ENVIRONMENTAL ASSESSMENT

MAMMAL DAMAGE MANAGEMENT IN ALABAMA

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

ADAI	Alabama Department of Agriculture and Industries
ADCNR	Alabama Department of Conservation and Natural Resources
ADPH	Alabama Department of Public Health
AGL	Above Ground Level
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
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FLIR	Forward Looking Infrared
FPL	Feline Panleukopenia
FR	Federal Register
FSIS	Food Safety and Inspection Services
FY	Fiscal Year
GnRH	Gonadotropin-releasing Hormone
IV	Intravenous
IC	Intracardiac
MOU	Memorandum of Understanding
MRLC	Multi-Resolution Land Characteristics
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLCD	National Land Cover Dataset
NRP	Natural Resources Plan
NWRC	National Wildlife Research Center
ORV	Oral Rabies Vaccine
PEP	Post - Exposure Prophylaxis
PL	Public Law
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
TNR	Trap-Neuter-Release
TVA	Tennessee Valley Authority
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States 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 Alabama 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 the big brown bat (*Eptesicus fuscus*), black bear (*Ursus americanus*), bobcat (*Lynx rufus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), cotton mouse (*Peromyscus gossypinus*), coyote (*Canis latrans*), deer mouse (*Peromyscus maniculatus*), eastern chipmunk (*Tamia striatus*), eastern cottontail (*Sylvilagus floridanus*), eastern harvest mouse (*Reithrodontomys humulis*), eastern mole (*Scalopus aquaticus*), evening bat (*Nycticeius humeralis*), feral cat (*Felis domesticus*), feral dog (*Canis familiaris*), feral swine (*Sus scrofa*), fox squirrel (*Sciurus niger*), gray fox (*Urocyon cinereoargenteus*), gray squirrel (*Sciurus carolinensis*), hispid cotton rat (*Sigmodon hispidus*), house mouse (*Mus musculus*), little brown myotis (*Myotis lucifugus*), meadow vole (*Microtus pennsylvanicus*), mink (*Neovison vison*), nine-banded armadillo (*Dasypus novemcinctus*), Norway rat (*Rattus norvegicus*), pine vole (*Microtus pinetorum*), prairie vole (*Microtus ochrogaster*), raccoon (*Procyon lotor*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), red fox (*Vulpes vulpes*), rice rat (*Oryzomys palustris*), river otter (*Lontra canadensis*), roof rat (*Rattus rattus*), silver-haired bat (*Lasionycteris noctivagans*), southern flying squirrel (*Glaucomys volans*), striped skunk (*Mephitis mephitis*), tri-colored bat (*Perimyotis subflavus*), Virginia opossum (*Didelphis virginiana*), white-footed mouse (*Peromyscus leucopus*), white-tailed deer (*Odocoileus virginianus*), and woodchuck (*Marmota monax*). 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 Alabama. 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 that could be conducted by WS to manage damage and threats to agricultural resources, property, natural resources, and threats to people caused by those mammal species identified previously, including those activities that could be requested by the TVA. 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 conducting additional efforts to manage damage caused by those species. Because the goal of WS would be 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] would be to provide assistance 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 apply to actions that may occur in any locale and at any time within Alabama as part of a coordinated program. This EA analyzes the potential effects of mammal damage management when requested, as coordinated between WS, the TVA, and the Alabama Department of Conservation and Natural Resources (ADCNR).

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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 occurred at the following web address: http://www.aphis.usda.gov/wildlife_damage/ws_directives.shtml.

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 effects from the alternative approaches developed to meet the need for action. 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.

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. WS, in cooperation with the TVA, initially developed the issues and alternatives associated with mammal damage management in consultation with the ADCNR. The ADCNR has regulatory authority to manage populations of mammal species in the State. To assist with identifying additional issues and alternatives to managing damage associated with mammals in Alabama, WS and the TVA will make this EA available to the public for review and comment prior to the issuance of a Decision[3].

This EA will: (1) assist in determining if the proposed management of damage associated with mammals could have a significant impact on the environment for both people and other organisms, (2) analyze several alternatives to address the need for action and the identified issues, (3) coordinate efforts between WS, the TVA, the ADCNR, and other entities, (4) inform the public, and (5) document the environmental consequences of the alternatives to comply with the NEPA.

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.

Wildlife can have either positive or negative values depending on the perspectives and circumstances of individual people. In general, people regard wildlife as providing economic, recreational, and aesthetic benefits. Knowing that wildlife exists in the natural environment provides a positive benefit to some people. However, activities associated with wildlife may result in economic losses to agricultural resources, natural resources, property, and threaten human safety. Therefore, an awareness of the varying perspectives and values are required to balance the needs of people and the needs of wildlife. When addressing damage or threats of damage caused by wildlife, wildlife damage management professionals must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural, and economic considerations as well.

