply. In suburban areas, rabbits are numerous and mobile enough to fill any "*empty*" habitat created when other rabbits are removed. Population densities vary with habitat quality, but one rabbit per 0.4 hectares (1 acre) is a reasonable average (Craven 1994). Rabbits live only 12 to 15 months, yet make the most of time available reproductively. They can raise as many as six litters per year of one to nine young (usually four to six), having a gestation period of 28 to 32 days. If no young were lost, a single pair together with their offspring could produce 350,000 rabbits in five years (National Audubon Society 2000).

No population estimates were available for cottontail rabbits in Mississippi. Information on population densities of rabbits is also unavailable. Rabbits can be harvested in the State during statewide hunting seasons. Although the number of rabbits that can be harvested per person per day for rabbits is limited to eight rabbits, the MDWFP allows an unlimited number of rabbits to be harvested throughout the duration of the season. As shown in Table 4.2, over 1 million rabbits have been harvested in the State from 2006 through 2009. The highest harvest level occurred in 2008 when nearly 300,000 rabbits were harvested in the State. The number of rabbits harvested in the State during the 2010 season and the 2011 season is currently not available.

From FY 2006 through FY 2011, WS has lethally removed 37 rabbits to alleviate damage and threats of damage in the State. Overall, WS' take of 37 rabbits represented 0.003% of the estimated harvest of rabbits in the State occurring from 2006 through 2009. Based on previous requests for assistance and in anticipation of receiving additional requests for assistance, WS could lethally remove up to 50 rabbits annual to alleviate damage and threats of damage.

Table 4.2 – Cumulative cottontail rabbit take from known sources in Mississippi, 2006-2011

Year	Harvest[a,b]	WS' Take[c]	Total Take	WS % Take
2006	282,536	8	**282,544**	0.003%
2007	240,342	12	**240,354**	0.005%
2008	298,221	12	**298,233**	0.004%
2009	214,027	2	**214,029**	0.001%
2010	N/A[†]	1	**N/A**	N/A
2011	N/A	2	**N/A**	N/A
TOTAL	**1,035,126**	**37**	**1,035,160**	**0.003%**

[a]Harvest data reported by trapping season
[b]Harvest data provided by the MDWFP
[c]WS' take is reported by FY
[†]N/A=Data is currently unavailable

On average, 258,782 rabbits have been harvested in the State annually from 2006 through 2009. Based on the average number of rabbits harvested, WS' take of up to 50 rabbits would represent 0.02% of the annual rabbit harvest. The lowest harvest level occurred during the 2009 season when 214,027 rabbits were harvested in the State. If WS had lethally removed 50 rabbits during FY 2009, the take would have represented 0.02% of the lowest harvest level. Studies show that even if hunters take as many as 40% of the rabbits available in autumn, the rabbit population the following year will not be adversely affected because of the tremendous reproductive potential of rabbits (Fergus 2006).

Black Bear Population Information and Effects Analysis

The black bear has a wide but patchy distribution in the United States with populations found primarily in areas of dense forest, swamps, and thickets. Black bears can be found throughout the Rockies and West Coast mountain ranges; the lower Mississippi Valley, Gulf Coast, and Florida; and the northern Great Lakes area, Appalachian Mountains, and Northeastern States. In those areas, bears can also be found in a variety of other habitats as they forage for food, including cropland, orchards, and forest plantations. Bears are omnivorous; feeding on a variety of food sources, including berries, fruits, nuts, and grasses. Bears are also predators feeding on wildlife and domestic livestock, including sheep, goats, and cattle. Bears can also cause damage to telephone poles and tree plantings through clawing activities, raid apiaries in search of honey, and rummage through human refuse.

Female black bears reach reproductive maturity at approximately 3.5 years (Kohn 1982, Graber 1981). Following a 7- to 8-month gestation period, they may have one to five cubs (Rogers 1976, Alt 1981, Kolenosky and Strathearn 1987). Juvenile black bear annual mortality ranges between 20 and 70%, with orphaned cubs having the highest mortality (Kolenosky and Strathearn 1987). Natural mortality in adult black bears is approximately 10 to 20% (Fraser et al. 1982). Densities of bears vary between 0.3 and 3.4 per square mile, depending on habitat. Black bears can live up to 25 years (Rogers 1976).

Due to over harvest and habitat loss, the black bear was nearly eliminated from Mississippi by the 1900s with very isolated and small populations occurring in a few of counties of the Delta region through the early-1920s (Young 2006). When the hunting of black bears in the State was prohibited in 1932, fewer than 12 bears were thought to be present causing the black bear to be included on the first rare and threatened list compiled in the State during 1975 (Young 2006). Black bears were further classified as endangered in the State when the endangered list was published for the State in 1984 (Young 2006).

There are two subspecies of black bears that are currently known to occur in the State. The American black bear (*U. a. americanus*) historically occurred throughout much of eastern North America, the Great Plains, and Canada, including the northern portion of Mississippi. The Louisiana black bear (*U. a. luteolus*) historically occurred in eastern Texas, Louisiana, southern Arkansas, and the southern portion of Mississippi. The Louisiana black bear was formally listed as threatened in 1992 under the ESA by the USFWS within the historic range of the subspecies. In addition, the USFWS listed other bear subspecies within the historic range of the Louisiana black bear due to the similarities in appearance, including the American black bear. The historic range of the Louisiana black bear in Mississippi has been designated as those counties south of Highway 82, which includes Washington, Humphreys, Holmes, Attala, Neshoba, and Lauderdale Counties (see 57 FR 588-595). In 2009, the USFWS designated critical habitat for the Louisiana black bear; however, no critical habitat was designated in Mississippi (see 74 FR 10350-10409).

Although the statewide population of bears is unknown and likely fluctuates based on time of year, food availability, and changing habitat, the population has been estimated at approximately 50 bears with populations likely increasing in the State (Young 2006). Bears are generally found along the Gulf Coast region, the Loess Bluffs in southwestern Mississippi, and the Delta Region of the State with an estimated 80% of the American black bear population in the State occurring within the listed range of the Louisiana black bear (Young 2006). Previously, the majority of the bears found in the State were thought to be males dispersing from populations outside the State; however, more female bears are being located in the State (Young 2006). In addition, more female bears with cubs are being located within the State. During surveys conducted in 2011, females with newborn cubs were documented in Bolivar County along the Mississippi River, as well as litters in Sharkey, Issaquena, and Warren Counties in the south Delta Region (Young 2011).

As bear populations increase in the State, the likelihood of conflicts between people and bears is also likely to increase. Damage is usually associated with bears obtaining or trying to access a food source. Bears are known to cause damage to agricultural crops, such as corn, wheat, and rice by consuming the crop and by trampling crops as they forage. Bears will also feed on pet food, livestock feed, garbage, and bee hives. Although not common, bears are also known to prey upon livestock. Conflicts between people and bears in Mississippi have been primarily associated with bears causing damage to apiaries, as the bears tear open beehives to obtain honey (Young 2006).

WS could be requested to provide technical assistance and/or limited direct operational assistance at the request of the USFWS and/or the MDWFP when managing damage associated with black bears in the State. Direct operational assistance would be limited to WS providing equipment to the USFWS and/or the MDWFP to live-capture bears or could include providing/loaning electric fence to property owners or managers. In addition, WS could be requested to employ live-capture methods, limited to culvert traps and foot snares, and to participate in aversion techniques once bears were released. WS would provide assistance when requested in accordance with the SOPs established by the MDWFP for addressing interactions between bears and people.

Raccoon Population Information and Effects Analysis

The raccoon is a stocky mammal about 61 to 91 cm (two to three feet) long, weighing 4.5 to 13.5 kg (10 to 30 lbs). It is distinctly marked, with a prominent black mask over the eyes and a heavily furred, ringed tail. The animal is a grizzled salt-and-pepper gray and black above, although some individuals are strongly washed with yellow (Boggess 1994).

The raccoon is one of the most omnivorous of animals. Raccoons will eat carrion, garbage, birds, mammals, insects, crayfish, mussels, other invertebrates, and a wide variety of grains, various fruits, other plant materials, and most or all foods prepared for human or animal consumption (Sanderson 1987). They occasionally kill poultry (Boggess 1994).

The raccoon is found throughout most of the United States, with the exception of the higher elevations of mountainous regions and some areas of the arid southwest (Boggess 1994, National Audubon Society 2000). Raccoons are more common in the wooded eastern portions of the United States than in the more arid western plains (Boggess 1994), and are frequently found in cities or suburbs as well as rural areas (National Audubon Society 2000). Movements and home ranges of raccoons vary according to sex, age, habitat, food sources, season, and other factors. In general, males have larger home ranges than females. Home range diameters of raccoons have been reported as being 1 to 3 km (0.6 to 2.9 mi) maximum, with some home range diameters of dense suburban populations to be 0.3 to 0.7 km (0.2 to 0.4 mi).

Absolute raccoon population densities are difficult or impossible to determine because of the difficulty in knowing what percentage of the population has been counted or estimated. In addition, it can be difficult to determine how large an area the raccoons are using (Sanderson 1987). Due to their adaptability, raccoon densities reach higher levels in urban areas than that of rural areas. Relative raccoon population densities have been variously inferred by take of animals per unit area. For instance, Twichell and Dill (1949) reported removing 100 raccoons from tree dens in a 41 ha (101 acres) waterfowl refuge area, while Yeager and Rennels (1943) studied raccoons on 881 ha (2,177 acres) in Illinois and reported trapping 35-40 raccoons in 1938-39, 170 in 1939-1940, and 60 in 1940-1941. Slate (1980) estimated one raccoon per 7.8 ha (19.3 acres) in New Jersey in predominantly agricultural land on the inner coastal plain. Raccoon densities of 100 per square mile (1 raccoon per 6.4 acres) have been attained around abundant food sources (Kern, Jr. 2002). Riley et al. (1998) summarized rural raccoon densities based on published literature that ranged from 2 to 650 per square mile in rural habitats, with an average of 10 to 80 raccoons per square mile.

In Mississippi, raccoons cause damage to gardens, residential and non-residential buildings, fish, domestic fowl, and pets, as well as general property damage. Results of their feeding may be the total loss of ripened sweet corn in a garden. Damage to buildings generally occurs when they seek to gain entry or begin denning in those structures. Raccoons may den in uncapped chimneys, or may tear off shingles or fascia boards to gain access to attics or wall spaces. They may also damage or destroy sod by rolling it up in search of earthworms and other invertebrates (Boggess 1994).

The public are also concerned about health and safety issues associated with raccoons. Those diseases include, but are not limited to, canine distemper and rabies, and the roundworm *Baylisascaris procyonis*, the eggs of which survive for extremely long periods in raccoon feces and soil contaminated by them. Ingestion of those eggs can result in serious or fatal infections in other animals as well as humans (see Table 1.3; Davidson and Nettles 1997).

Raccoons can be found throughout the State and thrive in a variety of habitats including rural, suburban, and urban areas. However, the statewide population of raccoons is currently unknown. Using the summarized density ranges for raccoons in rural areas provided by Riley et al. (1998) and the assumption that raccoons only inhabit 50% of the land areas of Mississippi, a statewide population could be estimated to range from a low of nearly 47,000 raccoons to a high of over 15 million raccoons. Using the average number of raccoons per square mile of 10 to 80 raccoons, the statewide population could be estimated at 235,000 to 1.9 million raccoons if raccoons only occupied 50% of the available land area of the State. Similar to estimates derived for the other mammal species in this EA, estimating that raccoons inhabit only 50% of the land area of the State is intended to determine a minimum population estimate to compare the potential range of WS' proposed take of raccoons and to determine the magnitude of WS' proposed take.

Raccoons are classified as furbearers in Mississippi with regulated annual hunting and trapping seasons with unlimited take allowed during the length of those seasons, although daily limits may apply during the annual hunting seasons. The number of raccoons reported as harvested in the State during the annual hunting and trapping seasons from 2006 through 2011 are shown in Table 4.3. Reported take of raccoons during the hunting and trapping seasons is based on a voluntary trapper survey; therefore, take is considered as minimum take that likely occurred. As with other furbearing species, raccoons can also be lethally taken to alleviate damage or threats of damage when authorized by the MDWFP through the issuance of a permit. The total number of raccoons taken annually in the State to alleviate damage or threats of damage is currently unknown and Table 4.3 does not include take for other damage management purposes.

Table 4.3 - Cumulative raccoon take from known sources in Mississippi, 2006-2011

Year	Type of Harvest		WS' Take[1,2]	TOTAL	WS % of Total
	Hunting	Trapping			
2006	107,631	13,433	186	**121,250**	0.2%
2007	50,314	13,482	39	**63,835**	0.1%
2008	69,289	11,539	35	**80,863**	0.04%
2009	36,658	12,917	47	**49,622**	0.1%
2010	N/A[†]	8,391	36	**8,427**[‡]	N/A
2011	N/A	N/A	117	N/A	N/A
TOTAL	**263,892**	**59,762**	**460**	**343,997**[‡]	**0.1%**

[1]WS' take is reported by federal fiscal year

[2]WS' take includes all take including unintentional take during other damage management activities

[†]N/A=data is currently not available; data is incomplete

‡Total does not include the number of raccoons harvested during the hunting season; information for 2010 and 2011 is unavailable

Of the 460 raccoons lethally removed by WS from FY 2006 through FY 2011, 149 raccoons were unintentionally removed by WS during other damage management activities, primarily activities to alleviate damage associated with aquatic rodents. WS' annual take of raccoons during all projects from 2006 to 2009 never exceeded 0.2% of the annual reported harvest for the corresponding year. The average number of raccoons reported harvested in the State during the annual hunting and trapping seasons from 2006 through 2009 is 78,893 raccoons per year. Although harvest figures are not currently available for 2010 and 2011, WS' take of 36 raccoons during FY 2010 would represent less than 0.1% of the average annual harvest during the four previous harvest years and represents 0.4% of the raccoon harvest during the trapping season. Therefore, WS' take during FY 2010 is likely lower than 0.4% of the overall harvest since the number of raccoons harvested during the hunting season in 2010 is unknown. WS' previous take of raccoons to alleviate damage has been of a low magnitude when compared to the number of raccoons reported harvested in the State, especially given reported take is likely the minimum number of raccoons harvested.

Based on previous requests for assistance received by WS to alleviate damage and in anticipation of receiving additional requests for assistance with managing damage, up to 150 raccoons could be lethally removed by WS annually under all wildlife damage management activities, including unintentional take during other wildlife damage management activities. Using the lowest population estimate of 47,000 raccoons in the State, the take of 150 raccoons would represent 0.3% of the population. However, the number of raccoons harvested annually in the State has exceeded the minimum population estimated, which provides an indication that the population is higher than 47,000 individuals. Using a population estimated at 235,000 raccoons, the lethal take of up to 150 raccoons by WS would represent 0.1% of the estimated population. If WS had lethally removed 150 raccoons every year from FY 2006 through FY 2011, the total cumulative take of raccoons from 2006 through 2010 in the state would have increased to 324,654 raccoons, which is an increase of only 0.1% above what actually occurred within the State. If WS had taken 150 raccoons during FY 2009, the take would have represented 0.3% of the cumulative take of raccoons.

The unlimited harvest levels allowed by the MDWFP during the length of the trapping seasons provides an indication that cumulative take, including take for damage management, would not reach a level where overharvest of the raccoon population would occur resulting in an undesired population decline. The MDWFP has regulatory authority over the management of wildlife within the State, including raccoons, and all take by WS has occurred and would continue to occur only after being authorized by the MDWFP and only at the levels authorized.

River Otter Population Information and Effects Analysis

Historically, river otters inhabited aquatic ecosystems throughout much of North America, excluding the frozen Arctic and arid Southwest (Hall and Kelson 1959). Information on historic numbers and distribution is limited. As its broad geographic distribution suggests, the river otter is able to adapt to diverse aquatic habitats. Otters are found in both marine and freshwater environments, ranging from coastal to high mountainous habitat. Riparian vegetation adjacent to lakes, streams, and other wetland areas is a key component of otter habitat.

Human encroachment, habitat destruction, and overharvest have eliminated river otters from marginal portions of their range. However, present distribution spans the North American continent from east to west and extends from southern Florida to northern Alaska (Melquist and Dronkert 1987). River otters remained relatively abundant in Mississippi despite declines in other parts of the country. River otter are known to occur throughout Mississippi where habitat exists. However, the number of otters present in the

State is currently unknown. Melquist and Dronkert (1987) summarized studies estimating river otter densities, which showed that densities were about 1 per 175 to 262 acres in Texas coastal marshes, and ranged from 1 per 1.8 miles to 1 per 3.6 miles of waterway (stream or river), which is an average of 1 otter per 2.4 miles of stream. Density information for otter specific to Mississippi is not currently available. To provide an indication of the potential magnitude of take that could occur by WS, this analysis will use the available otter densities to estimate a statewide otter population.

There are over 2.7 million acres of freshwater wetlands in Mississippi along with 83,674 miles of rivers and streams in the State (Alley and Segrest 2008). Using the lowest otter density per linear measure derived from other studies of one otter per 3.6 stream mile and using the assumption that all stream miles in Mississippi are suitable otter habitat and occupied by otter, a statewide population of otter in Mississippi could be estimated at 23,000 otter. Of the 83,674 miles of streams and rivers in the State, 53,754 miles are considered intermittent streams where water is not present throughout the year. Using only those river miles with water throughout the year, an otter population in the State could be estimated at 8,300 otter using the lowest densities of otter per stream mile. Using the average otter density of one otter per 2.4 miles of stream and using only those permanent streams, the statewide population could be estimated at 12,500 otters.

River otters are a state-regulated furbearer in Mississippi with a regulated annual trapping season. During the trapping season, an unlimited number of otter can be harvested. During the annual trapping season from 2006 through 2010, a total of 10,291 otters have been harvested in the State with a range of 1,470 otters harvested during 2010 to 3,507 otters harvested during 2006 (see Table 4.4). Trappers in the State harvested an average of 2,059 otters annually from 2006 through 2010.

Table 4.4 – Cumulative river otter take from known sources in Mississippi, 2006-2011

Year	Harvest[a,b]	WS' Take[c]	Total Take	WS % Take
2006	3,507	65	**3,572**	1.8%
2007	2,228	59	**2,287**	2.6%
2008	1,396	69	**1,465**	4.7%
2009	1,690	82	**1,772**	4.6%
2010	1,470	74	**1,544**	4.8%
2011	N/A[†]	64	N/A	N/A
TOTAL	**10,291**	**413**	**10,640**	**3.3%**

[a]Harvest data reported by trapping season
[b]Harvest data provided by the MDWFP
[c]WS' take is reported by FY
[†]N/A=data is currently not available; data is incomplete

In addition to the annual harvest during the trapping season, WS has also lethally removed otter during damage management activities. WS lethally removed two otter in FY 2006 to alleviate damage and one otter during FY 2010 to alleviate damage based on requests for assistance received. Unintentional take of otter has also occurred by WS during other damage management activities, primarily aquatic rodent damage management, which is reflected in Table 4.4. Based on requests for assistance received by WS and in anticipation of receiving additional requests for assistance, WS could lethally take up to 120 river otters annually in the State to alleviate damage, including unintentional take that could occur during other damage management activities.

If the lowest derived population estimate were reflective of the actual statewide population of otter in the State, take of up to 120 otter by WS would represent 1.5% of the population estimated at 8,300 otter. Based on an otter population estimated at 23,000 otter using the total stream miles in the State and the lowest population density estimates, take of up to 120 otter would represent 0.5% of the population. Take

of up to 120 otter would represent 1.0% of the population estimated at 12,500 otters based on the average density of one otter per 2.4 miles of streams and including only those streams with permanent water.

Overall, WS' take of otter has not exceeded 4.8% of the total number of otter harvested in the State from 2006 through 2010. On average, WS' annual take has represented 3.3% of annual harvest of otter in the State. If WS had lethally removed 120 annually from FY 2006 through FY 2010, the total take would have represented 5.5% of the total harvest of otter in the State. The lowest harvest of otter during the annual trapping season from 2006 through 2010 occurred in 2008 when 1,396 otter were harvested. If WS had lethally removed 120 otter during FY 2008, WS' take would have represented 7.9% of the overall harvest of otter in the State.

As with many of the mammal species addressed in this document, the unlimited take allowed by the MDWFP provides an indication that harvest during the regulated trapping season and take for damage management, is not likely to reach a level where overharvest would occur. Otter maintain sufficient densities in the State to allow annual harvesting, which is regulated by the MDWFP, including take that occurs during damage management activities.

Striped Skunk Population Information and Effects Analysis

Although easily recognized by their black and white fur, the striped skunk may be most readily recognized by the odiferous smell of their musk. Skunks are common throughout the United States and Canada (Rosatte 1987). Striped skunks are primarily nocturnal and do not have a true hibernation period, although during extremely cold weather, skunks may become temporarily dormant. The striped skunk is an omnivore, feeding heavily on insects such as grasshoppers, crickets, beetles, bees, and wasp (Chapman and Feldhamer 2003). The diet of striped skunks also includes small mammals, the eggs of ground-nesting birds, and amphibians. Striped skunks are typically non-aggressive and will often flee when approached by humans (Rosatte 1987). However, when provoked, skunks will give a warning and assume a defensive posture prior to discharging their foul-smelling musk. This musk is comprised of sulfur-alcohol compounds known as butylmercaptan (Chapman and Feldhamer 2003).

Adult skunks begin breeding in late February. Yearling females (born in the preceding year) mate in late March. Gestation usually lasts about seven to 10 weeks. Litters commonly consist of five to nine young with two litters per year possible (Hall and Kelson 1959). The home range of striped skunks is usually not consistent. Home ranges appear to be reliant upon life history requirements such as winter denning, feeding activities, dispersal, and parturition (Rosatte 1987). According to Chamberlain and Leopold (2001), very little information regarding striped skunk densities in the southeast exists other than those based on harvest numbers and trapper/hunter observations. During the breeding season, males may travel larger areas in search of females. Skunk densities vary widely according to season, food sources, and geographic area. Densities have been reported to range from one skunk per 77 acres to one per 10 acres (Rosatte 1987).

Population estimates for striped skunks in Mississippi are currently not available. Striped skunks can be found in a variety of habitats across the State. If skunks only inhabit 50% of the land area of the State and densities occur at one skunk per 77 acres, the statewide population could be estimated at 390,000 skunks based on the land area of the State. Similar to other furbearing species, skunks can be found throughout the State and the estimate is intended to evaluate the magnitude of take proposed under the proposed action.

Skunks are considered "*nuisance animals*" in the State (Public Notice LE4-3779) and can be lethally taken throughout the year with no limit on the number that can be taken. In addition, skunks can be trapped during an annual season that places no limit on the number of skunks that can be harvested daily

and no limit on the number of skunks that can be possessed throughout the trapping season. The reported number of skunks harvested during the annual trapping seasons is shown in Table 4.5. Like most furbearing species, the number of skunks harvested annually is based on mail-in surveys. Skunks are also lethally taken to alleviate damage or threats of damage; however, the number of skunks lethally taken annually in the State to alleviate damage or threats of damage is currently unknown and Table 4.5 does not include take reported by other entities to alleviate damage or threats of damage.

Table 4.5 – Cumulative striped skunk take from known sources in Mississippi, 2006-2011

Year	Harvest[a,b]	WS' Take[c]	Total Take	WS % Take
2006	752	1	**753**	0.1%
2007	1,051	0	**1,051**	0%
2008	869	9	**878**	1.0%
2009	781	13	**794**	1.6%
2010	455	6	**461**	1.3%
2011	N/A[†]	0	**N/A**	N/A
TOTAL	**3,908**	**29**	**3,937**	**0.7%**

[a]Harvest data reported by trapping season
[b]Harvest data provided by the MDWFP
[c]WS' take is reported by FY
[†]N/A=data is currently not available; data is incomplete

Based on previous requests for assistance received by WS to alleviate damage and in anticipation of receiving additional requests for assistance with managing damage, up to 50 skunks could be lethally removed by WS annually, when requested, including skunks that are unintentionally lethally removed during other wildlife damage management activities. Using the lowest population estimate of 390,000 skunks, the take of 50 skunks would represent 0.01% of the estimated statewide population.

Coyote Population Information and Effects Analysis

Coyotes are a familiar mammal to most people. Their coloration is blended, primarily gray mixed with a reddish tint. The belly and throat are a paler color than the rest of the body (Beckoff 1982). Coyotes have long, rusty or yellowish legs with dark vertical lines on the lower foreleg. They are similar in appearance to gray and red wolves (National Audubon Society 2000). Color varies greatly, ranging from nearly black to red or nearly white in some individuals and local populations. Most have dark or black guard hairs over their back and tail (Green et al. 1994). Coyotes sometimes breed with domestic dogs producing hybrids called "*coydogs*" (National Audubon Society 2000). The size of coyotes varies from about 20 to 40 lbs (9 to 18 kg) (Voigt and Berg 1987).

Coyotes range throughout the United States with the highest densities occurring on the Plains and in the south-central United States, including Texas. The distribution of coyotes in eastern North America began to expand beginning around 1900 to 1920. Now, all eastern states and Canadian provinces have at least a small population of coyotes (Voigt and Berg 1987).

Coyotes often include many items in their diet. Rabbits are one of the most common prey items. Other items in the coyote's diet include carrion, rodents, ungulates (usually fawns), insects (such as grasshoppers), as well as livestock and poultry. Coyotes readily eat fruits, such as watermelons, berries, persimmons, and other vegetative matter, when it is available. In some areas, coyotes feed on human refuse at dumpsites and take small domestic pets, such as cats and dogs (Voigt and Berg 1987).

Coyotes breed between January and March and are able to breed before their first birthday (Kennely and Johns 1976), but the percentage of yearlings having litters varies from zero to 80% in different populations (Gier 1968). This variation is influenced by a number of factors that cause large annual variations in total number of coyotes breeding. In a study in Texas, the percentage of females having litters varied from 48% to 81% (Knowlton 1972). Pups are born after a gestation period of 60 to 63 days, with litter sizes varying primarily with prey availability. Gier (1968) reported average litter sizes of 4.8 to 5.1 in years with low rodent numbers, but litters of 5.8 to 6.2 during years with high rodent numbers. Litter sizes of 1 to 19 pups have been reported (National Audubon Society 2000).

Many references indicate that coyotes were originally found in relatively open habitats, particularly grasslands and sparsely wooded areas of the western United States. Today, coyotes have adapted to and now exist in virtually every type of habitat, arctic to tropic, in North America. Coyotes live in deserts, swamps, tundra, grasslands, brush, dense forests, from below sea level to high mountain ranges, and at all intermediate altitudes. High densities of coyotes also appear in the suburbs of major cities (Green and Gipson 1994).

Similar to striped skunks, coyotes are considered "*nuisance animals*" and can be lethally removed throughout the year with no limit on the number that can be lethally taken. In addition, coyotes can be harvested during the annual hunting and trapping seasons. The estimated harvest of coyotes during the hunting and trapping season from 2006 through 2010 are shown in Table 4.6. The number of coyotes lethally removed to alleviate damage by entities other than WS is currently unknown. Between 2006 and 2009, hunters in Mississippi harvested an average of 15,717 coyotes in the State. The number of coyotes harvested during 2010 and 2011 is currently unavailable. Between 2006 and 2010, trappers harvested an average of 3,080 coyotes per year during the annual trapping season. The highest harvest level occurred during the 2009 hunting and trapping season when an estimated 21,196 coyotes were harvested.

Table 4.6 - Cumulative coyote take from known sources in Mississippi, 2006-2011

Year	Type of Harvest		WS' Take[1,2]	TOTAL	WS % of Total
	Hunting	Trapping			
2006	16,423	3,418	61	**19,902**	0.3%
2007	14,586	3,264	10	**17,860**	0.1%
2008	14,103	2,701	8	**16,812**	0.1%
2009	17,753	3,443	27	**21,223**	0.1%
2010	N/A[†]	2,571	25	**2,596**	0.1%
2011	N/A	N/A	21	**N/A**	N/A
TOTAL	**62,865**	**15,397**	**152**	**78,393**	**0.2%**

[1]WS' take is reported by federal fiscal year

[2]WS' take includes all take including unintentional take during other damage management activities

[†]N/A=data is currently not available; data is incomplete

[‡]Total does not include the number of raccoons harvested during the hunting season; information for 2010 is unavailable

Between FY 2006 and FY 2011, WS has lethally removed 152 coyotes in the State to alleviate damage or threats of damage. The highest level of take occurred during FY 2006 when 61 coyotes were lethally removed. Overall, WS has lethally removed an average of 26 coyotes per year from FY 2006 through FY 2011. As a percentage of the overall harvest of coyotes during the hunting and trapping season in the State, WS' take of coyotes has ranged from a high of 0.3% of the estimated harvest to a low 0.1% of the harvest, with an overall average of 0.2% of the estimated harvest. Based on previous requests for assistance and in anticipation of receiving additional requests for assistance in the future, WS predicts that up to 100 coyotes could be lethally removed during all damage management activities within the State.

The coyote is probably the most extensively studied carnivore (Bekoff 1982), and considerable research has been conducted on population dynamics. Because determinations of absolute coyote densities are frequently unknown (Knowlton 1972), many researchers have estimated coyote populations using various methods (Clark, 1972, Knowlton 1972, Camenzind 1978, USDI 1979, Pyrah 1984). The cost to accurately determine absolute coyote densities over large areas is prohibitive (Connolly 1992) and would not appear to be warranted given the coyote's overall relative abundance. The presence of unusual food concentrations and the assistance provided to a breeding pair by non-breeding coyotes at the den can influence coyote densities and complicate efforts to estimate abundance (Danner and Smith 1980). Coyote densities are lowest in late winter prior to whelping, highest immediately after whelping, followed by a continued decline to the next whelping season (Parker 1995).

Predator abundance indices suggest that densities of coyotes in North America increase from north to south (Knowlton and Stoddart 1985, Parker 1995). Coyote densities range from 0.2 per square mile when populations are low (pre-whelping) to 3.6 coyotes per square mile when populations are high (post-whelping) (USDI 1979, Knowlton 1972). Knowlton (1972) concluded that coyote densities may approach a high of five to six coyotes per square mile under extremely favorable conditions with densities of 0.5 to 1.0 per square mile possible throughout much of their range. Such an estimate is speculative but represents some of the best available information for estimating coyote populations.

Although coyote densities vary considerably between habitat types and vary based on numerous environmental variables, Knowlton (1972) estimated an average population density was likely 0.5 to 1.0 coyote per square mile over the entire range of the coyote in the United States. Exact coyote population densities in Mississippi are unknown. Using a coyote population density of 0.5 to 1.0 coyote per square mile and the total area of Mississippi of 46,923 square miles (United States Census Bureau 2011), a statewide coyote population could be estimated at 23,500 to 47,000 coyotes. If the population density were half of the lowest estimated population density determined by Knowlton (1972), the statewide coyote population would be estimated at 11,750 coyotes based on 0.25 coyotes per square mile. Population modeling suggests that a viable coyote population can withstand an annual removal of 70% of their population without causing a decline in the population (Connolly and Longhurst 1975, Connolly 1995).

The unique resilience of the coyote, its ability to adapt, and its perseverance under adverse conditions is commonly recognized among biologists and land managers. Despite intensive historical damage management efforts in livestock production areas and despite sport hunting and trapping for fur, coyotes continue to thrive and expand their range, occurring widely across North and Central America (Miller 1995). Connolly and Longhurst (1975) determined that "*...if 75% of the coyotes are killed each year, the population would be exterminated in slightly over 50 years.*" However, Connolly and Longhurst (1975) go on to explain that their "*...model suggests that coyotes, through compensatory reproduction, can withstand an annual population mortality of 70%*" and that coyote populations would regain pre-control densities (through recruitment, reproduction, and migration) by the end of the fifth year after control was terminated even though 75% mortality had occurred for 20 years. In addition, other researchers (Windberg and Knowlton 1988) recognized that immigration, (not considered in the Connolly and Longhurst (1975) model) could result in rapid occupancy of vacant territories, which helps to explain why coyotes have thrived in spite of intensive damage management activities (Connolly 1978).

A statewide coyote population based on available information could be estimated to range from 23,500 to 47,000 coyotes with a population estimate of 11,750 coyotes representing a worst-case scenario. If the coyote population remains stable or increases annually, WS' take of up to 100 coyotes to alleviate damage or threats would range from 0.4% to 0.2% of the estimated population and 0.9% under a worst case scenario.

Gray Fox Population Information and Effects Analysis

The gray fox is common in many parts of the United States where deciduous woodlands provide habitat; yet, the secretive grey fox is seldom observed in the wild. The gray fox is somewhat smaller in stature than the red fox, having shorter legs and extremities. Gray fox exhibit striking pelage that has grizzled upper parts resulting from individual guard hairs being banded with white, gray, and black. A predominance of black-tipped hairs in the middle of the back forms a dark longitudinal stripe that extends into a conspicuous black mane of coarse hair at the top of the black-tipped tail. Portions of the neck, sides, and limbs are cinnamon-colored. The ventral areas of a gray fox are buff colored. White shows on the ears, throat, chest, belly, and back legs, and the black, white, and reddish facial markings provide distinctive accents (Fritzell 1987).

Gray fox adults weigh from three to seven kg (6.5 to 15 lbs), with males being slightly larger than females. Generally, adult gray fox measure 80 to 113 cm (31.5 to 44 inches) from the tip of the nose to the tip of the tail. They inhabit wooded, brushy, and rocky habitats from extreme southern Canada to northern Venezuela and Colombia, excluding portions of the mountainous northwestern United States, the Great Plains, and eastern Central America. Gray fox occur over most of North America, north and east from southern California, Arizona, and central Texas (Fritzell 1987).

Gray fox prefer habitat with dense cover, such as thickets, riparian areas, swampland, or rocky pinyon-cedar ridges. In eastern North America, gray fox are closely associated with edges of deciduous forest. They can also be found in urban areas where suitable habitat exists (Phillips and Schmidt 1994).

Gray fox mate from January through March and produce litters of one to seven kits after a gestation period of 53 days (National Audubon Society 2000). Gray fox rear young in a maternity den, commonly located in woodpiles, rocky outcrops, hollow trees, or brush piles (Phillips and Schmidt 1994). The male parent helps tend to the young but does not den with them. The young are weaned at three months and hunt for themselves at four months, when they weigh about 3.2 kg (7 lbs). Rabies and distemper are associated with this species (National Audubon Society 2000).

Accurate estimates of carnivore populations are rare and those for gray fox populations are no exception. Published estimates of gray fox density vary from 1.2 to 2.1 per square kilometer (3.1 to 5.4/mi^2) depending on location, season, and method of estimation (Errington 1933, Gier 1948, Lord, Jr. 1961, Trapp 1978). Over areas larger than 5,000 km^2 (1,930 mi^2) in which habitat quality varies, densities are likely lower. However, exceptionally high fox densities have been recorded in some situations (Grinnell et al. 1937, Hallberg and Trapp 1984).

Home ranges for gray fox vary throughout the year. Both males and females travel over larger areas during fall and winter, probably in response to increased energy demands and a declining food base (Follmann 1973, Nicholson 1982). During April, when young fox require regular feeding, a female's home range is less extensive than it is without the demands of those young (Follman 1973). Although exceptions exist, eastern gray fox generally have larger home ranges than western animals (Fritzell 1987). For instance, 16 adult fox were tracked for more than one month in Alabama (Nicholson 1982) and Missouri (Haroldson and Fritzell 1984) and it was determined that they all had home ranges larger than 200 ha (500 acres), and many exceeded 500 ha (1,235 acres).

Gray fox feed on a wide variety of plant and animal matter and are considered to be more omnivorous than other North American canids (Fritzell 1987). Although active primarily at twilight and at night, the gray fox is sometimes seen foraging by day in brush, thick foliage, or timber. The only American canid with true climbing ability, gray fox occasionally forage in trees and often takes refuge in them, especially leaning or thickly branched trees. The gray fox feeds heavily on cottontail rabbits, mice, voles, other

small mammals, birds, insects, and plant material, including corn, apples, persimmons, nuts, cherries, grapes, pokeweed fruit, grass, and blackberries. Grasshoppers and crickets are often a very important part of the diet in late summer and autumn (National Audubon Society 2000).

Gray fox are considered a "*nuisance animal*" in the State and can be lethally removed to alleviate damage or threats of damage with few exceptions. Gray fox can also be harvested during annual hunting and trapping seasons. During those hunting and trapping seasons, an unlimited number of fox can be harvested daily or possessed during the length of the season. The total number of gray fox harvested during the annual hunting and trapping seasons from 2006 through 2010 are shown in Table 4.7. The number of gray fox lethally removed to alleviate damage is currently unknown.

Table 4.7 - Cumulative gray fox take from known sources in Mississippi, 2006-2010

Year	Type of Harvest		WS' Take[1,2]	TOTAL	WS % of Total
	Hunting	Trapping			
2006	3,387	1,273	7	**4,667**	0.2%
2007	745	1,843	0	**2,588**	0%
2008	3,472	1,548	2	**5,022**	0.04%
2009	873	1,556	4	**2,433**	0.2%
2010	N/A[†]	1,066	2	**1,068**	0.2%
2011	N/A	N/A	0	N/A	N/A
TOTAL	**8,477**	**7,286**	**15**	**15,778**	**0.1%**

[1]WS' take is reported by federal fiscal year

[2]WS' take includes all take including unintentional take during other damage management activities

[†]N/A=data is currently not available; data is incomplete

[‡]Total does not include the number of raccoons harvested during the hunting season; information for 2010 is unavailable

In total, 8,477 gray fox have been harvested during the hunting season in the State from 2006 through 2009, while 7,286 gray fox were harvested in the State during the 2006 through the 2010 trapping season. The number of gray fox harvested during the 2010 and 2011 hunting season is currently unavailable. The highest level of harvest occurred during the 2008 hunting and trapping seasons when 5,020 gray fox were harvested in the State. In addition to take during the hunting and trapping season, WS also removed gray fox to alleviate damage and threats of damage in the State. From FY 2006 through FY 2011, WS has lethally removed 15 gray fox in the State with the highest annual take level occurring in FY 2006 when seven gray fox were lethally removed by WS. No gray fox were addressed by WS during FY 2007 and FY 2011.

As a percentage of the total take of gray fox in the State, WS' take has ranged from a low of 0.04% to a high of 0.2% with the average take by WS representing 0.1% of the total take of gray fox. Based on the number of gray fox lethally removed by WS previously and in anticipation of receiving additional requests to lethally remove gray fox, WS anticipates that up to 50 gray fox could be lethally removed annually by WS in the State to alleviate damage and threats of damage.

Gray fox can be found statewide in Mississippi in areas with suitable habitat. If gray fox only occupy 50% of the land area of Mississippi and the density of gray fox in the State was 3.1 gray fox per square mile, the statewide population could be estimated at nearly 73,000 gray fox. Gray fox can be found in a variety of habitats, including urban areas, so gray fox occupying only 50% of the land area of the State is unlikely since fox can be found statewide. However, similar to the other furbearing species, gray fox occupying only 50% of the land area was used to provide a minimum population estimate to determine the magnitude of the proposed take by WS to alleviate or prevent damage.

Using the lowest population estimate of 73,000 fox, the take of 50 gray fox by WS would represent 0.1% of the population. Like other mammal species addressed in this EA, the unlimited take allowed by the MDWFP during the hunting and trapping seasons and the permitting of take to alleviate damage by the MDWFP provides an indication that gray fox populations maintain sufficient densities within the State to sustain unlimited harvest and that overharvest is unlikely.

Red Fox Population Information and Effects Analysis

The red fox is a typically proportioned member of the dog family. The bushy and unusually long tail, pointed ears, slender muzzle, and slanted eyes coupled with its small dog size and typical reddish coloration, make the red fox instantly recognizable to most people. Red fox are also the most common and well-known species in the genus *Vulpes*, which includes about 10 other species worldwide (Honacki et al. 1982). Typically, black-tipped ears, black cheek patches, white throat parts, a lighter underside, and black "*leg stockings*" are found on most red fox. The white tip of the tail (which is much more prominent in North American fox than elsewhere) can be used to distinguish brownish fox pups from similarly colored coyote pups, which lack a white tail tip (Voigt 1987).

In North America, the red fox weighs about 3.5 to 7 kg (7.7 to 15.4 lbs), with males averaging about one kg (2.2 lbs), which is heavier than females. Generally, adult fox measure 100 to 110 cm (39 to 43 inches) from the tip of the nose to the tip of the tail. Juveniles in their first autumn are similar in size as adults (Voigt 1987). They occur over most of North America, north and east from southern California, Arizona, and central Texas. Red fox are found throughout most of the United States with the exception of a few isolated areas. Prehistoric fossil records suggest the red fox may not have inhabited much of the United States, but fox were plentiful in many parts of Canada. However, it has been suggested that climatic factors, interbreeding with the introduced European red fox, extirpation of the gray and red wolf, and clearing of land for agriculture has possibly contributed to the present-day expansion and range of red fox in North America (Voigt 1987).

Red fox are adaptable to most habitats within their range, but usually prefer open country with moderate cover. Some of the highest fox densities reported are in the north-central United States in areas where woodlands are interspersed with farmlands. Red fox have also demonstrated their adaptability by establishing breeding populations in many urban areas of the United States, Canada, and Europe (Phillips and Schmidt 1994). In many areas, competition with other canids and the availability of suitable year-round food resources limit fox survival. Habitat determines the availability of year-round food resources and the presence or absence of other canids. Because those two factors strongly influence red fox survival, habitat limits fox numbers but seldom limits distribution (Voigt 1987).

Red fox mate from January through March and produce litters of one to 10 kits after a gestation period of 51 to 53 days. Fox rear young in a maternity den, commonly an enlarged woodchuck or badger den, usually in sparse ground cover on a slight rise, with a good view of all approaches (National Audubon Society 2000). Juvenile fox are able to breed before reaching a year old, but in areas of high red fox densities, most yearlings do not produce pups (Harris 1979, Voigt and MacDonald 1984, Voigt 1987). Gier (1968) reported average litter sizes of 4.8 to 5.1 in years with low rodent numbers, but litters of 5.8 to 6.2 during years with high rodent numbers. Litter sizes of one to 19 pups have been reported (National Audubon Society 2000). Offspring disperse from the denning area during the fall and establish breeding areas in vacant territories, sometimes dispersing considerable distances. Red fox are generally solitary animals as adults, except when mating (Phillips and Schmidt 1994). Rabies and distemper are associated with this species.

The red fox is a skilled nonspecific predator, foraging on a variety of prey. Fox are also an efficient scavenger, and in parts of the world, garbage and carrion are extremely important to its diet (Voigt 1987).

Fox are opportunists, feeding mostly on rabbits, mice, bird eggs, insects, and native fruit. They usually kill animals smaller than a rabbit, although fawns, pigs, kids, lambs, and poultry are sometimes taken (Phillips and Schmidt 1994). They also feed on squirrels, woodchucks, crayfish, and even grasses (National Audubon Society 2000).

The density of red fox populations is difficult to determine because of the animals secretive and elusive nature. Estimates are prone to error even in open areas with good visibility. Methods used to estimate numbers have included aerial surveys, questionnaires to rural residents and mail carriers, scent post surveys, intensive ground searches, and indices derived from hunting and trapping harvest (Voigt 1987). In Great Britain, where food is abundant in many urban areas, densities as high as 30 fox per square kilometer (78 per mi^2) have been reported (Harris 1977, MacDonald and Newdick 1982, Harris and Rayner 1986), while in southern Ontario, densities of about 1 fox per square kilometer (2.6 per mi^2) occur during spring. This includes both pups and adults. In small areas of the best habitat, three times as many fox have been observed (Voigt 1987). However, those densities rarely occur extensively because of the dispersion of unsuitable habitat, high mortality, or from competition with coyotes (Voigt and Earle 1983). Cyclical changes in fox numbers occur routinely and complicate density estimates as well as management. Those cycles can occur because of changes in prey availability, or disease outbreaks, especially rabies, among red fox. For fox populations to remain relatively stable, mortality and reproduction must balance approximately.

Home ranges for red fox in the eastern United States are usually from 500 to 2,000 hectares (1,235 to 4,940 acres) in rural settings such as farmland (Voigt and Tinline 1980), but such sizes may not apply among fox populations in urban settings. Red fox can be found statewide in Mississippi in suitable habitat. If red fox only occupied 50% of the land area of the State and the density of red fox in Mississippi were 2.6 red fox per square mile, the statewide population could be estimated at nearly 61,000 red fox.

Red fox are also considered a "*nuisance animal*" in the State and can be lethally removed at any time to alleviate damage or threats of damage. Red fox can also be harvested during annual hunting and trapping seasons in the State. An unlimited number of fox can be harvested daily and possessed during the length of the season. The number of red fox reported as harvested from 2006 through 2010 is shown in Table 4.8. Red fox are also taken to alleviate damage and threats of damage; however, the number of fox lethally taken annually to alleviate damage or threats of damage is currently unknown.

Table 4.8 - Cumulative red fox take from known sources in Mississippi, 2006-2011

Year	Type of Harvest		WS' Take[1,2]	TOTAL	WS % of Total
	Hunting	Trapping			
2006	3,490	259	25	**3,774**	0.7%
2007	0	387	0	**387**	0%
2008	1,085	306	0	**1,391**	0%
2009	873	329	1	**1,203**	0.1%
2010	N/A[†]	174	2	**176**[‡]	1.1%
2011	N/A	N/A	0	N/A	N/A
TOTAL	**5,448**	**1,455**	**28**	**6,931**	**0.4%**

[1]WS' take is reported by federal fiscal year

[2]WS' take includes all take including unintentional take during other damage management activities

[†]N/A=data is currently not available; data is incomplete

[‡]Total does not include the number of raccoons harvested during the hunting season; information for 2010 is unavailable

Between 2006 and 2009, 5,448 red fox have been harvested in the State during the annual hunting season while 1,455 red fox have been harvested in the State during the annual trapping season from 2006 through 2010. The highest level of take occurred in 2006 when 3,749 fox were reported taken during the hunting and trapping season. As shown in Table 4.8, WS has lethally taken 28 red fox in the State from FY 2006 through FY 2011 with the highest level of take occurring in FY 2006 when 25 red fox were taken to alleviate damage. When take has occurred by WS, the take of red fox to alleviate damage or threats of damage has ranged from 0.1% of the total harvest of red fox to a high of 1.1% during 2010. The number of red fox harvested in the State during the 2010 hunting season is currently unavailable; therefore, WS' take of two red fox during FY 2010 was likely a much lower percentage of the total take of fox during the 2010 hunting and trapping season in the State.

Based on the number of requests for assistance received previously and based on the number of red fox addressed as part of those requests for assistance, WS could take up to 50 red fox total annually to alleviate damage and threats of damage during all wildlife damage management activities. Using a statewide red fox population estimated at 61,000 fox, take of up to 50 red fox annually by WS would represent 0.1% of the estimated population. Although exact population estimates for red fox in Mississippi are not available, the unlimited take limits allowed by the MDWFP for the species during hunting and trapping seasons and the classification of the species as a "*nuisance animal*" indicates the species is not at risk of overharvesting.

Bobcat Population Information and Effects Analysis

The bobcat, also called "*wildcat*," is a medium-sized member of the North American cat family, and may be mistaken for a large bob-tailed domestic cat by some people. Bobcats are actually two to three times larger than most domestic cats and appear more muscular and fuller in body. Bobcats are capable of hunting and killing prey that range from the size of a mouse to that of a deer. Rabbits, tree squirrels, ground squirrels, wood rats, porcupines, pocket gophers, and woodchucks comprise most of their diet. Opossums, raccoon, grouse, wild turkey, and other ground nesting birds are also eaten. Occasionally, insects and reptiles can be part of a bobcat's diet and bobcats are known to scavenge. Bobcats are opportunistic predators, and may feed on livestock and domestic animals such as poultry, sheep, goats, house cats, small dogs, exotic birds and game animals, and rarely, calves (Virchow and Hogeland 1994). McCord and Cardoza (1982) reported the cottontail rabbit to be the principal prey of bobcats throughout their range.

Bobcats reach densities of about 1 per 0.7 km^2 (1 per ¼ mi^2) on some islands in the Gulf Coast of the southeastern United States. Densities vary from about 1 per 1.3 square kilometer (1 per ½ mi^2) in coastal plains to about 1 cat per 10.7 square kilometer (1 per 4 mi^2) in portions of the Appalachian foothills. Mid-Atlantic and mid-western states usually have scarce populations of bobcats (Virchow and Hogeland 1994). Populations are stable in many northern states and reviving in other states where intensive trapping formerly decimated the species (National Audubon Society 2000). Rates of natural mortality reported for adult bobcats in protected populations appear to be quite low. Crowe (1975) estimated a 3% mortality rate in a protected population, based on study of bobcats in southeastern Idaho conducted by Bailey (1972). Causes of natural mortality for adult bobcats include starvation (Hamilton 1982), disease and predation (Lembeck 1978), and injuries inflicted by prey (Fuller et al. 1985).

Bobcats are common statewide in Mississippi in suitable habitat. Population estimates for bobcats in Mississippi are not currently available. Since population estimates are not available for bobcats, the best available data will be used to estimate a population size to analyze potential impacts.

Bobcats are classified as furbearers in Mississippi, with regulated annual hunting and trapping seasons. During the annual trapping season, there is no daily or possession limit for bobcats. At the time this

document was prepared, take limits were in place for a portion of the hunting season for bobcats while no possession limit occurs during other portions of the hunting season. The number of bobcats harvested from 2006 through 2010 is shown in Table 4.9. As mandated through the Convention on International Trade in Endangered Species, the MDWFP requires that all bobcat pelts to be sold must be tagged. However, bobcats can be found statewide in Mississippi where suitable habitat occurs and are not considered a threatened or endangered species.

Table 4.9 - Cumulative bobcat take from known sources in Mississippi, 2006-2011

Year	Type of Harvest		WS' Take[1,2]	TOTAL	WS % of Total
	Hunting	Trapping			
2006	6,657	2,072	11	**8,740**	0.1%
2007	5,424	2,248	1	**7,673**	0.01%
2008	7,828	1,851	0	**9,679**	0%
2009	2,587	1,754	3	**4,344**	0.1%
2010	N/A[†]	1,120	4	**1,124**[‡]	0.4%
2011	N/A	N/A	2	N/A	N/A
TOTAL	**22,496**	**9,045**	**21**	**31,560**	**0.1%**

[1]WS' take is reported by federal fiscal year

[2]WS' take includes all take including unintentional take during other damage management activities

[†]N/A=data is currently not available; data is incomplete

[‡]Total does not include the number of raccoons harvested during the hunting season; information for 2010 is unavailable

Since FY 2006, WS has lethally removed 21 bobcats in the State during damage management activities. Of those 21 bobcats lethally taken by WS, one was unintentionally taken in FY 2010 during other damage management activities. As shown in Table 4.9, WS' take as a percentage of the overall take of bobcats in the State has not exceeded 0.4% between 2006 and 2010. On average, WS' take of bobcats has represented 0.1% of the annual total harvest of bobcats in the State. The number of bobcats harvested during the hunting season in 2010 and 2011 is currently not available; therefore, WS' take during FY 2010 was likely a lower percentage of the overall take of bobcats in the State.

Habitat preferred by bobcats is quite diverse in Mississippi ranging from upland forests to coastal wetlands. If only 50% of the land area of Mississippi represents suitable bobcat habitat and using density estimates for the Appalachian foothills of 1 bobcat per 4 square miles, a statewide population could be estimated to be approximately 5,900 bobcats. However, this estimate could be considered low given that where quality habitat and prey are available densities tend to be much higher. A recent study where bobcats were reintroduced to an island off the coast of Georgia, bobcat densities stabilized at 1 bobcat per 1.2 square mile (Diefenbach et al. 2006). A total bobcat population could be estimated at 19,600 bobcats using a density of 1 bobcat per 1.2 square mile. Given the harvest levels that occurred from 2006 through 2010, the actual population is likely to be much higher. No information indicates the densities of bobcats in the State are declining and the continued unlimited take allowed during the trapping season and portions of the hunting season provide an indication that overharvest in not likely to occur.

Based upon an anticipated increase in damage management activities associated with bobcats in the future, it is possible that WS could kill up to 50 bobcats per year in Mississippi. Under the worst case scenario outlined above based on population densities of 1 bobcat per 4 square mile and only half of the land area of the State containing bobcats, if 50 bobcats were removed, the take would represent less than 0.8% of the estimated bobcat population in Mississippi of 5,900 bobcats. The statewide population is likely higher than 5,900 bobcats since the annual harvest of bobcats between 2006 and 2009 was near or exceeded the population estimate. In addition, the unlimited take allowed by the MDWFP indicates the

species is not likely to be overharvested. The take of bobcats by WS would only occur when permitted by the MDWFP and only at levels permitted.

Feral Swine Population Information and Effects Analysis

Feral swine are also known as "*wild pigs*", "*wild boars*", and "*feral hogs*". Feral swine are medium-size hoofed mammals that often can look like domestic pigs. Feral swine usually have coarser and denser coats than their domestic counterparts and exhibit modified canine teeth called "*tusks*" which are usually 7.5 to 12.5 cm (3 to 5 inches) long, but may be up to 23 cm (9 inches) long. Tusks can curl out and up along the sides of the mouth. Lower canines are also prominent but smaller. Young feral hogs have pale longitudinal stripes on the body until they are 6 weeks of age. Adults of the species average 90 cm (3 feet) in height and 1.32 to 1.82 m (4 feet 6 inches to 6 feet). Males may attain a weight of 75 to 200 kg (165 to 440 lb) while females may weigh from 35 to 150 kg (77 to 330 lbs). Feral swine mate any time of year but peak breeding times usually occur from January and February through early summer. Litter sizes are usually three to 12 (National Audubon Society 2000). Feral hogs are the most prolific wild mammal in North America. Given adequate nutrition, a wild pig population can double in just four months. Feral hogs may begin to breed before six months of age and sows can produce two litters per year (Barrett and Birmingham 1994).

Evidence of the presence of feral swine may be rooted up earth, tree rubs at ground level to 900 cm (36 inches) high, with clinging hair or mud, and muddy wallows in wild habitat. In Mississippi, feral swine can be found statewide and often exploit a variety of habitats. Feral swine are considered a "*nuisance animal*" in Mississippi and can be addressed throughout the year, with few exceptions and no limits on the number of feral swine that can be removed.

Damage in areas supporting feral swine populations is sometimes a serious natural resource management concern for land managers. Substantial damage has occurred to natural resources, including destruction of fragile plant communities, killing and destruction of tree seedlings, and erosion of soils (Barrett and Birmingham 1994). Food sources for feral hogs includes acorns, hickory nuts, pecans, beech nuts, and a wide variety of vegetation including roots, tubers, grasses, fruit, and berries, but feral hogs also eat crayfish, frogs, snakes, salamanders, mice, eggs and young of ground -nesting birds, young rabbits, and any other easy prey or carrion encountered. Feral swine have been known to kill and eat fawns (National Audubon Society 2000). Feral swine have also been reported to kill considerable numbers of domestic livestock, especially young animals, in some areas (Barrett and Birmingham 1994). Several diseases are associated with feral swine populations (see Chapter 1).

The population of feral swine in Mississippi is currently unknown and population density information is not currently available to estimate a statewide population. The number of feral swine harvested in the State from 2006 through 2009 is shown in Table 4.10 along with take that has occurred by WS from FY 2006 through FY 2011. The number of feral swine harvested in the State during 2010 and 2011 is currently unknown. In total, 153,059 feral swine have been harvested, which is an average harvest of 38,265 swine from 2006 through 2009. The highest harvest level occurred in 2008 when nearly 71,000 feral swine were harvested in the State, which compares to the lowest harvest level estimated at nearly 23,000 swine that occurred in 2007.

WS has lethally removed 706 feral swine from FY 2006 through FY 2011 in the State to alleviate damage and threats of damage. WS' total take of feral swine has represented 0.5% of the total number of feral swine harvested in the State. In anticipation of future requests for assistance, up to 500 feral swine could be lethally removed by WS to alleviate damage or threats of damage. Take of 500 swine would represent 1.3% of the average number of feral swine harvested from 2006 through 2009. If WS had lethally

removed 500 feral swine in FY 2007, the take would have represented 2.2% of the lowest harvest level of feral swine that occurred during 2007.

Table 4.10 – Cumulative feral swine take from known sources in Mississippi, 2006-2011

Year	Harvest[a,b]	WS' Take[c]	Total Take	WS % Take
2006	31,582	20	**31,602**	0.1%
2007	22,996	18	**23,014**	0.1%
2008	70,909	78	**70,987**	0.1%
2009	27,572	147	**27,719**	0.5%
2010	N/A[†]	161	**N/A**	N/A
2011	N/A	282	**N/A**	N/A
TOTAL	**153,059**	**706**	**153,483**	**0.5%**

[a]Harvest data reported by trapping season
[b]Harvest data provided by the MDWFP
[c]WS' take is reported by FY
[†]N/A=data is currently not available; data is incomplete

In those cases where feral swine are causing damage or where feral swine are a nuisance and complete removal of the local population could be achieved, this could be considered as providing some benefit to the native environment since feral swine are not considered part of the native ecosystem.

White-tailed Deer Population Information and Effects Analysis

When compared to other land mammals in North America, the white-tailed deer currently occupies the largest geographic range of any other mammal (Pagel et al. 1991). Rural areas containing a matrix of forest and agricultural crops can contain the highest deer densities (Roseberry and Woolf 1998). Biologists and resource managers have been challenged with managing escalating populations of deer in many urban/suburban areas and in some rural areas. As deer populations increase, there is an increasing occurrence of damage from white-tailed deer to agricultural crops (DeVault et al. 2007), increasing incidences of Lyme disease (Fernandez 2008), a rise in deer-vehicle collisions (Conover et al. 1995), and a disruption in forest health, regeneration, and forest dependent species (Tilghman 1989).

The authority for management of resident wildlife species, including deer, is the responsibility of the MDWFP. The MDWFP collects and compiles information on white-tailed deer population trends and take, and uses this information to manage deer populations. The primary tool for the management of deer populations is through adjusting the allowed lethal take during the deer harvest season in the State, which is determined and regulated by the MDWFP. Where deer damage is severe, the MDWFP also issues depredation permits for the take of deer outside of the regulated season to reduce damage.

Between the 2006 deer harvest season in Mississippi and the 2009 season, the highest level of take of deer occurred in 2007 when 324,024 deer were harvested (see Table 4.11). In 2009, the number of deer killed during the regulated season was estimated to be 279,662 deer. Hunters have harvested nearly 1.2 million deer between 2006 and 2009 during the regulated harvest season. The number of deer harvested during the 2010 and 2011 hunting season is currently unknown. In addition to take occurring during the regulated season, deer populations are also regulated by other factors. Mortality also occurs from vehicle collisions, dogs, illegal take, tangling in fences, depredation permits, disease, and other causes (Crum 2003). The highest mortality from vehicle collisions occurred in 2010 when an estimated 14,738 deer were killed. Deer mortality associated with other factors is currently unknown in the State.

Since FY 2006, WS has used lethal methods to take 657 deer in Mississippi to alleviate damage and threats with the highest level of take occurring in FY 2009 when 209 deer were taken (see Table 4.11). All take by WS has occurred after receiving a request for assistance with resolving damage caused by deer and after a permit and approval was issued by the MDWFP. WS in Mississippi has also conducted 49 technical assistance projects involving deer damage management since FY 2005 as shown in Table 1.1.

Table 4.11 - Total known deer mortality in Mississippi by year

Year	Deer Harvest[a]	Vehicle Collisions	WS' Take[b]	Total Mortality	WS' % Take
2006	285,130	12,146	81	**297,357**	0.03%
2007	324,024	13,197	25	**337,246**	0.01%
2008	295,126	13,954	61	**309,141**	0.02%
2009	279,662	14,327	209	**294,198**	0.07%
2010	295,986[†]	14,738	188	**310,912**	0.06%
2011	295,986[†]	13,489	93	**309,568**	0.03%
TOTAL	**1,775,914**	**81,851**	**657**	**1,858,422**	**0.04%**

[a]Data adapted from Hunt (2010)

[b]Data reported by federal fiscal year

[†]Data for 2010 and 2011 is an average of harvest from 2006 through 2009 since data is currently unavailable for 2010 and 2011

As shown in table 4.11, the highest level of take by WS occurred in FY 2009 when 209 deer were removed using lethal methods, which accounted for 0.07% of the total known mortality of deer in Mississippi. Since FY 2006, 657 deer have been taken by WS as targets, which represents 0.04% of the total mortality of deer in the State. Based on previous requests for assistance, the magnitude of WS' take of deer to resolve damage or threats has been low in Mississippi. When take of deer has occurred by WS, the magnitude of take compared to the total known mortality has ranged from 0.01% to 0.07% since FY 2006. Based on the limited take by WS from FY 2006 through FY 2011, WS' activities to resolve or prevent damage have not adversely affected the deer population.

After review of the number of requests for assistance to resolve and prevent deer damage in Mississippi received by WS since FY 2006 and in consultation with the MDWFP, WS' anticipates the number of requests for assistance to increase in the future. Based on consultation with MDWFP, a review of previous requests for assistance, and in anticipation of an increasing number of requests for assistance, WS anticipates the use of non-lethal and lethal methods to resolve deer damage and threats to increase.

An increasing number of requests for assistance would likely result in the escalated use of lethal and non-lethal methods to resolve damage and threats associated with deer as permitted by the MDWFP. Non-lethal methods are generally regarded as having minimal impacts on wildlife populations since no lethal take occurs and wildlife are dispersed to other areas. No population reduction is likely from the use of non-lethal methods, except for reproductive inhibitors, which are currently not available for use in Mississippi. Therefore, the increased use of non-lethal methods to resolve and prevent damage would not adversely affect deer populations in the State.

After review of previous activities conducted by WS and in anticipation of a gradual increase in requests for lethal take, WS anticipates that future lethal take would not exceed 450 deer annually. In addition, WS may be requested by the MDWFP and/or the MDAC to assist with sampling and managing the spread of diseases found in free-ranging and/or captive deer populations. In the case of a disease outbreak, WS could lethally take up to 250 additional white-deer for sampling and/or to prevent further spread of diseases. Therefore, WS' total annual take would not exceed 700 deer annually under the proposed action. Any take of deer by WS in Mississippi must be authorized and permitted by the MDWFP.

If requested, WS could also assist with sampling and removing deer from captive facilities where deer are confined inside a perimeter fence. The detection of a disease at a captive facility often raises concerns of the potential spread of diseases to free-ranging herds. The spread of diseases among deer inside these facilities is often increased due to their close contact with one another. Often, once a disease is detected in a confined deer herd, the entire herd is destroyed to ensure the containment of the disease. Any involvement with the depopulation of deer confined inside a perimeter fence by WS would be at the request of the MDWFP and/or the MDAC. As proposed in this alternative, in those cases where WS was requested to assist with the removal of a captive deer herd in Mississippi, the take would not exceed 250 deer for purposes of disease monitoring or surveillance. Deer confined inside perimeter fences for the purposes of non-traditional farming, including confined for hunting, are not included in statewide deer population management objectives. However, since take of deer by WS for disease surveillance or monitoring could occur in free-ranging or captive herds, the potential take of up to 250 deer for disease surveillance and monitoring by WS would be considered as part of the impact analysis on the statewide free-ranging deer population. Therefore, the analyses will evaluate the lethal take (killing) of up to 700 deer annually by WS at the request of cooperators and approved by the MDWFP.

In addition to WS' intentional take of deer to resolve or prevent damage, WS also conducts other damage management activities that pose a risk for the unintentional lethal take of deer, primarily projects that target coyotes, red fox, feral dogs, and feral swine. From FY 2006 through FY 2011, no deer were unintentionally taken by WS. However, the unintentional take of deer could occur during other damage management activities. Based on the limited unintentional take that occurred from FY 2006 through FY 2011 during other program activities in Mississippi and after the review of proposed activities, the unintentional take of deer by WS during other activities is not expected to increase to any appreciable extent. The unintentional take of deer by WS would continue to be nominal when compared to the number of deer harvest annually. WS would report all take, including unintentional take, to the MDWFP. In addition, total take would be evaluated by WS to ensure take, whether intentional or unintentional, would not adversely affect deer populations in the State.

Since deer harvest levels and other mortality events fluctuate annually in the State (see Table 4.11), the analysis of impacts of WS' take on the statewide deer population under this alternative will be evaluated using several scenarios. WS' proposed take would not exceed 450 deer annually. In the event of a disease threat, the take of deer by WS for disease monitoring and surveillance would not exceed 250 deer when requested by the MDWFP and/or the MDAC. Under a worst-case scenario, 700 deer could be taken by WS annually under this alternative. Since the worst-case scenario would represent the highest level of annual take, the analyses will evaluate take of 700 deer to determine the maximum possible potential impact; although, take of 700 deer annually is unlikely and would likely be less than 450 deer.

From 2006 through 2009, the highest deer harvest (324,024) in Mississippi and the highest level of mortality from vehicle collisions (14,738) occurred in 2010 for 338,762 deer killed. During the same period, the lowest deer harvest (279,662) in Mississippi occurred in 2009 while the lowest number of deer killed from vehicle strikes occurred in 2006 when 12,146 deer were killed. If WS' take reached 700 deer during the highest known mortality of deer in the State, WS' take of 700 deer would have represented 0.2% of the total known mortality in the State. If WS' take reached 700 deer during the lowest known mortality of deer in the State, WS' take of deer would have represented 0.2% of the total known mortality.

If WS had lethally taken 700 deer each year from FY 2006 through FY 2011, WS' take would have presented 0.2% of the total harvest of deer in the State during the annual hunting season. The deer population in Mississippi is currently unknown. However, the MDWFP currently estimates the deer

population in the State to be expanding and that deer hunters are not harvesting enough deer to cause a decline in the overall deer population (MDWFP 2011).

The take of deer unintentionally during other WS' damage management activities is not expected to greatly increase the potential impacts on the deer population in Mississippi even under the worst-case scenario. With oversight of the MDWFP, the magnitude of take of deer by WS annually to resolve damage and threats would be low. All take by WS would continue to be reported to the MDWFP to ensure WS' activities were incorporated into deer population objectives for the State. Since deer can be taken to alleviate damage through the issuance of permits by the MDWFP, those deer taken by WS would likely be removed by those persons experiencing damage or threats since they could obtain permits for the lethal take of deer. WS' damage management activities associated with deer would be carried out under a permit issued by the MDWFP to a property owner and/or manager or directly to WS to conducted deer damage management activities for a property owner and/or manager. Therefore, WS' activities are removing deer that the property owner and/or manager could remove themselves under depredation permits but has chosen to request assistance from WS. Even in the event of a disease threat, those deer that could be taken by WS would likely be taken whether WS was directly involved or not. Therefore, WS' activities under the proposed action would not likely be additive to the mortality that already occurs under permits and that could occur during disease threats. The potential impacts to the statewide deer population under the proposed action would likely be similar to the other alternatives given that WS' activities would not substantial increase the take that could occur in the absence of WS' direct involvement since take could occur when permitted by the MDWFP. The deer that could be taken by WS under the proposed action are likely those deer that would be taken by other entities when permitted by the MDWFP in the absence of WS' direct involvement in the activities.

GonaCon™ was officially registered by the EPA in 2009 for use in reducing fertility in female white-tailed deer. According to the label, only WS or state wildlife management agency personnel or individuals working under their authority can use the reproductive inhibitor. Additionally, in order for GonaCon™ to be used in any given state, the product must also be registered with the state and approved for use by the appropriate state agency responsible for managing wildlife. The reproductive inhibitor Gonacon™ is currently not registered for use in Mississippi. However, if Gonacon™ becomes available to manage deer in the State, the use of the inhibitor could be evaluated under the proposed action as a method available that could be used in an integrated approach to managing damage.

Population management from the use of reproductive inhibitors to induce a decline in a localized deer population occurs through a reduction in the recruitment of fawns into the population by limiting reproductive output of adults. A reduction in the population occurs when the number of deer being recruited into the population cannot replace those individuals that die from other causes each year, which equates to a net loss in the number of individuals in the population and a reduction in the overall population. Although not generally considered a lethal method since no direct take occurs, reproductive inhibitors can result in the reduction of a target species' population. WS' use of GonaCon™ would target a local deer population identified as causing damage or threatening human safety. Although a reduction in a local deer population would likely occur from constant use of GonaCon™, the actual reduction in the local population annually would be difficult to derive prior to the initiation of the use of the vaccine.

One of the difficulties in calculating and analyzing any actual reduction that could occur from the use of the vaccine in a targeted population prior to application of the vaccine is the variability in the response of deer to the vaccine. Previous studies on GonaCon™ as a reproductive inhibitor have shown variability in the immune response of deer to the vaccine (Miller et al. 2000). Not all deer injected with GonaCon™ develop sufficient antibodies to neutralize the GnRH produced in the body. Those deer continue to enter into a reproductive state and produce fawns even after vaccination. The number of deer that do not develop sufficient antibodies after the initial vaccination cannot be predicted beforehand. In one study,

88% of the deer vaccinated with GonaCon™ did not produce fawns the following reproductive season while 12% of the deer injected with GonaCon™ produced fawns (Gionfriddo et al. 2009). The year following the initial vaccination, the number of deer that were vaccinated the first year that did not produce fawns declined to 47% while the number of deer producing fawns increased to 53% (Gionfriddo et al. 2009) demonstrating the diminishing results that are likely over time if deer are not provided a booster shot periodically.

Since the effects of GonaCon™ are reversible if deer were not provided with a booster shot periodically, the reduction in a local population of deer from the use of GonaCon™ could be maintained at appropriate levels where damages or threats were resolved by increasing or decreasing the number of deer receiving booster injections. Although localized deer populations would likely be reduced from the use of GonaCon™, the extent of the reduction would be variable. For example, not all vaccinated deer are prevented from entering into a reproductive state and those deer that were initially prevented from entering into a reproductive state often become reproductively active in subsequent years as the antibody levels neutralizing the GnRH hormone diminish over time. Therefore, the actual decline in the number of deer in a localized population achieved from the use of GonaCon™ would be difficult to predict prior to the use of the reproductive inhibitor. However, since the decline would occur through attrition over time and since the ability of the inhibitor to prevent reproduction diminishes with time, the actual decline in a localized population would be gradual and could be monitored. In addition, the reduction in a local deer population could be fully reversed if deer are no longer vaccinated or provided booster shots and other conditions (*e.g.*, food, disease) are favorable for population growth.

Turner et al. (1993) noted that although contraception in white-tailed deer may be used to limit population growth, it would not reduce the number of deer in excess of the desired level in many circumstances. Turner et al. (1993) further contend that initial population reductions by various other means may be necessary to achieve management goals, and that reproduction control would be one facet of an integrated program. Although immunocontraceptive technology has been effective in laboratories, pens, and in island field applications, it has not been effective in reducing populations of free-ranging white-tailed deer over large geographical areas.

The magnitude of WS' activities to alleviate damage and threats associated with deer in the State would be low with the oversight and permitting of WS' activities occurring by the MDWFP. If take by WS had reached 700 deer during 2009 when the lowest known deer mortality occurred in the State, WS' take would have represented 0.07% of the total known mortality. Based on those worst-case scenarios, WS' take of up to 700 deer under the proposed action would be insignificant when compared to the total known mortality. WS would report to the MDWFP and monitor take to ensure WS' activities do not adversely affect deer. The permitting of all WS' take by the MDWFP ensures WS' take would meet the population goals for deer in the State as determined by the MDWFP.

Feral Cat Population Information and Effects Analysis

Feral cats are domesticated cats living in the wild. They are small in stature, weighing from 3 to 8 pounds (1.4 to 3.6 kg), standing 8 to 12 inches (20 to 30.5 cm) high at the shoulder, and 14 to 24 inches (35.5 to 61 cm) long. The tail adds another 20 to 30.5 cm (8 to 12 inches) to their length. Colors range from black to white to orange, and a variety of combinations of those colors. Other hair characteristics also vary greatly (Fitzwater 1994).

Feral cats are found in commensal relationships wherever people are found. In some urban and suburban areas, cat populations equal human populations. In many suburban and eastern rural areas, feral cats are the most abundant predators. They are opportunistic predators and scavengers that feed on rodents,

rabbits, shrews, moles, birds, insects, reptiles, amphibians, fish, carrion, garbage, vegetation, and leftover pet food (Fitzwater 1994).

Feral cats produce two to 10 kittens during any month of the year. An adult female may produce three litters per year where food and habitat are sufficient. Cats may be active during the day but typically are more active during twilight or night. House cats have been reported to live up to 27 years, but feral cats probably average only three to five years. They are territorial and move within a home range of roughly 4 square kilometers (1.5 mi^2). After several generations, feral cats can be considered to be completely wild in habits and temperament (Fitzwater 1994).

Where it has been documented, the impact of feral cats on wildlife populations in suburban and rural areas, directly by predation, and indirectly by competition for food, has been enormous (Coleman and Temple 1989). In the United Kingdom, one study determined that house cats might take an annual toll of some 70 million animals and birds (Churcher and Lawton 1987). In addition, feral cats serve as a reservoir for human and wildlife diseases, including cat scratch fever, distemper, histoplasmosis, leptospirosis, mumps, plague, rabies, ringworm, salmonellosis, toxoplasmosis, tularemia, and various parasites (Fitzwater 1994).

WS killed 16 feral cats in Mississippi from FY 2006 through FY 2011. The statewide population of feral cats in Mississippi is unknown. Feral cats are considered by many wildlife biologists and ornithologists to be a detriment to native wildlife species. Feral cats prey upon native wildlife species and compete with native predators for prey. Thus, removing feral cats could be considered to have beneficial effects on the environment by elimination of predation and competition from an introduced species in the environment.

In future programs, WS may be requested to address damage being caused by feral cats anywhere in Mississippi to protect any resource being damaged or threatened. It is possible that WS could kill as many as 100 feral cats each year to alleviate damage and threats of damage. Feral cats would be removed in projects to reduce damage and threats occurring to human safety, valuable wildlife, or captive wildlife. Feral cats are not viewed as furbearers in Mississippi.

Based upon the above information, WS' limited lethal removal of feral cats would have minimal effects on local or statewide populations of this species in Mississippi. Any damage management activities involving lethal control actions by WS would be restricted to isolated individual sites. Some local populations may be temporarily reduced because of WS' activities aimed at reducing damage at a local site. In those cases where feral cats were causing damage or where feral cats were a nuisance and complete removal of the local population could be achieved, this could be considered as providing some benefit since feral cats are not considered part of the native ecosystem.

Feral Dog Population Information and Effects Analysis

Like domestic dogs, feral dogs (sometimes referred to as wild or free-ranging dogs) manifest themselves in a variety of shapes, sizes, colors, and even breeds. McKnight (1964) noted German shepherds, Doberman pinschers, and collies are the breeds that most often become feral. Most feral dogs today are descendants of domestic dogs that appear similar to dog breeds that are locally common (Green and Gipson 1994). The primary feature that distinguishes feral from domestic dogs is the degree of reliance or dependence on humans, and in some respect, their behavior toward people. Feral dogs survive and reproduce independently of human intervention or assistance. While it is true that some feral dogs use human garbage for food, others acquire their primary subsistence by hunting and scavenging like other wild canids.

Feral and domestic dogs often differ markedly in their behavior toward people. Scott and Causey (1973) based their classification of those two types by observing the behavior of dogs while confined in cage traps. Domestic dogs usually wagged their tails or exhibited a calm disposition when a human approached, whereas most feral dogs showed highly aggressive behavior, growling, barking, and attempting to bite. Some dogs were intermediate in their behavior and could not be classified as either feral or domestic based solely on their reaction to humans. Since many feral dogs have been pursued, shot at, or trapped by people, their aggressive behavior toward humans is not surprising. Gipson (1983) described the numerous lead pellets imbedded under the skin of a feral dog caught in Arkansas as a testament to its relationship with people (Green and Gipson 1994).

Feral dogs are usually secretive and wary of people. Thus, they are active during dawn, dusk, and at night, much like other wild canids. They often travel in packs or groups and may have rendezvous sites, similar to wolves. Travel routes to and from the gathering or den sites may be well defined. Food scraps and other evidence of concentrated activity may be observed at gathering sites.

The appearance of tracks left by feral dogs varies with the size and weight of the animal. Generally, dog tracks are more round and show more prominent nail marks than those of coyotes, and they are usually larger than those of fox. Since a pack of feral dogs likely consists of animals in a variety of sizes and shapes, the tracks from a pack of dogs will be correspondingly varied, unlike the tracks of a group of coyotes (Green and Gipson 1994).

Feral dogs may occur wherever people are present and permit dogs to roam free or abandon unwanted dogs. Feral dogs probably occur in all of the 50 states, Canada, and Central and South America. They are also common in Europe, Australia, Africa, and on several remote ocean islands, such as the Galapagos. Home ranges of feral dogs vary considerably in size. Home ranges are probably influenced by the availability of food. Dog packs that are primarily dependent on garbage may remain in the immediate vicinity of a landfill, while other packs that depend on livestock or wild game may forage over an area of 130 square kilometers (50 mi^2) or more (Green and Gipson 1994).

Feral dogs are often found in forested areas or shrubland near human habitation. Some people will not tolerate feral dogs in close proximity to human activity; thus, they take considerable effort to eliminate them in such areas. Feral dogs may be found on lands where human access is limited, such as military reservations and large airports. They may also live in remote sites, where they feed on wildlife and native fruits. The only areas that do not appear to be suitable for feral dogs are places where food and escape cover are not available, or where large native carnivores, particularly wolves, are common and prey on dogs (Green and Gipson 1994).

Like coyotes, feral dogs are best described as opportunistic feeders. They can be efficient predators, preying on small and large animals, including domestic livestock. Many rely on carrion, particularly road-killed animals, crippled waterfowl, green vegetation, berries and other fruits, and refuse at garbage dumps (Green and Gipson 1994).

Feral dogs are highly adaptable, social carnivores. Gipson (1983) suggested that family groups of feral dogs are more highly organized than previously believed. Pup rearing may be shared by several members of a pack. Survival of pups born during autumn and winter has been documented, even in areas with harsh winter weather. Gipson found that only one female in a pack of feral dogs studied in Alaska gave birth during two years of study, even though other adult females were present in the pack. The breeding female gave birth during late September or early October during both years. It is noteworthy that all pups from both litters had similar color markings, suggesting that the pups had the same father. Adult males of different colors were present in the pack.

Nesbitt (1975) commented on the rigid social organization of a pack of feral dogs where nonresident dogs were excluded, including females in estrus. In one instance, Nesbitt used three separate female dogs in estrus as bait (dogs were chained in the back of a corral-type trap) over a 59-day period and captured no feral dogs. He then baited the same trap with carrion, and a pack of feral dogs, including four adult males, entered the trap within one week (Green and Gipson 1994).

Hybridization between feral dogs and other wild canids can occur, but non-synchronous estrus periods and pack behavior (that is, excluding non-resident canids from membership in the pack) may preclude much interbreeding. Dens may be burrows dug in the ground or sheltered spots under abandoned buildings or farm machinery. Feral dogs commonly use former fox or coyote dens (Green and Gipson 1994).

Feral dogs can cause damage by preying on livestock, poultry, house cats, or domestic dogs. They may also feed on fruit crops including melons, berries, grapes, and native fruit. They may also attack people, especially children. This is especially true where they feed at and live around landfills near human dwellings (Green and Gipson 1994). In some locales, they may present a serious threat to deer (Lowry 1978) and other valuable wildlife (Green and Gipson 1994).

WS provided technical assistance during 19 feral dog complaints related to human health and safety from FY 2005 to FY 2011. Most complaints regarding dogs were referred to local animal control agencies since requesters are usually unable to determine if the dog is feral or a pet. A record is only generated when some kind of technical assistance is provided by WS because of the request for assistance. From FY 2006 through FY 2011, WS lethally removed 40 feral dogs during damage management activities in Mississippi. Based on previous requests for assistance and in anticipation of receiving additional requests for assistance, WS could lethally remove up to 100 feral dogs per year under the proposed action alternative. In most cases, WS would employ live-capture methods to alleviate damage or threats of damage associated with dogs. Once live-captured, WS would transfer custody of the dogs to a local animal control facility. After relinquishing the dogs to a local animal control facility, the care and the final disposition of the dog would be the responsibility of the animal control facility.

Based upon the above information, WS' limited lethal removal of feral dogs should have no adverse effects on overall populations in Mississippi. Any activities conducted by WS involving lethal control actions by WS would be restricted to isolated individual sites. Some local populations may be temporarily reduced because of removal activities aimed at reducing damage at a local site. In those cases where feral dogs were causing damage or posing as a nuisance and complete removal of the local population could be achieved, this would be considered as providing some benefit to the natural environment since feral dogs are not considered part of the native ecosystem.

Additional Target Species

Target species, in addition to those mammal species discussed previously, have been lethally taken in small numbers by WS and have included no more than 10 individuals of the following species: woodchucks, swamp rabbits, southern flying squirrels, gray squirrels, fox squirrels, and mink. Those species have been lethally taken during damage management activities and could include unintentional take during other damage management activities. However, the total take by WS would not exceed 10 individuals of each species.

Based on previous requests for assistance and the take levels necessary to alleviate those requests for assistance, no more than 10 individuals of any of those species could be taken annually by WS in the State. None of those mammal species would be expected to be taken by WS at any level that would adversely affect populations of those species. Swamp rabbits, gray squirrels, fox squirrels, and mink have

hunting and/or trapping seasons that allow those species to be harvested in the State. Woodchucks are an unregulated species in the State and take can occur at any time to alleviate damage or threats of damage. If up to 10 individuals of each of those species were lethally removed by WS to alleviate damage or threats of damage, the take would be of low magnitude when compared to the number of those species harvested each year and would be of extremely low magnitude when compared to the statewide population of those species. Those species are not considered to be of low densities in the State.

Wildlife Disease Surveillance and Monitoring

The ability to efficiently conduct surveillance for and detect diseases is dependent upon rapid detection of the pathogen if it is introduced. Effective implementation of a surveillance system would facilitate planning and execution at regional and state levels, and coordination of surveillance data for risk assessment. It would also facilitate partnerships between public and private interests, including efforts by federal, state, and local governments as well as non-governmental organizations, universities, and other interest groups.

Sampling strategies that could be employed include sampling live-captured mammals that could be released on site after sampling occurs. This sampling (*e.g.*, drawing blood, swabbing nasal cavities, collecting fecal samples) and the subsequent release of live-captured mammals would not result in adverse effects since those mammals are released unharmed on site. In addition, sampling of sick, dying, or mammals harvested by hunters would not result in the additive lethal take of mammals that would not have already occurred in the absence of a program sampling for diseases. Therefore, the sampling of mammals for diseases would not adversely affect the populations of any of the mammals addressed in this EA nor would the sampling of mammals result in any take of mammals that would not have already occurred in the absence of disease sampling (*e.g.*, hunter harvest).

Alternative 2 – Mammal Damage Management by WS through Technical Assistance Only

Mammal populations in the State would not be directly impacted by WS from a program implementing technical assistance only. However, persons experiencing damage or threats from mammals may implement methods based on WS' recommendations. Under a technical assistance only alternative, WS would recommend and demonstrate for use both non-lethal and lethal methods legally available for use to resolve mammal damage. Methods and techniques recommended would be based on WS' Decision Model using information provided from the requestor or from a site visit. Requestors may implement WS' recommendations, implement other actions, seek assistance from other entities, or take no action. However, those persons requesting assistance are likely people that would implement damage abatement methods in the absence of WS' recommendations.

Under a technical assistance only alternative, those persons experiencing threats or damage associated with mammals in the State could lethally take mammals despite WS' lack of direct involvement in the management action. Therefore, under this alternative the number of mammals lethally taken would likely be similar to the other alternatives since take could occur through the issuance of a permit by the MDWFP, take of non-native mammal species can occur without the need for a permit from the MDWFP, and take would continue to occur during the harvest season for those species. WS' participation in a management action would not be additive to an action that would occur in the absence of WS' participation.

With the oversight of the MDWFP, it is unlikely that mammal populations would be adversely impacted by implementation of this alternative. Under this alternative, WS would not be directly involved with damage management actions and therefore, direct operational assistance could be provided by other entities, such as the MDWFP, private entities, and/or municipal authorities. If direct operational

assistance was not available from WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal take, which could lead to real but unknown effects on other wildlife populations. People have resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

Alternative 3 – No Mammal Damage Management Conducted by WS

Under this alternative, WS would not conduct damage management activities in the State. WS would have no direct involvement with any aspect of addressing damage caused by mammals and would provide no technical assistance. No take of mammals by WS would occur under this alternative. Mammals could continue to be lethally taken to resolve damage and/or threats occurring through permits issued by the MDWFP, during the regulated hunting or trapping seasons, or in the case of non-native species, take could occur anytime using legally available methods. Management actions taken by non-federal entities would be considered the *environmental status quo*.

Local mammal populations could decline, stay the same, or increase depending on actions taken by those persons experiencing mammal damage. Some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of mammals out of frustration or ignorance. While WS would provide no assistance under this alternative, other individuals or entities could conduct lethal damage management resulting in lethal take levels similar to the proposed action.

Since mammals could still be taken under this alternative, the potential effects on the populations of those mammal species in the State would be similar to the other alternatives for this issue. WS' involvement would not be additive to take that could occur since the cooperator requesting WS' assistance could conduct mammal damage management activities without WS' direct involvement. Therefore, any actions to resolve damage or reduce threats associated with mammals could occur by other entities despite WS' lack of involvement under this alternative.

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

As discussed previously, a concern is often raised about the potential impacts to non-target species, including T&E species, from the use of methods to resolve damage caused by mammals. The potential effects on the populations of non-target wildlife species, including T&E species, are analyzed below.

Alternative 1 - Continue the Current Adaptive Integrated Mammal Damage Management Program (No Action/Proposed Action)

The potential for adverse effects to non-targets occurs from the employment of methods to address mammal damage. Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The risks to non-targets from the use of non-lethal methods as part of an integrated direct operational assistance program would be similar to those risks to non-targets discussed in the other alternatives.

Personnel from WS would be experienced with managing wildlife damage and would be trained in the employment of methods, which would allow WS' employees to use the WS Decision Model to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target exposure to methods during program activities, the potential for WS to disperse or

lethally take non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-lethal methods have the potential to cause adverse effects to non-targets primarily through exclusion, harassment, and dispersal. Any exclusionary device erected to prevent access of target species also potentially excludes species that were not the primary reason the exclusion was erected; therefore, non-target species excluded from areas may potentially be adversely impacted if the area excluded was large enough. The use of auditory and visual dispersal methods used to reduce damage or threats caused by mammals would also likely disperse non-targets in the immediate area the methods were employed. Therefore, non-targets may be permanently dispersed from an area while employing non-lethal dispersal techniques. However, like target species, the potential impacts on non-target species would expect to be temporary with target and non-target species often returning after the cessation of dispersal methods.

Non-lethal methods that use auditory and visual stimuli to reduce or prevent damage are intended to elicit fright responses in wildlife. When employing those methods to disperse or harass target species, any non-targets near those methods when employed would also likely be dispersed from the area. Similarly, any exclusionary device constructed to prevent access by target species would also exclude access to non-target species. The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas where non-lethal methods were employed of both target and non-target species. Therefore, any use of non-lethal methods would be similar to those results on both non-target and target species. Though non-lethal methods do not result in lethal take of non-targets, the use of non-lethal methods can restrict or prevent access of non-targets to beneficial resources. However, non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods would generally be regarded as having minimal impacts on overall populations of wildlife since individuals of those species were unharmed. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely affect populations since those methods are often temporary.

Other non-lethal methods available for use under this alternative include live traps, nets, and repellents. Live traps and nets are considered live-capture methods since wildlife are restrained once captured. Live traps would have the potential to capture non-target species. Trap and net placement in areas where target species were active and the use of target-specific attractants would likely minimize the capture of non-targets. If traps and nets were attended to appropriately, any non-targets captured could be released on site unharmed.

Chemical repellents would also be available to reduce mammal damage. Since FY 2006, WS has not used repellents to reduce mammal damage in the State. However, WS may recommend commercially available repellents when providing technical assistance. Only those repellents registered with the EPA pursuant to the FIFRA and the MDAC would be recommended or used by WS under this alternative. The active ingredients in many commercially available repellents are naturally occurring substances (*e.g.*, capsaicin, fish oil, whole egg solids), which are often used in food preparation (EPA 2001). When used according to label instructions, most repellents would be regarded as safe since 1) they are not toxic to animals, if ingested; 2) there is normally little to no contact between animals and the active ingredient, and 3) the active ingredients are found in the environment and degrade quickly (EPA 2001). Only those repellents registered with the EPA pursuant to the FIFRA, and the MDAC would be recommended and used by WS under this alternative. Therefore, the use and recommendation of repellents would not have negative impacts on non-target species when used according to label requirements. Most repellents for mammals pose a very low risk to non-targets when exposed to or when ingested.

Exposure of non-target wildlife to GonaCon™ would occur primarily from secondary hazards associated with wildlife consuming deer that have been injected with GonaCon™. Since GonaCon™ would be applied directly to deer through hand injection after the animal was live-captured and restrained, the risk of directly exposing non-target wildlife to GonaCon™ while being administered to deer would be nearly non-existent. Several factors inherent with GonaCon™ reduce risks to non-target wildlife from direct consumption of deer injected with the vaccine (EPA 2009). The vaccine itself and the antibodies produced by the deer in response to the vaccine are both proteins, which if consumed would be broken down by stomach acids and enzymes (EPA 2009, USDA 2010). The EPA determined that the potential risks to non-target wildlife from the vaccine and the antibodies produced by deer in response to the vaccine "*...are not expected to exceed the Agency's concern levels*" (EPA 2009).

Potential impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur. Non-lethal methods would be available under all the alternatives analyzed; however, the use of Gonacon™ would be restricted to use by the MDWFP and their designated agents under Alternative 2, if registered. WS' involvement in the use of or recommendation of non-lethal methods would ensure the potential impacts to non-targets were considered under WS' Decision Model. Non-lethal methods would not be employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term adverse effects would occur to a species' population. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since individuals of those species are unharmed. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely affect populations since those methods are often temporary and do not result in lethal take. Potential impacts to non-targets under this alternative from the use of and/or the recommendation of non-lethal methods are likely to be low.

WS could also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage, when those methods were deemed appropriate for use using the WS Decision Model. Lethal methods available for use to manage damage caused by mammals under this alternative would include body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, shooting, and euthanasia chemicals. In addition, target mammal species live-captured using non-lethal methods (*e.g.*, live-traps, immobilizing drugs) could be euthanized. Available methods and the application of those methods to resolve mammal damage is further discussed in Appendix B.

The use of firearms would essentially be selective for target species since animals would be identified prior to application; therefore, no adverse impacts would be anticipated from use of this method. Similarly, the use of euthanasia methods would not result in non-target take since identification would occur prior to euthanizing an animal.

When using fumigants, burrows and dens would be observed for the presence of non-targets before the use of fumigants. If non-target activity (*e.g.*, tracks, scat) were observed, the fumigation of those burrows or dens would not occur. Since non-targets are known to occur in burrows or dens, some risks of unintentional take of non-targets does exist from the use of fumigants. For example, burrows of woodchucks can be used by a variety of non-target species such as the Eastern cottontail, striped skunk, raccoon, red fox, coyote, white-footed mouse (*Peromyscus leucopus*), house mouse (*Mus musculus*), and short-tailed shrew (*Blarina brevicauda*) (Hamilton, Jr. 1934, Grizzell 1955, Dolbeer et al. 1991).

Fumigants would be used in active burrows or dens only, which would minimize risk to non-targets. Dolbeer et al. (1991) found a total of one cottontail rabbit and three mice (*Permyscus* spp.) in three of the 97 woodchuck burrows treated with gas cartridges during the late summer. During 2,064 trap nights at 86

woodchuck burrow entrances targeting small mammals, Swihart and Picone (1995) captured 99 individuals of four small mammal species, which included short-tailed shrews, meadow voles (*Microtus pennsylvanicus*), meadow jumping mouse (*Zapus hudsonius*), and white-footed mice. Risks to non-targets can be minimized by treating only burrows that appear to be active (Dolbeer et al. 1991). There are no secondary poisoning risks involved with the use of gas cartridges as the gas produced dissipates into the atmosphere shortly after activation. Primary risks to non-targets would be minimized by treating only active burrows or dens, by covering entrances of burrows or dens, and by following the pesticide label. Although non-targets could be present in burrows or dens, even after WS' conducts site investigations, the risks would be relatively low and unintentional take from the use of fumigants would be limited.

While every precaution would be taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by mammals, the use of such methods could result in the incidental lethal take of unintended species. The unintentional take and capture of wildlife species during damage management activities conducted under the proposed action alternative would primarily be associated with the use of body-gripping traps and in some situations, with live-capture methods, such as foothold traps, cage traps, and cable restraints.

Between FY 2006 and FY 2011, the unintentional take of non-targets by WS during damage management activities has been minimal with take not exceeding one or two individuals of any species, with non-target take primarily involving opossum and Norway rats. Although additional species of non-targets could be lethally taken by WS, take of individuals from any species is not likely to increase substantively above the number of non-targets taken annually by WS during previous damage management activities. In addition, most of the species lethally taken or live-captured from FY 2006 through FY 2011 are also considered targets species in the EA and the level of take analyzed for each species under Issue 1 includes non-target take that could occur by WS. Therefore, the take of those species has been evaluated cumulatively under Issue 1, including take that could occur when a species is considered a target or non-target. WS would continue to monitor activities, including non-target take to ensure the annual take of non-targets does not result in adverse effects to a species' population. No T&E species have been captured or adversely affected by WS' activities conducted previously in Mississippi.

Methods available to resolve and prevent mammal damage or threats when employed by trained, knowledgeable personnel would be selective for target species. WS would report to the MDWFP any non-target take to ensure take by WS was considered as part of management objectives established for those species by the MDWFP. The potential for adverse effects to non-targets would be similar to the other alternatives and would be considered minimal to non-existent.

As discussed previously, the use of non-lethal methods to address damage or threats would generally be regarded as having no adverse effect on a species' population since those individuals addressed using non-lethal methods would be unharmed and no actual reduction in the number of individuals in a species' population occurs. Similarly, the live-capture and release of non-targets would generally be regarded as having no adverse effects on a species' population since those individuals are released unharmed and no actual reduction in the number of individuals in a population occurs. Therefore, the live-capture and subsequent releasing of non-targets during damage management activities conducted under the proposed action alternative would not result in declines in the number of individuals in a species' population.

The lethal take of non-targets could result in declines in the number of individuals in a population; however, the lethal take of non-targets by WS during damage management activities targeting those mammal species addressed in this EA occurs rarely. The non-targets taken previously by WS are representative of non-targets that could be lethally taken by WS under the proposed action alternative. Although additional species of non-targets could be lethally taken by WS, take of individuals from any

species is not likely to increase substantively above the number of non-targets taken annually by WS during previous damage management activities. In addition, most of the species lethally taken or live-captured from FY 2006 through FY 2011 are also considered target species in this EA and the level of take analyzed for each species under Issue 1 includes non-target take that could occur by WS. Therefore, the take of those species has been evaluated cumulatively under Issue 1, including take that could occur when a species is considered a target or non-target. WS would continue to monitor activities, including non-target take to ensure the annual take of non-targets does not result in adverse effects to a species' population. No T&E species have been captured or adversely affected by WS' activities conducted previously in Mississippi.

While every precaution would be taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by mammals, the use of such methods could result in the incidental take of unintended species. Those occurrences would be rare and should not affect the overall populations of any species under the proposed action.

T&E Species Effects

Special efforts would be made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. SOPs to avoid T&E species effects are described in Chapter 3 of this EA.

Federally Listed Species - The current list of species designated as threatened and endangered in Mississippi as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix C contains the list of species currently listed in the State along with common and scientific names. Based on a review of those T&E species listed in the State during the development of the EA, WS determined that activities conducted pursuant to the proposed action would not likely adversely affect those species listed in the State by the USFWS and the National Marine Fisheries Services nor their critical habitats. As part of the development of the EA, WS consulted with the USFWS under Section 7 of the ESA. The USFWS concurred with WS' determination that activities conducted pursuant to the proposed action would not likely adversely affect those species currently listed in the State or their critical habitats if the following recommendations made by the USFWS were followed (S. Ricks, USFWS pers. comm. 2012):

- Avoid working in ponds where Mississippi gopher frogs (*Rana capito sevosa*) are known to occur, avoid working in streams with listed mussels, fish, or turtles, and avoid Mississippi sandhill crane nesting areas
- When conducting ground-disturbing activities, the project site should be surveyed for potential roosting locations of T&E bat species, such as culverts, underpasses, caves, abandoned mines and buildings, wells, and snags. Because methods can disturb roosting bats offsite and result in abandonment of an area, activities should be conducted 500 yards away from any identified or potential roosting areas
- In vegetated wetland areas, surveys for Mitchell's satyr butterflies (*Neonympha mitchellii mitchellii*), Price's potato bean (*Apios priceana*), pondberry (*Lindera melissifolia*), and Louisiana quillwort (*Isoetes louisianensis*) should be conducted, if suitable habitat were present
- Forested areas with suitable habitat for red-cockaded woodpeckers (*Picoides borealis*) should be surveyed
- Areas with suitable soils and vegetation should be surveyed for gopher tortoises (*Gopherus polyphemus*)
- Louisiana black bear breeding areas have been documented along the Mississippi River. No activities should take place during the breeding season in those locations

- Chemical repellents should not be used in locations with listed species or areas with critical habitats

WS would abide by those recommendations made by the USFWS to ensure activities were not likely to adversely affect T&E species in the State. If T&E species were detected in an area, WS would contact the USFWS prior to initiating any further activities.

State Listed Species – The current list of State listed species designated as endangered or threatened by the State as determined by the Mississippi Museum of Natural Science was obtained and reviewed during the development of the EA (see Appendix D). Based on the review of species listed in the State, WS has determined that the proposed activities would not adversely affect those species currently listed by the State. The MDWFP has concurred with WS' determination for State listed species (S. Peyton, Mississippi Museum of Natural Sciences pers. comm. 2012).

Alternative 2 – Mammal Damage Management by WS through Technical Assistance Only

Under a technical assistance alternative, WS would have no direct impact on non-target species, including T&E species. Methods recommended or provided through loaning of equipment could be employed by those people requesting assistance. Recommendations would be based on WS' Decision Model using information provided by the person requesting assistance or through site visits. Recommendations would include methods or techniques to minimize non-target impacts associated with the methods being recommended or loaned. Methods recommended could include non-lethal and lethal methods as deemed appropriate by WS' Decision Model and as permitted by laws and regulations.

The potential impacts to non-targets under this alternative would be variable and based on several factors. If methods were employed, as recommended by WS, the potential impacts to non-targets would likely be similar to the proposed action. If recommended methods and techniques were not followed or if other methods were employed that were not recommended, the potential impacts on non-target species, including T&E species would likely be higher compared to the proposed action.

The potential impacts of harassment and exclusion methods on non-target species would be similar to those described under the proposed action. Harassment and exclusion methods would be easily obtainable and simple to employ. Since identification of targets would occur when employing shooting as a method, the potential impacts to non-target species would likely be low under this alternative.

Those persons experiencing damage from mammals may implement methods and techniques based on the recommendations of WS. The potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. If those persons experiencing damage do not implement methods or techniques correctly, the potential impacts from providing only technical assistance could be greater than the proposed action. The incorrect implementation of methods or techniques recommended by WS could lead to an increase in non-target take when compared to the non-target take that could occur by WS under the proposed action alternative.

If requestors were provided technical assistance but do not implement any of the recommended actions and take no further action, the potential to take non-targets would be lower when compared to the proposed action. If those persons requesting assistance implement recommended methods appropriately and as instructed or demonstrated, the potential impacts to non-targets would be similar to the proposed action. If WS made recommendations on the use of methods to alleviate damage but those methods were not implemented as recommended by WS or if those methods recommended by WS were used inappropriately, the potential for lethal take of non-targets would likely increase under a technical

assistance only alternative. Therefore, the potential impacts to non-targets, including T&E species would be variable under a technical assistance only alternative.

If non-lethal methods recommended by WS under this alternative were deemed ineffective by those requesting assistance, lethal methods could be employed by those experiencing damage. Those persons requesting assistance are those persons likely to use lethal methods since a damage threshold has been met for that individual requestor that has triggered assistance to reduce damage. The potential impacts on non-targets by those persons experiencing damage would be highly variable. People whose mammal damage problems were not effectively resolved by non-lethal control methods would likely resort to other means of legal or illegal lethal control. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action. When those persons experiencing damage caused by wildlife reach a level where assistance does not adequately reduce damage or where no assistance is available, people have resorted to using chemical toxicants that are illegal for use on the intended target species. The illegal use of methods often results in loss of both target and non-target wildlife (White et al. 1989, USFWS 2001, FDA 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance or assistance that inadequately reduces damage to an acceptable level can often result in the indiscriminate take of wildlife species.

The ability to reduce negative impacts caused by mammals to wildlife species and their habitats, including T&E species, would be variable under this alternative. The ability to reduce risks would be based upon the skills and abilities of the person implementing damage management actions. It would be expected that this alternative would have a greater chance of reducing damage than Alternative 3 since WS would be available to provide information and advice on appropriately employing methods and reducing the risk of non-target take.

Alternative 3 – No Mammal Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with damage management activities in the State. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Mammals would continue to be taken under permits issued by the MDWFP, take would continue to occur during the regulated harvest seasons, and non-native mammal species could continue to be taken without the need for a permit. Risks to non-targets and T&E species would continue to occur from those people who implement damage management activities on their own or through recommendations by the other federal, state, and private entities. Although some risks occur from those people that implement mammal damage management in the absence of any involvement by WS, those risks would likely be low and would be similar to those risks under the other alternatives.

The ability to reduce negative impacts caused by mammals to other wildlife species and their habitats, including T&E species, would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative.

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

A common concern is the potential adverse effects that methods available could have on human health and safety. The threats to human safety of methods available under the alternatives are evaluated below by each of the alternatives.

Alternative 1 - Continue the Current Adaptive Integrated Mammal Damage Management Program (No Action/Proposed Action)

The cooperator requesting assistance would be made aware through a MOU, cooperative service agreement, or a similar document that those methods agreed upon could potentially be used on property owned or managed by the cooperator. Therefore, the cooperator would be made aware of the possible use of those methods on property they own or manage through the signing of a MOU, cooperative service agreement, or similar document, which would assist with identifying any risks to human safety associated with the use of those methods.

Under the proposed action, those methods discussed in Appendix B, could be integrated to resolve and prevent damage associated with mammals in the State. WS would use the Decision Model to determine the appropriate method or methods that would effectively resolve the request for assistance. Those methods would be continually evaluated for effectiveness and if necessary, additional methods could be employed. Non-lethal and lethal methods could be used under the proposed action. WS would continue to provide technical assistance and/or direct operational assistance to those persons seeking assistance with managing damage or threats from mammals. Risks to human safety from technical assistance conducted by WS would be similar to those risks addressed under Alternative 2. The use of non-lethal methods as part of an integrated approach to managing damage that could be employed as part of direct operational assistance by WS would be similar to those risks addressed in the other alternatives.

Lethal methods available under the proposed action would include the use of body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, shooting, and euthanasia chemicals. In addition, target mammal species live-captured using non-lethal methods (*e.g.*, live-traps, immobilizing drugs) could be euthanized. Those lethal methods available under the proposed action alternative or similar products would also be available under the other alternatives. None of the lethal methods available would be restricted to use by WS only. Euthanasia chemicals would not be available to the public but those mammals live-captured could be killed using other methods.

WS' employees who conduct activities to manage damage caused by mammals would be knowledgeable in the use of methods, wildlife species responsible for causing damage or threats, and WS' directives. That knowledge would be incorporated into the decision-making process inherent with the WS' Decision Model that would be applied when addressing threats and damage caused by mammals. When employing lethal methods, WS' employees consider risks to human safety when employing those methods based on location and method. For example, risks to human safety from the use of methods would likely be lower in rural areas that are less densely populated. Consideration would also be given to the location where damage management activities would be conducted based on property ownership. If locations where methods would be employed occur on private property in rural areas where access to the property is controlled and monitored, the risks to human safety from the use of methods is likely less. If damage management activities occur at parks or near other public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety increases. Activities would generally be conducted when human activity is minimal (*e.g.*, early mornings, at night) or in areas where human activities are minimal (*e.g.*, in areas closed to the public).

The use of live-capture traps, restraining devices (*e.g.*, foothold traps, some cable restraints), and body-gripping traps have been identified as a potential issue. Live-capture traps available for mammals would typically be walk-in style traps where mammals enter but are unable to exit. Live-traps, restraining devices, and body-gripping traps would typically be set in situations where human activity was minimal to ensure public safety. Those methods rarely cause serious injury and are triggered through direct activation of the device. Therefore, human safety concerns associated with live-traps, restraining devices, and body-gripping traps used to capture wildlife, including mammals, would require direct contact to

cause bodily harm. Therefore, if left undisturbed, risks to human safety would be minimal. Signs warning of the use of those tools in the area would be posted for public view at access points to increase awareness that those devices were being used and to avoid the area, especially pet owners.

Other live-capture devices, such as cannon nets, pose minor safety hazards to the public since activation of the device occurs by trained personnel after target species have been observed in the capture area of the net. Lasers also pose minimal risks to the public since application occurs directly to target species by trained personnel, which limits the exposure of the public to misuse of the method.

Safety issues related to the misuse of firearms and the potential human hazards associated with firearms use are issues identified when employed to reduce damage and threats. To help ensure safe use and awareness, WS' employees who use firearms during official duties are required to attend an approved firearm safety-training course and to remain certified for firearm use must attend a safety training course in accordance with WS Directive 2.615. As a condition of employment, WS' employees who carry and use firearms are subject to the Lautenberg Domestic Confiscation Law, which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence (18 USC § 922(g)(9)). A safety assessment based on site evaluations, coordination with cooperating and local agencies (if applicable), and consultation with cooperators would be conducted before firearms were deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities in the State. WS would work closely with cooperators requesting assistance to ensure all safety issues were considered before firearms would be deemed appropriate for use. The use of all methods, including firearms, would be agreed upon with the cooperator to ensure the safe use of those methods.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would include immobilizing drugs, euthanasia drugs, reproductive inhibitors, fumigants, and repellents.

The use of immobilizing drugs would only be administered to mammals that have been live-captured using other methods or administered through injection using a projectile (*e.g.*, dart gun). Immobilizing drugs used to sedate wildlife would be used to temporarily handle and transport animals to lessen the distress of the animal from the experience. Drug delivery to immobilize mammals would be likely to occur on site with close monitoring of the animal to ensure proper care of the animal. Immobilizing drugs would be fully reversible with a full recovery of sedated animals occurring. A list and description of immobilizing drugs available for use under the identified alternatives can be found in Appendix B.

Euthanizing drugs would be administered under similar circumstances to immobilizing drugs. Euthanizing drugs would be administered to animals live-captured using other methods. Euthanized animals would be disposed of in accordance with WS Directives; therefore, would not be available for harvest and consumption. If mammals were immobilized for sampling or translocation and released, risks could occur to human safety if harvest and consumption occurred. SOPs employed by WS to reduce risks are discussed in Chapter 3 and in Appendix B.

Drugs used in capturing, handling, and euthanizing wildlife include ketamine, a mixture of ketamine/xylazine, sodium pentobarbital, potassium chloride, and Beuthanasia-D. Meeting the requirements of the AMDUCA should prevent any adverse effects to human health with regard to this issue (see Section 1.6). SOPs that would be part of the activities conducted would include:

- All drugs used in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS.

- As determined on a state-level basis by those veterinary authorities (as allowed by AMDUCA), wildlife hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Ear tagging or other marking of animals drugged and released to alert hunters and trappers that they should contact state officials before consuming the animal.
- Most animals administered drugs would be released well before hunting/trapping seasons, which would give the drug time to completely metabolize out of the animals' systems before they might be taken and consumed by humans. In some instances, animals collected for control purposes would be euthanized when they are captured within a certain specified time period prior to the legal hunting or trapping season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems.

By following those procedures in accordance with AMDUCA, wildlife management programs would avoid any adverse effects on human health with regard to this issue.

All WS' personnel who handle and administer chemical methods would be properly trained in the use of those methods. Training and adherence to agency directives (see WS Directive 2.430) would ensure the safety of employees applying chemical methods. Mammals euthanized by WS or taken using chemical methods would be disposed of in accordance with WS Directive 2.515. All euthanasia would occur in the absence of the public, whenever possible, which would minimize risks. SOPs are further described in Chapter 3 of this EA.

The recommendation of repellents or the use of those repellents registered for use to disperse mammals in the State could occur under the proposed action as part of an integrated approach to managing mammal damage. Those chemical repellents that would be available to recommend for use or that could be directly used by WS under this alternative would also be available under any of the alternatives. Therefore, risks to human safety from the recommendation of repellents or the direct use of repellents would be similar across all the alternatives. Risks to human safety associated with the use of repellents by WS or the recommendation of repellents by WS is addressed under the technical assistance only alternative (Alternative 2). Risks to human safety would be similar across all the alternatives. WS' involvement, either through recommending the use of repellents or the direct use of repellents, would ensure that label requirements of those repellents were discussed with those persons requesting assistance when recommended through technical assistance or would be specifically adhered to by WS' personnel when using those chemical methods. Therefore, the risks to human safety associated with the recommendation of or direct use of repellents could be lessened through WS' participation.

Gas cartridges would be ignited and placed inside of burrows or dens with the entrance covered by dirt, which traps carbon monoxide inside the burrow. The carbon monoxide would dissipate into the atmosphere and be diluted by the air (EPA 1991). WS would follow label instructions when employing gas cartridges. Therefore, no risks to human safety would occur from the use of gas cartridges.

Due to the classification of GonaCon™ as a restricted-use pesticide by the EPA, this product would be restricted to use by federal or state agencies that have successfully completed the requirements of the MDAC for the purchase and application of restricted-use pesticides. Risks to human safety would be limited primarily to the actual applicator due to the necessity to capture and inject GonaCon™ into each animal to be vaccinated. At this time, GonaCon™ has not been registered for use in Mississippi and is therefore not available for use within the State. However, this product could be registered for use in Mississippi and could be administered by MDWFP or their agents under any of the alternatives.

Risks to human safety from the use of GonaCon™ would be minimal and would occur primarily to those persons injecting the deer through accidental self-injection or those persons handling syringes. To reduce the risks of accidental exposure through self-injection, the label of GonaCon™ requires the use of long sleeved shirts, long pants, gloves, socks, and shoes. In addition, injection would only occur after deer have been properly restrained to minimize accidental injection during application to the deer. The label also requires that children be absent from the area during application of the vaccine as well as a warning to women that accidental self-injection could cause infertility. WS' employees who are pregnant would not be involved with handling or injecting of the vaccine.

In addition, human exposure could occur through consumption of deer that were treated with GonaCon™. As was discussed previously, the vaccine and the antibodies produced in response to the vaccine are amino acid proteins that if consumed would be broken down by stomach acids and enzymes, posing no risks to human safety. The vaccine would only be used in localized areas where deer populations have exceeded the biological or social carrying capacity. Those areas are likely places where hunting is prohibited or restricted (*e.g.*, in parks); therefore, the consumption of deer is unlikely in those areas where the vaccine would be used since hunting would be prohibited or restricted. Deer injected with the vaccine must also be marked for identification, which would allow for placement of warnings to people that could take and consume a treated deer. Based on the use pattern of GonaCon™ and the chemical make-up of the vaccine and the antibodies, the risks to human safety from the use of the vaccine would be extremely low and would occur primarily to the handler (EPA 2009).

The recommendation by WS that mammals be harvested during the regulated hunting and/or trapping seasons that are established by the MDWFP would not increase risks to human safety above those risks already inherent with hunting or trapping those species. Recommendations of allowing hunting and/or trapping on property owned or managed by a cooperator to reduce mammal populations, which could then reduce damage or threats, would not increase risks to human safety. Safety requirements established by the MDWFP for the regulated hunting and trapping season would further minimize risks associated with hunting and trapping. Although hunting and trapping accidents do occur, the recommendation of allowing hunting or trapping to reduce localized populations of mammals would not increase those risks.

No adverse effects to human safety have occurred from WS' use of methods to alleviate mammal damage in the State from FY 2006 through FY 2011. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, would be considered low.

Alternative 2 – Mammal Damage Management by WS through Technical Assistance Only

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to resolve damage. WS would only provide technical assistance to those persons requesting assistance with mammal damage and threats. Although hazards to human safety from non-lethal methods exist, those methods are generally regarded as safe when used by trained individuals who are experienced in their use. Risks to human safety associated with non-chemical methods such as resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, and cage traps would be considered low based on their use profile for alleviating damage associated with wildlife. Although some risk of fire and bodily harm exists from the use of pyrotechnics and propane cannons, when used appropriately and in consideration of those risks, they can be used with a high degree of safety.

Under a technical assistance only alternative, the use of immobilizing drugs, euthanasia drugs, and Gonacon™ would not be available to the public. However, personnel with the MDWFP or their designated agents could use Gonacon™ under this alternative. Drugs used in capturing and handling wildlife could be administered under the direction and authority of state veterinary authorities, either

directly or through procedures agreed upon between those authorities and other entities, such as the MDWFP. Personnel employing nets would be present at the site during application to ensure the safety of the public and operators. Although some fire and explosive hazards exist with rocket nets during ignition and storage of the explosive charges, safety precautions associated with the use of the method, when adhered to, would pose minimal risks to human safety and would primarily occur to the handler. Nets would not be employed in areas where public activity was high, which further reduces the risks to the public. Nets would be employed in areas where public access was restricted whenever possible to reduce risks to human safety. Overall, nets would pose minimal risks to the public.

The use of chemical methods that are considered non-lethal would be available under this alternative. Chemical methods available would include repellents. There are few chemical repellents registered for use to manage damage caused by mammals in the State. Most repellents require ingestion of the chemical to achieve the desired affects on target species. Repellents that require ingestion are intended to discourage foraging on vulnerable resources and to disperse mammals from areas where the repellents are applied. Repellents, when used according to label directions, are generally regarded as safe especially when the ingredients are considered naturally occurring. Some risk of exposure to the chemical would occur to the applicator and to others from the drift as the product was applied. Some repellents also have restrictions on whether application can occur on edible plants with some restricting harvest for a designated period after application. All restrictions on harvest and required personal protective equipment would be included on the label and if followed, would minimize risks to human safety associated with the use of those products.

The recommendation by WS that mammals be harvested during the regulated hunting and/or trapping season, that would be established by the MDWFP would not increase risks to human safety above those risks already inherent with hunting and trapping mammals. Recommendations of allowing hunting or trapping on property owned or managed by a cooperator to reduce local mammal populations that could then reduce mammal damage or threats would not increase risks to human safety. Safety requirements established by the MDWFP for the regulated hunting and trapping season would further minimize risks associated with those activities. Although hunting and trapping accidents do occur, the recommendation of allowing hunting or trapping to reduce localized mammal populations would not increase those risks.

The recommendation of shooting with firearms as a method of direct lethal take could occur under this alternative. Safety issues do arise related to misusing firearms and the potential human hazards associated with firearms use when employed to reduce damage and threats. When used appropriately and with consideration for human safety, risks associated with firearms would be minimal. If firearms were employed inappropriately or without regard to human safety, serious injuries could occur. Under this alternative, recommendations of the use of firearms by WS would include human safety considerations. Since the use of firearms to alleviate mammal damage would be available under any of the alternatives and the use of firearms by those persons experiencing mammal damage could occur whether WS was consulted or contacted, the risks to human safety from the use of firearms would be similar among all the alternatives.

If non-chemical methods were employed according to recommendations and as demonstrated by WS, the potential risks to human safety would be similar to the proposed action. If methods were employed without guidance from WS or applied inappropriately, the risks to human safety could increase. The extent of the increased risk would be unknown and variable. Non-chemical methods inherently pose minimal risks to human safety given the design and the extent of the use of those methods.

The cooperator requesting assistance would also be made aware of threats to human safety associated with the use of those methods. SOPs for methods are discussed in Chapter 3 of this EA. Risks to human safety from activities and methods recommended under this alternative would be similar to the other

alternatives since the same methods would be available. If misused or applied inappropriately, any of the methods available to alleviate mammal damage could threaten human safety. However, when used appropriately, methods available to alleviate damage would not threaten human safety.

Alternative 3 – No Mammal Damage Management Conducted by WS

Under the no involvement in damage management by WS alternative, WS would not be involved with any aspect of managing damage associated with mammals in the State, including technical assistance. Due to the lack of involvement in managing damage caused by mammals, no impacts to human safety would occur directly from WS. This alternative would not prevent those entities experiencing threats or damage from mammals from conducting damage management activities in the absence of WS' assistance. The direct burden of implementing permitted methods would be placed on those persons experiencing damage or require those persons to seek assistance from other entities.

Similar to the technical assistance only alternative, Gonacon™, immobilizing drugs, and euthanasia chemicals would not be available under this alternative to the public. However, fumigants and repellents would continue to be available to those persons with the appropriate pesticide applicators license. Gonacon™ would be available to the MDWFP and persons under their authority, if registered in the State. Since most methods available to resolve or prevent mammal damage or threats would be available to anyone, the threats to human safety from the use of those methods would be similar between the alternatives. However, methods employed by those persons not experienced in the use of methods or are not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

Issue 4 - Effects on the Aesthetic Values of Mammals

Another concern often raised is the potential impact the alternatives could have on the aesthetic value that people often regard for mammals. The effects of the alternatives on this issue are analyzed below by alternative.

Alternative 1 - Continue the Current Adaptive Integrated Mammal Damage Management Program (No Action/Proposed Action)

Under the proposed action, methods would be employed that would result in the dispersal, exclusion, or removal of individuals or small groups of mammals to resolve damage and threats. In some instances where mammals were dispersed or removed, the ability of interested persons to observe and enjoy those mammals would likely temporarily decline.

Even the use of exclusionary devices can lead to the dispersal of wildlife if the resource being damaged was acting as an attractant. Thus, once the attractant has been removed or made unavailable, the wildlife would likely disperse to other areas where resources would be more vulnerable.

The use of lethal methods would result in temporary declines in local populations resulting from the removal of mammals to address or prevent damage and threats. The goal under the proposed action would be to respond to requests for assistance and to manage those mammals responsible for the resulting damage. Therefore, the ability to view and enjoy mammals would remain if a reasonable effort were made to locate mammals outside the area in which damage management activities were occurring. The mammals removed by WS would be those mammals that could be removed by the person experiencing damage.

All activities would be conducted where a request for assistance was received and only after the cooperator and WS had signed a cooperative agreement or similar document. Some aesthetic value would be gained by the removal of mammals and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by high mammal densities.

Since those mammals removed by WS under this alternative could be removed with a permit issued by the MDWFP, without the need for a permit if the species is unregulated, or during the regulated hunting or trapping seasons, WS' involvement in taking those mammals would not likely be additive to the number of mammals that could be taken in the absence of WS' involvement.

WS' take of mammals from FY 2006 through FY 2011 has been of low magnitude compared to the total mortality and populations of those species. WS' activities would not likely be additive to the mammals that could be taken in the absence of WS' involvement. Although mammals removed by WS would no longer be present for viewing or enjoying, those mammals would likely be taken by the property owner or manager if WS was not involved in the action since take by the property owner or manager could occur under a permit, during the regulated hunting and trapping seasons, or if the mammals were unregulated, take could occur without the need for a permit. Given the limited take proposed by WS under this alternative when compared to the known sources of mortality of mammals and the populations of those species, WS' mammal damage management activities conducted pursuant to the proposed action would not adversely affect the aesthetic value of mammals. The impact on the aesthetic value of mammals and the ability of the public to view and enjoy mammals under the proposed action would be similar to the other alternatives and would likely be low.

Alternative 2 – Mammal Damage Management by WS through Technical Assistance Only

If those persons seeking assistance from WS were those persons likely to conduct damage management activities in the absence of WS' involvement, then technical assistance provided by WS would not adversely affect the aesthetic value of mammals in the State similar to Alternative 1. Mammals could be lethally taken under this alternative by those entities experiencing mammal damage or threats, which would result in localized reductions in the presence of mammals at the location where damage was occurring. The presence of mammals where damage was occurring would be reduced where damage management activities were conducted under any of the alternatives. Even the recommendation of non-lethal methods would likely result in the dispersal of mammals from the area if those non-lethal methods recommended by WS were employed by those persons receiving technical assistance. Therefore, technical assistance provided by WS would not prevent the aesthetic enjoyment of mammals since any activities conducted to alleviate mammal damage could occur in the absence of WS' participation in the action, either directly or indirectly.

Under this alternative, the effects on the aesthetic values of mammals would be similar to those addressed in the proposed action. When people seek assistance with managing damage from either WS or another entity, the damage level has often reached an unacceptable economic threshold for that particular person. Therefore, in the case of mammal damage, the social acceptance level of those mammals has reached a level where assistance has been requested and those persons would likely apply methods or seek those entities that would apply those methods based on recommendations provided by WS or by other entities. Based on those recommendations, methods would likely be employed by the requestor that would result in the dispersal and/or removal of mammals responsible for damage or threatening safety. If those mammals causing damage were dispersed or removed by those persons experiencing damage based on recommendations by WS or other entities, the potential effects on the aesthetic value of those mammals would be similar to the proposed action alternative.

The impacts on aesthetics from a technical assistance program would only be lower than the proposed action if those individuals experiencing damage were not as diligent in employing those methods as WS would be if conducting an operational program. If those persons experiencing damage abandoned the use of those methods, then mammals would likely remain in the area and available for viewing and enjoying for those persons interested in doing so. Similar to the other alternatives, the geographical area in which damage management activities could occur would not be such that mammals would be dispersed or removed from such large areas that opportunities to view and enjoy mammals would be severely limited.

Alternative 3 – No Mammal Damage Management Conducted by WS

Under the no mammal damage management by WS alternative, the actions of WS would have no impact on the aesthetic value of mammals in the State. Those persons experiencing damage or threats from mammals would be responsible for researching, obtaining, and using all methods as permitted by federal, state, and local laws and regulations. Mammals could continue to be dispersed and lethally taken under this alternative in the State. Lethal take could continue to occur when permitted by the MDWFP through the issuance of permits, take could occur during the regulated harvest season, and in the case of non-regulated species, take could occur any time without the need for a permit.

Since mammals would continue to be taken under this alternative, despite WS' lack of involvement, the ability to view and enjoy mammals would likely be similar to the other alternatives. The lack of WS' involvement would not lead to a reduction in the number of mammals dispersed or taken since WS' has no authority to regulate take or the harassment of mammals in the State. The MDWFP with management authority over mammals could continue to adjust all take levels based on population objectives for those mammal species in the State. Therefore, the number of mammals lethally taken annually through hunting and under permits would be regulated and adjusted by the MDWFP.

Those persons experiencing damage or threats could continue to use those methods they feel appropriate to resolve mammal damage or threats, including lethal take. Therefore, WS' involvement in mammal damage management would not be additive to the mammals that could be taken in the State. The impacts to the aesthetic value of mammals would be similar to the other alternatives.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

As discussed previously, a common issue often raised is concerns about the humaneness of methods available under the alternatives for resolving mammal damage and threats. The issues of method humaneness relating to the alternatives are discussed below.

Alternative 1 - Continue the Current Adaptive Integrated Mammal Damage Management Program (No Action/Proposed Action)

Under the proposed action, WS would integrate methods using WS' Decision Model as part of technical assistance and direct operational assistance. Methods available under the proposed action could include non-lethal and lethal methods integrated into direct operational assistance conducted by WS. Under this alternative, non-lethal methods would be used by WS that were generally regarded as humane. Non-lethal methods would include exclusion, cultural methods, minor habitat modifications, supplemental feeding, animal behavior modification (*e.g.*, electronic guards, propane exploders, pyrotechnics, effigies), translocation, foothold traps, cable restraints, cage traps, immobilizing drugs, nets, reproductive inhibitors, reproductive inhibitors, and repellents.

As discussed previously, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal. People may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

Some individuals believe any use of lethal methods to resolve damage associated with wildlife is inhumane because the resulting fate is the death of the animal. Others believe that certain lethal methods can lead to a humane death. Others believe most non-lethal methods of capturing wildlife to be humane because the animal is generally unharmed and alive. Still others believe that any disruption in the behavior of wildlife is inhumane. With the multitude of attitudes on the meaning of humaneness and the varying perspectives on the most effective way to address damage and threats in a humane manner, agencies are challenged with conducting activities and employing methods that are perceived to be humane while assisting those persons requesting assistance to manage damage and threats associated with wildlife. The goal of WS would be to use methods as humanely as possible to effectively resolve requests for assistance to reduce damage and threats to human safety. WS would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

Some methods have been stereotyped as "*humane*" or "*inhumane*". However, many "*humane*" methods can be inhumane if not used appropriately. For instance, a cage trap would generally be considered by most members of the public as "*humane*". Yet, without proper care, live-captured wildlife in a cage trap can be treated inhumanely if not attended to appropriately.

Therefore, the goal would be to effectively address requests for assistance using methods in the most humane way possible that minimizes the stress and pain to the animal. Overall, the use of resource management methods, harassment methods, and exclusion devices are regarded as humane when used appropriately. Although some concern arises from the use of live-capture methods, the stress of animals is likely temporary.

Although some issues of humaneness could occur from the use of cage traps, foothold traps, reproductive inhibitors, translocation, immobilizing drugs, nets, and repellents, those methods, when used appropriately and by trained personnel, would not result in the inhumane treatment of wildlife. Concerns from the use of those non-lethal methods would be from injuries to animals while those animals were restrained and from the stress of the animal while being restrained or during the application of the method. Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

If mammals were to be live-captured by WS, WS' personnel would be present on-site during capture events or capture devices would be checked at least once every 24 hours or in accordance with Mississippi laws and regulations. This would help ensure non-target species were released in a timely manner. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary. Euthanasia of live-captured target mammals by WS under Alternative 1 would occur pursuant to WS Directive 2.505.

Under the proposed action, lethal methods could also be employed to resolve requests for assistance to alleviate or prevent mammal damage and threats. Lethal methods would include body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, shooting, and euthanasia chemicals. In addition, target species live-captured using non-lethal methods could be euthanized by WS. WS' use of lethal control methods under the proposed action would follow those required by WS' directives (see WS Directive 2.505, WS Directive 2.430).

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods were used in situations where non-lethal damage management methods were not practical or effective. Personnel from WS would be experienced and professional in their use of management methods. Consequently, management methods would be implemented in the most humane manner possible. Many of the methods discussed in Appendix B to alleviate mammal damage and/or threats in the State could be used under any of the alternatives by those persons experiencing damage regardless of WS' direct involvement. The only methods that would not be available to those persons experiencing damage associated with mammals would be reproductive inhibitors, immobilizing drugs, and euthanasia drugs. Therefore, the issue of humanness associated with methods would be similar across any of the alternatives since those methods could be employed by other entities in the absence of WS' involvement. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that would be incorporated into WS' activities to ensure methods were used by WS as humanely as possible are listed in Chapter 3.

Alternative 2 – Mammal Damage Management by WS through Technical Assistance Only

The issue of humaneness of methods under this alternative would be similar to the humaneness issues discussed under the proposed action. This perceived similarity is derived from WS' recommendation of methods that some people may consider inhumane. WS would not directly be involved with damage management activities under this alternative. However, the recommendation of the use of methods would likely result in the requester employing those methods. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to the proposed action. Under Alternative 2, WS would recommend the use of euthanasia methods pursuant to WS Directive 2.505. However, the person requesting assistance would determine what methods to use to euthanize or kill a live-captured animal under Alternative 2.

WS would instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing target mammal species and to ensure methods were used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by a cooperator would be based on the skill and knowledge of the requestor in resolving the threat to safety or damage situation despite WS' demonstration. Therefore, a lack of understanding of the behavior of mammals or improperly identifying the damage caused by mammals along with inadequate knowledge and skill in using methodologies to resolve the damage or threat could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering would likely be regarded as greater than discussed in the proposed action.

Alternative 3 – No Mammal Damage Management Conducted by WS

Under this alternative, WS would not be involved with any aspect of mammal damage management in Mississippi. Those persons experiencing damage or threats associated with mammals could continue to use those methods legally available. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods.

The humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals

and groups would still be available to the public to use to resolve damage and threats caused by mammals. Under Alternative 3, euthanasia or killing of live-captured animals would also be determined by those persons employing methods to live-captured wildlife.

Issue 6 - Effects of Mammal Damage Management Activities on the Regulated Harvest of Mammals

The populations of several of the mammal species addressed in this assessment are sufficient to allow for annual harvest seasons that typically occur during the fall. Hunting and trapping seasons are established by the MDWFP. Those species addressed in this EA that have established hunting and/or trapping seasons include: Virginia opossum, raccoons, river otters, striped skunks, coyotes, gray fox, red fox, bobcats, gray squirrels, fox squirrels, and white-tailed deer. For many mammal species considered harvestable during hunting and/or trapping seasons, the estimated number of mammals harvested during the season is reported by the MDWFP in published reports.

Alternative 1 - Continue the Current Adaptive Integrated Mammal Damage Management Program (No Action/Proposed Action)

The magnitude of lethal take addressed in the proposed action would be low when compared to the mortality of those species from all known sources. When WS' proposed take of mammals was included as part of the known mortality of those species and compared to the estimated populations, the impact on those species' populations was below the level of removal required to lower population levels.

With oversight of mammal populations by the MDWFP, the number of mammals permitted by the MDWFP to be taken by WS would not limit the ability of those persons interested to harvest those mammal species during the regulated season. All take by WS would be reported to the MDWFP annually to ensure take by WS was incorporated into population management objectives established for mammal populations. Based on the limited take proposed by WS and the oversight by the MDWFP, WS' take of mammals annually would have no effect on the ability of those persons interested to harvest mammals during the regulated harvest season.

Alternative 2 – Mammal Damage Management by WS through Technical Assistance Only

Under the technical assistance only alternative, WS would have no direct impact on mammal populations in the State. If WS recommended the use of non-lethal methods and those non-lethal methods were employed by those persons experiencing damage, mammals would likely be dispersed from the damage area to areas outside the damage area, which could serve to move those mammals from those less accessible areas to places accessible to hunters. Although lethal methods could be recommend by WS under a technical assistance only alternative, the use of those methods could only occur after the property owner or manager received a permit from the MDWFP or when considered a non-regulated species, could be removed at any time using legally available methods. Lethal take could also occurring during the annual hunting and trapping season in areas where those activities were permitted. WS' recommendation of lethal methods could lead to an increase in the use of those methods. However, the number of mammals taken under a permit and during the regulated hunting/trapping seasons would be determined by the MDWFP. Therefore, WS' recommendation of the use of lethal methods under this alternative would not limit the ability of those persons interested in harvesting mammals during the regulated season since the MDWFP determines the number of mammals that may be taken during the hunting/trapping season and under permits.

Alternative 3 – No Mammal Damage Management Conducted by WS

WS would have no impact on the ability to harvest mammals under this alternative. WS would not be involved with any aspect of mammal damage management. The MDWFP would continue to regulate populations through adjustments of the allowed take during the regulated harvest season and the continued use of permits.

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Under Alternative 1 and Alternative 2, WS would address damage associated with mammals either by providing technical assistance only (Alternative 2) or by providing technical assistance and direct operational assistance (Alternative 1) in the State. WS would be the primary federal agency conducting direct operational mammal damage management in the State under Alternative 1 and Alternative 2. However, other federal, state, and private entities could also be conducting mammal damage management in the State.

WS does not normally conduct direct damage management activities concurrently with such agencies or other entities in the same area, but may conduct damage management activities at adjacent sites within the same period. In addition, commercial companies may conduct damage management activities in the same area. The potential cumulative impacts analyzed below could occur from either WS' damage management program activities over time or from the aggregate effects of those activities combined with the activities of other agencies and private entities. Through ongoing coordination and collaboration between WS, the TVA, and the MDWFP, activities of each agency and the take of mammals would be available. Damage management activities in the State would be monitored to evaluate and analyze activities to ensure they were within the scope of analysis of this EA.

The activities proposed in the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur because of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

Issue 1 - Effects of Damage Management Activities on Target Mammal Populations

Evaluation of activities relative to target species indicated that program activities would likely have no cumulative adverse effects on mammal populations when targeting those species responsible for damage at the levels addressed in this EA. WS' actions would be occurring simultaneously, over time, with other natural processes and human generated changes that are currently taking place. These activities include, but would not be limited to

- Natural mortality of mammals
- Mortality through vehicle strikes, aircraft strikes, and illegal harvest
- Human-induced mortality of mammals through annual hunting and trapping seasons
- Human-induced mortality of mammals through private damage management activities
- Human and naturally induced alterations of wildlife habitat

- Annual and perennial cycles in wildlife population densities

All those factors play a role in the dynamics of mammal populations. In many circumstances, requests for assistance arise when some or all of those elements have contrived to elevate target species populations or place target species at a juncture to cause damage to resources. The actions taken to minimize or eliminate damage would be constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS uses the Decision Model to evaluate damage occurring, including other affected elements and the dynamics of the damaging species; to determine appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

With management authority over statewide mammal populations, the MDWFP can adjust take levels, including the take of WS, to ensure population objectives for mammals were achieved. Consultation and reporting of take by WS would ensure the MDWFP considers any activities conducted by WS.

WS' take of mammals in Mississippi from FY 2006 through FY 2011 was of a low magnitude when compared to the total known take of those species and the populations of those species. The MDWFP considers all known take when determining population objectives for mammals and can adjust the number of mammals that could be taken during the regulated hunting/trapping season and the number of mammals taken for damage management purposes to achieve the population objectives. Any take by WS would occur at the discretion of the MDWFP. Any mammal population declines or increases would be the collective objective for mammal populations established by the MDWFP through the regulation of take. Therefore, the cumulative take of mammals annually or over time by WS would occur at the desire of the MDWFP as part of management objectives for mammals in the State. No cumulative adverse effects on target and non-target wildlife would be expected from WS' damage management actions based on the following considerations:

Historical outcomes of WS' damage management activities on wildlife

Damage management activities associated with mammals would be conducted by WS only at the request of a cooperator to reduce damage that was occurring or to prevent damage from occurring and only after methods to be used were agreed upon by all parties involved. WS would monitor activities to ensure any potential impacts were identified and addressed. WS would work closely with state and federal resource agencies to ensure damage management activities would not adversely affect a mammal population, which ensures WS' activities were considered as part of management goals established by those agencies. Historically, WS' activities to manage mammals in Mississippi have not reached a magnitude that would cause adverse effects to mammal populations in the State.

SOPs built into the WS program

SOPs are designed to reduce the potential negative effects of WS' actions on mammals, and have been tailored to respond to changes in wildlife populations that could result from unforeseen environmental changes. This would include those changes occurring from sources other than WS. Alterations in programs would be defined through SOPs, and implementation would be insured through monitoring, in accordance with the WS' Decision Model (Slate et al. 1992).

Issue 2 - Effects on Non-target Wildlife Species Populations, Including T&E Species

Potential effects on non-target species from conducting mammal damage management arise from the use of non-lethal and lethal methods to alleviate or prevent those damages. The use of non-lethal methods during activities to reduce or prevent damage caused by mammals has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods are often temporary and often do not involve the take (killing) of non-target wildlife species. When using exclusion devices and/or repellents, both target and non-target wildlife can be prevented from accessing the resource being damaged. Since exclusion and repellents do not involve lethal take, cumulative impacts on non-target species from the use of exclusionary or repellent methods would not occur but would likely disperse those individuals to other areas. Exclusionary methods can often be expensive and require constant maintenance to ensure effectiveness. Similarly, repellents can also be expensive to apply and require constant re-application to ensure effectiveness. Therefore, the use of exclusionary devices and repellents would be somewhat limited to small, high-value areas and not used to the extent that non-targets would be excluded from large areas that would cumulatively impact populations from the inability to access a resource, such as potential food sources or fawning sites. The use of visual and auditory harassment and dispersion methods would generally be temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the take (killing) of non-target species and similar to exclusionary methods would not be used to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

The use of lethal methods or those methods used to live-capture target species followed by euthanasia also have the potential to affect non-target wildlife through the take (killing) or capture of non-target species. Capture methods used are often methods that would be set to confine or restrain target wildlife after being triggered by a target individual. Capture methods would be employed in such a manner as to minimize the threat to non-target species by placement in those areas frequently used by target wildlife, using baits or lures that are as species specific as possible, and modification of individual methods to exclude non-targets from capture. Most methods described in Appendix B are methods that would be employed to confine or restrain wildlife that would be subsequently euthanized using humane methods. With all live-capture devices, non-target wildlife captured could be released on site if determined to be able to survive following release. SOPs are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

The use of firearms and euthanasia methods would essentially be selective for target species since identification of an individual would be made prior to the application of the method. Euthanasia methods would be applied through direct application to target wildlife. Therefore, the use of those methods would not affect non-target species.

All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according with WS' Directives and relevant federal, state, and local regulations. Chemical methods available for use under the proposed action would include repellents, reproductive inhibitors, fumigants, immobilizing drugs, and euthanasia chemicals, which are described in Appendix B. Repellents would be applied directly to the affected resource and fumigants would only be used in active burrows. All chemicals would be used according to product labels, which ensure that proper use would minimize non-target threats. WS' adherence to Directives and SOPs governing the use of chemicals would also ensure non-target hazards would be minimal.

Repellents may be used or recommended by the WS program in Mississippi to manage mammal damage. The active ingredients in numerous commercial repellents are capsaicin, pepper oil, and carnivore urine. Characteristics of these chemicals and potential use patterns indicate that no cumulative impacts related to

environmental fate would be expected from their use in WS' programs in Mississippi when used according to label requirements.

The amount of chemicals used or stored by WS would be minimal to ensure human safety. All label requirements of repellents and toxicants would be followed to minimize non-target hazards. Based on this information, WS' use of chemical methods, as part of the proposed action, would not have cumulative impacts on non-targets.

The methods described in Appendix B all have a high level of selectivity and could be employed using SOPs to ensure minimal impacts to non-target species. The unintentional take of wildlife that has occurred previously during damage management activities has been limited and has not reached a magnitude where adverse effects would occur. Based on the methods available to resolve mammal damage and/or threats, WS does not anticipate the number of non-targets taken to reach a magnitude where declines in those species' populations would occur. Therefore, take under the proposed action of non-targets would not cumulatively affect non-target species. WS' has reviewed the T&E species listed by the MDWFP, the USFWS, and the National Marine Fisheries Services and has determined that damage management activities proposed by WS would not likely adversely affect T&E species. Cumulative impacts would be minimal on non-targets from any of the alternatives discussed**.**

Issue 3 - Effects of Damage Management Methods on Human Health and Safety

Non-chemical methods described in Appendix B would be used within a limited period, would not be residual, and do not possess properties capable of inducing cumulative adverse impacts on human health and safety. Non-chemical methods would be used after careful consideration of the safety of those persons employing methods and to the public. Capture methods would be employed where human activity was minimal to ensure the safety of the public. Capture methods also require direct contact to trigger ensuring that those methods, when left undisturbed would have no effect on human safety. All methods would be agreed upon by the requesting entities, which would be made aware of the safety issues of those methods when entering into a MOU, cooperative service agreement, or other comparable document between WS and the cooperating entity. SOPs also ensure the safety of the public from those methods used to capture or take wildlife. Firearms used to alleviate or prevent damage, though hazards do exist, would be employed to ensure the safety of employees and the public.

Personnel employing non-chemical methods would continue to be trained to be proficient in the use of those methods to ensure the safety of the applicator and to the public. Based on the use patterns of non-chemical methods, those methods would not cumulatively affect human safety.

Repellents to disperse mammals from areas of application would be available. Repellents must be registered with the EPA according to the FIFRA and with the MDAC. Many of the repellents currently available for use have active ingredients that are naturally occurring and are generally regarded as safe. Although some hazards exist from the use of repellents, hazards occur primarily to the handler and applicator. When repellents are applied according to label requirements, no adverse effects to human safety would be expected. Similarly, fumigants must also be registered for use with the EPA and the MDAC. Given the use patterns of repellents and fumigants, no cumulative adverse effects would occur to human safety.

WS has received no reports or documented any adverse effects to human safety from WS' mammal damage management activities conducted from FY 2006 through FY 2011. No cumulative adverse effects from the use of those methods discussed in Appendix B would be expected given the use patterns of those methods for resolving mammal damage in the State.

Issue 4 - Effects on the Aesthetic Values of Mammals

The activities of WS would result in the removal of mammals from those areas where damage or threats were occurring. Therefore, the aesthetic value of mammals in those areas where damage management activities were being conducted would be reduced. However, for some people, the aesthetic value of a more natural environment would be gained by reducing mammal densities, including the return of native species that may be suppressed or dispersed by non-native species.

Some people experience a decrease in aesthetic enjoyment of wildlife because they feel that overabundant species are objectionable and interfere with their enjoyment of wildlife in general. Continued increases in numbers of individuals or the continued presence of mammals may lead to further degradation of some people's enjoyment of any wildlife or the natural environment. The actions of WS could positively affect the aesthetic enjoyment of wildlife for those people that were being adversely affected by the target species identified in this EA.

Mammal population objectives are established and enforced by the MDWFP through the regulation of take during the statewide harvest seasons. As part of the population objectives, the MDWFP considers other known mortality factors. Therefore, WS would have no direct impact on the status of mammal populations since all take by WS occurs at the discretion of the MDWFP. Since those persons seeking assistance could remove mammals from areas where damage was occurring when permitted by the MDWFP, WS' involvement would have no effect on the aesthetic value of mammals in the area where damage was occurring. When damage caused by mammals has occurred, any removal of mammals by the property or resource owner would likely occur whether WS was involved with taking the mammals or not.

In the wild, few animals in the United States have life spans approaching that of humans. Mortality is high among wildlife populations and specific individuals among a species may experience death early in life. Mortality of individuals from a wildlife population is a natural occurrence and humans who form affectionate bonds with animals experience loss of those animals over time in most instances. A number of professionals in the field of psychology have studied human behavior in response to attachment to pet animals (Gerwolls and Labott 1994, Marks and Koepke 1994, Zasloff 1996, Archer 1999, Ross and Baron-Sorensen 1998, Meyers 2000). Similar observations were probably applicable to close bonds that could exist between people and wild animals. As observed by researchers in human behavior, normal human responses to loss of loved ones proceed through phases of shock or emotional numbness, sense of loss, grief, acceptance of the loss or what cannot be changed, healing, and acceptance and rebuilding which leads to resumption of normal lives (Lefrancois 1999). Those who lose companion animals, or animals for which they may have developed a bond and affection, are observed to proceed through the same phases as with the loss of human companions (Gerwolls and Labott 1994, Boyce 1998, Meyers 2000). However, they usually establish a bond with other individual animals after such losses. Although they may lose the sense of enjoyment and meaning from the association with those animals that die or are no longer accessible, they usually find a similar meaningfulness by establishing an association with new individual animals or through other relational activities (Weisman 1991). Through this process of coping with the loss and establishing new affectionate bonds, people may avoid compounding emotional effects resulting from such losses (Parkes 1979, Lefrancois 1999).

Some mammals with which humans have established affectionate bonds may be removed from some project sites by WS. However, other individuals of the same species would likely continue to be present in the affected area and people would tend to establish new bonds with those remaining animals. In addition, human behavior processes usually result in individuals ultimately returning to normalcy after experiencing the loss of association with a wild animal that might be removed from a specific location.

WS' activities would not be expected to have any cumulative adverse effects on this element of the human environment.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

WS would continue to seek new methods and ways to improve current technology to improve the humaneness of methods used to manage damage caused by wildlife. Cooperation with individuals and organizations involved in animal welfare continues to be an agency priority for the purpose of evaluating strategies and defining research aimed at developing humane methods.

All methods not requiring direct supervision during employment (*e.g.*, live traps) would be checked and monitored to ensure any wildlife confined or restrained were addressed in a timely manner to minimize distress of the animal. All euthanasia methods used for live-captured mammals would be applied according to WS' directives. Shooting would occur in some situations and personnel would be trained in the proper use of firearms to minimize pain and suffering of mammals taken by this method.

WS employs methods as humanely as possible by applying measures to minimize pain and that allow wildlife captured to be addressed in a timely manner to minimize distress. Through the establishment of SOPs that guide WS in the use of methods to address damage and threats associated with mammals in the State, the cumulative impacts on the issue of method humaneness would be minimal. All methods would be evaluated continually to ensure SOPs were adequate to ensure those methods continue to be used to minimize suffering and that wildlife captured were addressed in a timely manner to minimize distress.

Issue 6 - Effects of Mammal Damage Management Activities on the Regulated Harvest of Mammals

As discussed in this EA, the magnitude of WS' mammal take for damage management purposes from FY 2006 through FY 2011 was low when compared to the total take of mammals and when compared to the estimated statewide population of those species. Since all take of mammals is regulated by the MDWFP, the take by WS that would occur annually and cumulatively would occur pursuant to mammal population objectives established in the State. WS' take of mammals (combined take) annually to alleviate damage would be a minor component to the known take that occurs annually during the harvest seasons.

The populations of several mammal species are sufficient to allow for annual harvest seasons that typically occur during the fall. Hunting and trapping seasons are established by the MDWFP. Those species addressed in this EA that have established harvest seasons include: Virginia opossum, raccoons, river otters, striped skunks, coyotes, gray fox, red fox, bobcats, gray squirrels, fox squirrels, Eastern cottontails, swamp rabbits and white-tailed deer.

With oversight of mammal take, the MDWFP maintains the ability to regulate take by WS to meet management objectives for mammals in the State. Therefore, the cumulative take of mammals would be considered as part of the MDWFP objectives for mammal populations in the State.

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

5.1 LIST OF PREPARERS

Kristina Casscles Godwin, State Director	USDA-APHIS-Wildlife Services
Ryan Wimberly, Environmental Coordinator	USDA-APHIS-Wildlife Services
Scott Alls, District Supervisor	USDA-APHIS-Wildlife Services

5.2 LIST OF PERSONS CONSULTED

Ed Penny, Wildlife Bureau Director	MDWFP
Ricky Flynt, Alligator Program Coordinator	MDWFP
Richard Rummel, Exotic Species Program Specialist	MDWFP
Brad Young, Black Bear Program Leader	MDWFP
Scott Peyton, Collections Manager	Mississippi Museum of Natural Sciences
Libby Hartfield, Director	Mississippi Museum of Natural Sciences
Charles Nicholson, NEPA Compliance Manager	TVA
Loretta McNamee, NEPA Compliance	TVA
Stephen Ricks, Field Supervisor	USFWS

APPENDIX A
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APPENDIX B
MAMMAL DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE

The most effective approach to resolving wildlife damage problems would be to integrate the use of several methods, either simultaneously or sequentially. An adaptive plan would integrate and apply practical methods of prevention and reduce damage by wildlife while minimizing harmful effects of damage reduction measures on humans, other species, and the environment. An adaptive plan may incorporate resource management, physical exclusion and deterrents, and population management, or any combination of these, depending on the characteristics of specific damage problems.

In selecting damage management techniques for specific damage situations, consideration would be given to the responsible species and the magnitude, geographic extent, duration and frequency, and likelihood of wildlife damage. Consideration would also be given to the status of target and potential non-target species, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. Those factors would be evaluated in formulating damage management strategies that incorporate the application of one or more techniques.

A variety of methods would potentially be available to the WS program in Mississippi relative to the management or reduction of damage from mammals. Various federal, state, and local statutes and regulations and WS directives would govern WS' use of damage management methods. WS would develop and recommend or implement strategies based on resource management, physical exclusion, and wildlife management approaches. Within each approach there may be available a number of specific methods or techniques. The following methods could be recommended or used by the WS program in Mississippi. Many of the methods described would also be available to other entities in the absence of any involvement by WS.

Non-chemical Wildlife Damage Management Methods

Non-chemical management methods consist primarily of tools or devices used to repel, capture, or kill a particular animal or local population of wildlife to alleviate damage and conflicts. Methods may be non-lethal (*e.g.*, fencing, frightening devices) or lethal (*e.g.*, firearms, body gripping traps). If WS' personnel apply those methods, a MOU, cooperative service agreement, or other similar document must be signed by the landowner or administrator authorizing the use of each damage management method. Non-chemical methods used or recommended by WS could include:

Exclusion pertains to preventing access to resources through fencing or other barriers. Fencing of small critical areas can sometimes prevent animals that cannot climb from entering areas of protected resources. Fencing, especially if it is installed with an underground skirt, can prevent access to areas for many mammal species that dig, including fox, feral cats, and striped skunks. Areas such as airports, yards, or hay meadows may be fenced. Hardware cloth or other metal barriers can sometimes be used to prevent girdling and gnawing of valuable trees and to prevent the entry of mammals into buildings through existing holes or gaps. Exclusion and one-way devices such as netting or nylon window screening can be used to exclude bats from a building or an enclosed structure (Greenhall and Frantz 1994). Electric fences of various constructions have been used effectively to reduce damage to various crops by deer, raccoons, and other species (Boggess 1994, Craven and Hygnstrom 1994).

Cultural Methods and Habitat Management includes the application of practices that seek to minimize exposure of the protected resource to damaging animals through processes other than

exclusion. They may include animal husbandry practices such as employing guard dogs, herders, shed lambing, carcass removal, or pasture selection. Strategies may also include minimizing cover where damaging mammals might hide, manipulating the surrounding environment through barriers or fences to deter animals from entering a protected area, or planting lure crops on fringes of protected crops. Removal of trees from around buildings can sometimes reduce damage associated with tree squirrels and raccoons.

Some mammals that cause damage in urban environments are attracted to homes by the presence of garbage or pet food left outside and unprotected. Removal or sealing of garbage in tight trash receptacles, and elimination of all pet foods from outside areas can reduce the presence of unwanted mammals. If raccoons are a problem, making trash and garbage unavailable, and removing all pet food from outside during nighttime hours can reduce their presence. Altering how bird feeders are hung and constructing mounting poles for the feeders that cannot be climbed by tree squirrels can reduce the presence of localized populations along with their associated damage.

Supplemental feeding is sometimes used to reduce damage by wildlife, such as lure crops. Food is provided so that the animal causing damage would consume it rather than the resource being protected. In feeding programs, target wildlife would be offered an alternative food source with a higher appeal with the intention of luring them from feeding on affected resources.

Animal behavior modification refers to tactics that deter or repel damaging mammals and thus, reduce damage to the protected resource. Those techniques are usually aimed at causing target animals to respond by fleeing from the site or remaining at a distance. They usually employ extreme noise or visual stimuli. Unfortunately, many of these techniques are only effective for a short time before wildlife habituate to them (Conover 1982). Devices used to modify behavior in mammals include electronic guards (siren strobe-light devices), propane exploders, pyrotechnics, laser lights, human effigies, effigies of predators, and the noise associated with the discharge of a firearm.

Live Capture and Translocation can be accomplished using hand capture, hand nets, catch poles, cage traps, suitcase type traps, cable restraints, or with foothold traps to capture some mammal species for the purpose of translocating them for release in other areas. WS could employ those methods in Mississippi when the target animal(s) can legally be translocated or can be captured and handled with relative safety by WS' personnel. Live capture and handling of mammals poses an additional level of human health and safety threat if target animals are aggressive, large, or extremely sensitive to the close proximity of humans. For that reason, WS may limit this method to specific situations and certain species. In addition, moving damage-causing individuals to other locations can typically result in damage at the new location, or the translocated individuals can move from the relocation site to areas where they are unwanted. In addition, translocation can facilitate the spread of diseases from one area to another. The AVMA, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists all oppose the relocation of mammals because of the risk of disease transmission, particularly for small mammals such as raccoons or skunks (CDC 1990). Although translocation is not necessarily precluded in all cases, it would be logistically impractical, in most cases, and biologically unwise in Mississippi due to the risk of disease transmission. High population densities of some populations may make this a poor wildlife management strategy for those species. Translocation would be evaluated by WS on a case-by-case basis. Translocation would only occur with the prior authorization of the MDWFP.

Trapping can utilize a number of devices, including nets, foothold traps, cage-type traps, and body gripping (Conibear) traps, foot snares, and neck/body snares. Those techniques are implemented by WS' personnel because of the technical training required to use such devices.

Foothold Traps can be effectively used to capture a variety of mammals. Foothold traps are placed either beside or in travel ways being actively used by the target species. Placement of traps is contingent upon the habits of the respective target species, habitat conditions, and presence of non-target animals. Effective trap placement and adjustment, and the use and placement of appropriate baits and lures by trained WS' personnel also contribute to the foothold trap's selectivity. An additional advantage is that foothold traps can allow for the on-site release of non-target animals since animals are captured alive. The use of foothold traps requires more skill than some methods.

Cable Restraints are typically made of wire or cable, and can be set to capture an animal by the neck, body, and foot. Cable restraints may be used as either lethal or live-capture devices depending on how or where they are set. Cable restraints set to capture an animal by the neck are usually lethal but stops can be attached to the cable to increase the probability of a live capture depending on the trap check interval. Snares positioned to capture the animal around the body can be a useful live-capture device, but are more often used as a lethal control technique. Snares can incorporate a breakaway feature to release non-target wildlife and livestock where the target animal is smaller than potential non-targets (Phillips 1996). Snares can be effectively used wherever a target animal moves through a restricted travel lane (*e.g.*, under fences or trails through vegetation). When an animal moves forward into the loop formed by the cable, the noose tightens and the animal is held. Snares must be set in locations where the likelihood of capturing non-target animals is minimized.

The foot or leg snare can be set as a spring-powered non-lethal device, activated when an animal places its foot on the trigger or pan. In some situations, using snares to capture wildlife is impractical due to the behavior or morphology of the animal, or the location of many wildlife conflicts.

Cage traps come in a variety of styles to live-capture animals. The most commonly known cage traps are box traps and corral traps. Box traps are usually rectangular and are made from various materials, including metal, wire mesh, plastic, and wood. These traps are well suited for use in residential areas and work best when baited with foods attractive to the target animal. Box traps are generally portable and easy to set-up.

Corral traps for feral swine are generally large circular traps consisting of panels anchored to the ground using steel posts with a door allowing entrance. Side panels are typically woven metal fencing referred to as hog panels or cow panels. The entrances into the traps generally consist of a door that allow entry into the trap but prevents exit. The doors are often designed to allow swine to continually enter the trap that allows for the possibility of capturing multiple swine.

The disadvantages of using cage traps are: 1) some individual target animals may avoid cage traps; 2) some non-target animals may associate the traps with available food and purposely get captured to eat the bait, making the trap unavailable to catch target animals; 3) cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions; and 4) some animals will fight to escape and may become injured; 5) expense of purchasing traps. Disadvantages associated with corral traps include: 1) the expense of purchasing the materials to construct trap, 2) once constructed, corral traps are not moveable until disassembled and transported, and 3) in remote areas, getting all the required equipment to the location can be difficult.

Trap monitors are devices that send a radio signal to a receiver if a set trap is disturbed and alerts field personnel that an animal may be captured. Trap monitors can be attached directly to the trap

or attached to a string or wire and then placed away from the trap in a tree or shrub. When the monitor is hung above the ground, it can be detected from several miles away, depending on the terrain in the area. There are many benefits to using trap monitors, such as saving considerable time when checking traps, decreasing fuel usage, prioritizing trap checks, and decreasing the need for human presence in the area. Trap monitors could be used when using cage traps.

Trap monitoring devices would be employed, when applicable, that indicate when a trap has been activated. Trap monitoring devices would allow personnel to prioritize trap checks and decrease the amount of time required to check traps, which decreases the amount of time captured target or non-targets would be restrained. By reducing the amount of time targets and non-targets are restrained, pain and stress can be minimized and captured wildlife can be addressed in a timely manner, which could allow non-targets to be released unharmed. Trap monitoring devices could be employed where applicable to facilitate monitoring of the status of traps in remote locations to ensure any captured wildlife was removed promptly to minimize distress and to increase the likelihood non-targets could be released unharmed.

Body-grip Traps are designed to cause the quick death of the animal that activates the trap. Body-grip traps may include snap traps, mole traps, and conibear traps. The conibear trap consists of a pair of rectangular wire frames that close like scissors when triggered, killing the captured animal with a quick body blow. For conibear traps, the traps should be placed so ensure the rotating jaws close on either side of the neck of the animal to ensure a quick death. Conibear traps are lightweight and easily set. Snap traps are common household rat or mouse traps. These traps are often used to collect and identify rodent species that cause damage so that species-specific control tools can be applied, such as identifying the prey base at airports. Spring-powered harpoon traps are used to control damage caused by surface-tunneling moles. Soil is pressed down in an active tunnel and the trap is placed at that point. When the mole reopens the tunnel, it triggers the trap. Two variations of scissor like traps are also used in tunnels for moles. Safety hazards and risks to humans are usually related to setting, placing, checking, or removing the traps. Body-grip traps present a minor risk to non-target animals. Selectivity of body-grip traps can be enhanced by placement, trap size, trigger configurations, and baits. When using body-grip traps, risks of non-target capture can be minimized by using recessed sets (placing trap inside a cubby, cage, or burrow), restricting openings, or by elevating traps. For example, conibear traps set to capture beaver can be placed underwater to minimize risks to non-targets. Choosing appropriately sized traps for the target species can also exclude non-targets by preventing larger non-targets from entering and triggering the trap. The trigger configurations of traps can be modified to minimize non-target capture. For example, offsetting the trigger can allow non-targets to pass through conibear traps without capture.

Drop-nets are nylon or cloth nets that are suspended above an area actively used by an animal or group of animals where target individuals have been conditioned to feed (Ramsey 1968). The area is baited and once feeding occurs under the net, the net is released. Drop nets require constant supervision by personnel to drop the net when target individuals are present and when animals are underneath the net. This method has limited use due to the time and effort required to condition animals to feed in a location and the required monitoring of the site to drop the net when target wildlife are present. Nets are used to live-capture target individuals and if any non-targets are present, they can be released on site unharmed. Drop nets allow for the capture of several animals during a single application. Injuries to animals also occur when using drop nets. For example, the rate of injury to deer captured was correlated with the number of deer captured during a single application of the net (Haulton et al. 2001).

Cannon nets also use a nylon or cloth net to capture wildlife conditioned to feed in a given area through baiting (Hawkins et al. 1968). When using cannon nets, the net is fully deployed to determine the capture area when fired. Once the capture zone has been established, the net is rolled up upon itself and bait is placed inside the zone to ensure feeding wildlife are captured. When target wildlife feed at the site and within the capture zone of the net, the launcher is activated by personnel near the site, which launches the net over the target wildlife. The net is launched using small explosive charges and weights or using compressed air. Only personnel trained in the safe handling of explosive charges would be allowed to employ rocket nets when explosive charges were used. Pneumatic cannon nets can also be used which propels the net using compressed air instead of small explosive charges. Cannon nets require personnel to be present at the site continually to monitor for feeding. Similar to drop nets, cannon nets can be used to capture multiple target individuals during a single application. Injury rates for cannons nets are also likely similar to drop nets. Non-targets incidentally captured can be released on site unharmed.

Hand nets are used to catch small mammals in confined areas, such as inside garages or barns. Hand nets resemble fishing dip nets but are usually larger and have longer handles. The nets are used to envelope target wildlife for capture.

Shooting with firearms is very selective for the target species and would be conducted with rifles, handguns, and shotguns. Methods and approaches used by WS may include use of vehicles or aircraft, illuminating devices, bait, firearm suppressors, night vision/thermal equipment, and elevated platforms. Shooting is an effective method in some circumstances, and can often provide immediate relief from the problem. Shooting may at times be one of the only methods available to effectively and efficiently resolve a wildlife problem.

Ground shooting is sometimes used as the primary method to alleviate damage or threats of damage. Shooting is limited to locations where it is legal and safe to discharge a weapon. A shooting program, especially conducted alone, can be expensive because it often requires many staff hours to complete.

Shooting can also be used in conjunction with an illumination device at night, which is especially useful for nocturnal mammals, such as deer or feral swine. Spotlights may or may not be covered with a red lens, which nocturnal animals may not be able to see, making it easier to locate them undisturbed. Night shooting may be conducted in sensitive areas that have high public use or other activity during the day, which would make daytime shooting unsafe. The use of night vision and Forward Looking Infrared (FLIR) devices can also be used to detect and shoot mammals at night, and is often the preferred equipment due to the ability to detect and identify animals in complete darkness. Night vision and FLIR equipment aid in locating wildlife at night when wildlife may be more active. Night vision and FLIR equipment could be used during surveys and in combination with shooting to remove target mammals at night. WS' personnel most often use this technology to target mammals in the act of causing damage or likely responsible for causing damage. Those methods aid in the use of other methods or allow other methods to be applied more selectively and efficiently. Night vision and FLIR equipment allow for the identification of target species during night activities, which reduces the risks to non-targets and reduces human safety risks. Night vision equipment and FLIR devices only aid in the identification of wildlife and are not actual methods of take. The use of FLIR and night vision equipment to remove target mammals would increase the selectivity of direct management activities by targeting those mammals most likely responsible for causing damage or posing threats.

Hunting/Trapping is sometimes recommended by WS to resource owners. WS may recommend the resource owner consider legal hunting and trapping as an option for reducing mammal damage.

Although legal hunting/trapping is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some populations of mammals.

Chemical Wildlife Damage Management Methods

All pesticides used by WS are registered under the FIFRA and administered by the EPA and the MDAC. All WS personnel in Mississippi who apply restricted-use pesticides are certified pesticide applicators by MDAC and have specific training by WS for pesticide application. The EPA and the MDAC require pesticide applicators to adhere to all certification requirements set forth in the FIFRA. Pharmaceutical drugs, including those used in wildlife capture and handling, are administrated by FDA and/or DEA.

No chemicals are used by WS on public or private lands without authorization from the land management agency or property owner or manager. The following chemical methods have been proven to be selective and effective in reducing damage by mammals.

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calms fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

Telazol (tiletamine) is another anesthetic used in wildlife capture. It is 2.5 to 5 times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telazol produces extensive muscle tension in dogs, but produces a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for those wild species (Fowler and Miller 1999). This drug is sold in a powder form and must be reconstituted with sterile water before use. Once mixed with sterile water, the shelf life is four days at room temperature and 14 days if refrigerated.

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions.

Sodium Pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are DEA restrictions on who can possess and administer this drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA and state regulations. All animals euthanized using sodium pentobarbital and all of its dilutions (*e.g.* Beuthanasia-D, Fatal-Plus) are disposed of immediately through incineration or deep burial to prevent secondary poisoning of scavenging animals and introduction of these chemicals to non-target animals.

Potassium Chloride used in conjunction with prior general anesthesia is used as a euthanasia agent for animals, and is considered acceptable and humane by the AVMA (2007). Animals that have been euthanized with this chemical experience cardiac arrest followed by death. Animals euthanized with potassium chloride are not toxic to predators or scavengers.

Beuthanasia®-D combines pentobarbital with another substance to hasten cardiac arrest. Intravenous (IV) and intracardiac (IC) are the only acceptable routes of injection. As with pure sodium pentobarbital, IC injections with Beuthanasia®-D are only acceptable for animals that are unconscious or deeply anesthetized. With other injection routes, there are concerns that the cardiotoxic properties may cause cardiac arrest before the animal is fully unconscious. It is a Schedule III drug, which means it can be obtained directly from the manufacturer by anyone with a DEA registration. However, Schedule III drugs are subject to the same security and record-keeping requirements as Schedule II drugs.

Fatal-Plus® combines pentobarbital other substances to hasten cardiac arrest. IV is the preferred route of injection; however, IC is acceptable as part of the two-step procedure used by WS. Animals are first anesthetized and sedated using a combination of ketamine/xylazine and once completely unresponsive to stimuli and thoroughly sedated, Fatal-Plus® is administered. Like Beuthanasia®-D, it is a Schedule III drug requiring a DEA registration for purchase and is subject to the security and record-keeping requirements of Schedule II drugs.

Carbon Dioxide is sometimes used to euthanize mammals that are captured in live traps and when relocation is not a feasible option. Live mammals are placed in a sealed chamber. CO_2 gas is released into the chamber and the animal quickly dies after inhaling the gas. This method is approved as a euthanizing agent by the AVMA. CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

Repellents are usually naturally occurring substances or chemicals formulated to be distasteful or to elicit pain or discomfort for target animals when they are smelled, tasted, or contacted. Only a few repellents are commercially available for mammals, and are registered for only a few species. Repellents would not be available for many species that may present damage problems, such as some predators or furbearing species. Repellents are variably effective and depend largely on resource to be protected, time and length of application, and sensitivity of the species causing damage. Again, acceptable levels of damage control would usually not be realized unless repellents were used in conjunction with other techniques.

Fumigants such as the large gas cartridge (EPA Reg. No. 56228-1) and gas cartridge (EPA Reg. No. 56228-2) are registered by WS with the MDAC and are often used to treat dens or burrows of coyotes, fox, or woodchucks. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the burrow or den. Sodium nitrate is the principle active chemical in gas cartridges and is a naturally occurring substance. Although stable under dry conditions, it is readily soluble in water and likely to be highly mobile in soils. In addition, dissolved nitrate is very mobile, moving quickly through the vadose zone to the underlying water table (Bouwer 1989). However, burning sodium nitrate, as in the use of a gas cartridge as a fumigant in a rodent burrow, is believed to produce mostly simple organic and inorganic gases, using all of the available sodium nitrate. In addition, the human health drinking water tolerance level for this chemical is 10 mg / L, a relatively large amount, according to EPA Quality Criteria for Water (EPA 1986*a*, EPA 1986*b*). The gas along with other components of the

cartridge, are likely to form oxides of nitrogen, carbon, phosphorus, and sulfur. Those products are environmentally non-persistent because they are likely to be metabolized by soil microorganisms or those products enter their respective elemental cycles. In rodent cartridges, sodium nitrate is combined with seven additional ingredients: sulfur, charcoal, red phosphorus, mineral oil, sawdust, and two inert ingredients. None of the additional ingredients in this formulation is likely to accumulate in soil, based on their degradation into simpler elements by burning the gas cartridge. Sodium nitrate is not expected to accumulate in soils between applications, nor does it accumulate in the tissues of target animals (EPA 1991). The EPA stated sodium nitrates "*...as currently registered for use as pesticides, do not present any unreasonable adverse effects to humans*" (EPA 1991).

GonaCon™ was developed by scientists with the NWRC as a reproductive inhibitor. GonaCon™ is a new single dose immunocontraceptive vaccine. Recent studies have demonstrated the efficacy of this single-shot Gonadotropin-releasing hormone (GnRH) vaccine on California ground squirrels, Norway rats, feral cats and dogs, feral swine, wild horses, and white-tailed deer. Infertility among treated female swine and white-tailed deer has been documented for up to two years without requiring a booster vaccination (Miller et al. 2000). This vaccine overcomes one of the major obstacles of previous two dose vaccines since target wildlife need to be captured only once for vaccination instead of twice. A single-injection vaccine would be much more practical as a field delivery system for use on free-ranging animals.

GonaCon™ was officially registered by the EPA in 2009 for use in reducing fertility in female white-tailed deer under EPA registration number 56228-40. GonaCon™ is registered as a restricted-use pesticide available for use by WS' personnel and personnel of the state wildlife management agency or persons under their authority. Additionally, in order for GonaCon™ to be used in any given state, the product must also be registered with the state and approved for use by the appropriate state agency responsible for managing wildlife. GonaCon™, when injected into the body, elicits an immune response that neutralizes the GnRH hormone being produced naturally by deer. The GnRH hormone in deer stimulates the production of other sexual hormones, which leads to the body reaching a reproductive state. The vaccine neutralizes the GnRH hormone being produced, which then prevents the production of other sexual hormones in the deer vaccinated; thereby, preventing the body of the deer from entering into a reproductive state (USDA 2010).

APPENDIX C

FEDERALLY THREATENED AND ENDANGERED SPECIES IN MISSISSIPPI

- This report shows the listed species associated in some way with this state.
- This list does not include experimental populations and similarity of appearance listings.
- This list includes non-nesting sea turtles and whales in State/Territory coastal waters.
- This list includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.

Summary of Animals listings

Animal species listed in this state and that occur in this state

Status	Species
E	Bat, Indiana (*Myotis sodalis*)
T	Bear, Louisiana black (*Ursus americanus luteolus*)
E	Clubshell, black (*Pleurobema curtum*)
E	Clubshell, ovate (*Pleurobema perovatum*)
E	Clubshell, southern (*Pleurobema decisum*)
E	Combshell, Cumberlandian (*Epioblasma brevidens*)
E	Combshell, southern (*Epioblasma penita*)
E	Crane, Mississippi sandhill (*Grus canadensis pulla*)
T	Darter, bayou (*Etheostoma rubrum*)
E	Frog, Mississippi gopher (*Rana capito sevosa*)
T	Heelsplitter, Alabama (=inflated) (*Potamilus inflatus*)
E	Manatee, West Indian (*Trichechus manatus*)
T	Moccasinshell, Alabama (*Medionidus acutissimus*)
T	Mucket, orangenacre (*Lampsilis perovalis*)
E	Mussel, snuffbox (*Epioblasma triquetra*)
E	Pigtoe, flat (*Pleurobema marshalli*)
E	Pocketbook, fat (*Potamilus capax*)
T	Sea turtle, green (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, Kemp's ridley (*Lepidochelys kempii*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Stirrupshell (*Quadrula stapes*)
T	Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)
E	Sturgeon, pallid (*Scaphirhynchus albus*)
E	Tern, least (*Sterna antillarum*)
T	Turtle, ringed map (*Graptemys oculifera*)
T	Turtle, yellow-blotched map (*Graptemys flavimaculata*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Woodpecker, red-cockaded (*Picoides borealis*)

Animal species listed in this state that do not occur in this state

Status	Species
E	Beetle, American burying (*Nicrophorus americanus*)
E	Panther, Florida (*Puma* (=*Felis*) *concolor coryi*)
E	Pigtoe, heavy (*Pleurobema taitianum*)
T	Plover, piping (*Charadrius melodus*)
T	Snake, eastern indigo (*Drymarchon corais couperi*)
E	Sturgeon, Alabama (*Scaphirhynchus suttkusi*)
E	Wolf, gray (*Canis lupus*)

Animal listed species occurring in this state that are not listed in this state

Status	Species
E	Bat, gray (*Myotis grisescens*)
E	Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)
E	Mussel, sheepnose (*Plethobasus cyphyus*)
E	Plover, piping Great Lakes watershed (*Charadrius melodus*)
E	Sawfish, smalltooth (*Pristis pectinata*)
E	Stork, wood (*Mycteria americana*)
T	Tortoise, gopher (*Gopherus polyphemus*)
E	Turtle, Alabama red-belly (*Pseudemys alabamensis*)

Summary of Plant listings

Plant species listed in this state and that occur in this state

Status	Species
E	Chaffseed, American (*Schwalbea americana*)
E	Pondberry (*Lindera melissifolia*)
T	Potato-bean, Price's (*Apios priceana*)
E	Quillwort, Louisiana (*Isoetes louisianensis*)

Last updated: April 18, 2012

MISSISSIPPI NATURAL HERITAGE PROGRAM
LISTED SPECIES OF MISSISSIPPI
2011

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS	STATE STATUS	STATE RANK
ANIMALS					
BIVALVIA					
Actinonaias ligamentina	Mucket	G5		LE	S1
Cyclonaias tuberculata	Purple Wartyback	G5		LE	S1
Elliptio arctata	Delicate Spike	G3Q		LE	S1
Elliptio dilatata	Spike	G5		LE	S1
Epioblasma brevidens	Cumberlandian Combshell	G1	LE, XN	LE	S1
Epioblasma penita	Southern Combshell	G1	LE	LE	S1
Epioblasma triquetra	Snuffbox	G3		LE	S1
Hamiota perovalis	Orangenacre Mucket	G2	LT	LE	S1
Lexingtonia dolabelloides	Slabside Pearlymussel	G2	C	LE	S1
Medionidus acutissimus	Alabama Moccasinshell	G2	LT	LE	S1
Plethobasus cyphyus	Sheepnose	G3	C	LE	S1
Pleurobema curtum	Black Clubshell	G1	LE	LE	SH
Pleurobema decisum	Southern Clubshell	G2	LE	LE	S1S2
Pleurobema marshalli	Flat Pigtoe	GH	LE	LE	SX
Pleurobema perovatum	Ovate Clubshell	G1	LE	LE	S1
Pleurobema rubrum	Pyramid Pigtoe	G2		LE	S1
Pleurobema taitianum	Heavy Pigtoe	G1	LE	LE	SX
Potamilus capax	Fat Pocketbook	G1	LE	LE	S1
Potamilus inflatus	Inflated Heelsplitter	G1G2	LT	LE	S1
Ptychobranchus fasciolaris	Kidneyshell	G4G5		LE	S1
Quadrula cylindrica cylindrica	Rabbitsfoot	G3T3		LE	S1
Quadrula metanevra	Monkeyface	G4		LE	SX
Quadrula stapes	Stirrupshell	GH	LE	LE	SX
MALACOSTRACA					
Fallicambarus gordoni	Camp Shelby Burrowing Crayfish	G1		LE	S1
INSECTA					
Neonympha mitchellii mitchellii	Mitchell's Satyr	G2T2	LE		S1
Nicrophorus americanus	American Burying Beetle	G2G3	LE	LE	SX
OSTEICHTHYES					
Acipenser oxyrinchus desotoi	Gulf Sturgeon	G3T2	LT	LE	S1
Crystallaria asprella	Crystal Darter	G3		LE	S1
Etheostoma blennioides	Greenside Darter	G5		LE	S1

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS	STATE STATUS	STATE RANK
OSTEICHTHYES					
Etheostoma rubrum	Bayou Darter	G1	LT	LE	S1
Notropis boops	Bigeye Shiner	G5		LE	S1
Notropis chalybaeus	Ironcolor Shiner	G4		LE	S2
Noturus exilis	Slender Madtom	G5		LE	S1
Noturus gladiator	Piebald Madtom	G3		LE	S1
Noturus munitus	Frecklebelly Madtom	G3		LE	S2
Percina aurora	Pearl Darter	G1	C	LE	S1
Percina phoxocephala	Slenderhead Darter	G5		LE	S1
Phenacobius mirabilis	Suckermouth Minnow	G5		LE	S1
Phoxinus erythrogaster	Southern Redbelly Dace [2]	G5		LE	S2
Scaphirhynchus albus	Pallid Sturgeon	G1	LE	LE	S1
Scaphirhynchus platorynchus	Shovelnose Sturgeon	G4	T/SA		S3?
Scaphirhynchus suttkusi	Alabama Sturgeon	G1	LE	LE	S1
AMPHIBIA					
Amphiuma pholeter	One-toed Amphiuma	G3		LE	S1
Aneides aeneus	Green Salamander	G3G4		LE	S1
Eurycea lucifuga	Cave Salamander	G5		LE	S1
Gyrinophilus porphyriticus	Spring Salamander	G5		LE	S1
Rana sevosa	Dusky Gopher Frog	G1	LE	LE	S1
REPTILIA					
Caretta caretta	Loggerhead	G3	LT	LE	S1B
Chelonia mydas	Green Turtle	G3	LE, LT	LE	SNA
Dermochelys coriacea	Leatherback	G2	LE	LE	SNA
Drymarchon couperi	Eastern Indigo Snake	G3	LT	LE	SH
Eretmochelys imbricata	Hawksbill	G3	LE	LE	SNA
Farancia erytrogramma	Rainbow Snake	G5		LE	S2
Gopherus polyphemus	Gopher Tortoise	G3	PS:LT	LE	S2
Graptemys flavimaculata	Yellow-blotched Map Turtle	G2	LT	LE	S2
Graptemys nigrinoda	Black-knobbed Map Turtle	G3		LE	S2
Graptemys oculifera	Ringed Map Turtle	G2	LT	LE	S2
Heterodon simus	Southern Hognose Snake	G2		LE	SX
Lepidochelys kempii	Kemp's or Atlantic Ridley	G1	LE	LE	S1N
Pituophis melanoleucus lodingi	Black Pine Snake	G4T3	C	LE	S2
Pseudemys alabamensis	Alabama Redbelly Turtle	G1	LE	LE	S1
AVES					
Campephilus principalis	Ivory-billed Woodpecker	G1	LE	LE	SX

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SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	FEDERAL STATUS	STATE STATUS	STATE RANK
AVES					
Charadrius alexandrinus tenuirostris	Southeastern Snowy Plover	G4T3Q		LE	S1B,S1N
Charadrius melodus	Piping Plover	G3	LE, LT	LE	S1N
Falco peregrinus	Peregrine Falcon	G4		LE	SNA
Grus canadensis pulla	Mississippi Sandhill Crane	G5T1	LE	LE	S1
Haliaeetus leucocephalus	Bald Eagle	G5		LE	S1B,S2N
Mycteria americana	Wood Stork	G4	PS:LE	LE	S1N
Pelecanus occidentalis	Brown Pelican	G4		LE	S1N
Picoides borealis	Red-cockaded Woodpecker	G3	LE	LE	S1
Sterna antillarum athalassos	Interior Least Tern [3]	G4T2Q	PS:LE	LE	S3?B
Thryomanes bewickii	Bewick's Wren	G5		LE	S2S3B
Vermivora bachmanii	Bachman's Warbler	GH	LE	LE	SXB
MAMMALIA					
Myotis grisescens	Gray Myotis	G3	LE	LE	SNA
Myotis sodalis	Indiana Bat	G2	LE	LE	SNA
Puma concolor coryi	Florida Panther	G5T1	LE	LE	SX
Trichechus manatus	West Indian Manatee	G2	LE	LE	SNA
Ursus americanus	American Black Bear	G5	PS	LE	S1
Ursus americanus luteolus	Louisiana Black Bear	G5T2	LT	LE	S1
PLANTS [1]					
DICOTYLEDONEAE					
Apios priceana	Price's Potato Bean	G2	LT		S1
Lindera melissifolia	Pondberry	G2	LE		S2
Schwalbea Americana	Chaffseed	G2	LE		SH
ISOETOPSIDA					
Isoetes louisianensis	Louisiana quillwort	G3	LE		S2

[1] *Mississippi has no status concerning endangered plants.*

[2] *West Mississippi disjunct populations*

[3] *Interior populations nesting along the Mississippi River*

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