Resolving wildlife damage problems requires consideration of both sociological and biological carrying capacities. 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

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

associated damage. This damage threshold determines the wildlife acceptance capacity. While the biological carrying capacity of the habitat may support higher populations of wildlife, in many cases the wildlife acceptance capacity is lower or has already 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.

Wildlife damage management is the alleviation of damage or other problems caused by or related to the behavior of wildlife and can be an integral component of wildlife management (Berryman 1991, The Wildlife Society 1992). The threat of damage or loss of resources is often sufficient for people to initiate individual actions and the need for damage management can occur from specific threats to resources. Wildlife has no intent to do harm. They utilize habitats (*e.g.*, feed, shelter, reproduce) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people often 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 many factors can influence when people request assistance (*e.g.*, economic, social, aesthetics). Therefore, what constitutes damage is often unique to the individual person. What one individual person considers damage, another person may not consider as damage. 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). Many people define the term "*damage*" as economic losses to resources or threats to human safety; however, "*damage*" could also occur from 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 Alabama arises from requests for assistance[4] received by WS. WS receives requests to reduce or prevent damage from occurring to four major categories: agricultural resources, natural resources, property, and threats to human safety. Table 1.1 lists WS' technical assistance projects involving mammal damage or threats of damage to those four major resource types in Alabama from the federal fiscal year[5] (FY) 2009 through FY 2013.

Table 1.1 – Technical assistance projects conducted by WS from FY 2009 through FY 2013

Species	Projects	Species	Projects
Bats (all species)	56	**House Mouse**	1
Black Bear	6	**Nine-banded Armadillo**	6
Bobcat	5	**Raccoon**	99
Coyote	77	**Red Fox**	10
Eastern Chipmunk	4	**River Otter**	14
Eastern Cottontail	1	**Southern Flying Squirrel**	3
Eastern Mole	1	**Striped Skunk**	16
Feral Cat	5	**Virginia Opossum**	10
Feral Dog	15	**Voles (all species)**	1
Feral Swine	200	**White-tailed Deer**	16
Gray Fox	2	**Woodchuck**	8
Gray Squirrel	12	**TOTAL**	**568**

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

WS has provided technical assistance 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 the requester could conduct without WS' direct involvement in managing or preventing the damage. This EA discusses technical assistance activities further in Chapter 3. Table 1.1 does not include direct operational assistance projects conducted by WS where an entity requested WS' assistance through the direct application of methods.

The technical assistance projects conducted by WS are representative of the mammal species that cause damage and threats in Alabama. As shown in Table 1.1, WS has conducted 568 technical assistance projects in Alabama that addressed damage and threats associated with those mammal species addressed in this assessment from FY 2009 through FY 2013. Over 52% of the requests for assistance were associated with feral swine and raccoons. Raccoons can cause damage to a variety of resource types and can pose threats to the safety of people, pets, and livestock. For example, raccoons can cause damage to agricultural resources by consuming livestock feed. Raccoons can also pose disease threats to people, pets, and livestock. Similarly, feral swine can cause damage to a variety of resource types through their rooting and wallowing behavior, and by competing with native wildlife for food resources.

Table 1.2 lists those mammal species addressed in this EA and the resource types that those mammal species can cause damage to in Alabama. Many of the mammal species can cause damage to or pose threats to a variety of resources. In Alabama, most requests for assistance received by WS are related to threats associated with those mammal species causing damage or posing threats of damage to property, agriculture, and human safety. All of the species addressed in this EA can cause damage to property, including posing strike risks at airports and airbases or posing as attractants for other species that are strike risks.

Table 1.2 – Mammal species that WS could address and the resource type damaged by those species

Species	Resource[a]				Species	Resource			
	A	N	P	H		A	N	P	H
Big Brown Bat			X	X	**Meadow Vole**	X	X	X	X
Black Bear	X		X	X	**Mink**	X	X	X	X
Bobcat	X	X	X	X	**Nine-banded Armadillo**	X	X	X	X
Brazilian Free-tailed Bat			X	X	**Norway Rat**	X	X	X	X
Cotton Mouse	X		X	X	**Pine Vole**	X	X	X	X
Coyote	X	X	X	X	**Prairie Vole**	X	X	X	X
Deer Mouse	X		X	X	**Raccoon**	X	X	X	X
Eastern Chipmunk			X		**Rafinesque's Big-eared Bat**			X	X
Eastern Cottontail	X		X	X	**Red Fox**	X	X	X	X
Eastern Harvest Mouse	X		X	X	**Rice Rat**	X	X	X	X
Eastern Mole			X		**River Otter**	X	X	X	X
Evening Bat			X	X	**Roof Rat**	X	X	X	X
Feral Cat	X	X	X	X	**Silver-haired Bat**			X	X
Feral Dog	X	X	X	X	**Southern Flying Squirrel**			X	X
Feral Swine	X	X	X	X	**Striped Skunk**	X	X	X	X
Fox Squirrel			X		**Tri-colored Bat**			X	X
Gray Fox	X	X	X	X	**Virginia Opossum**	X	X	X	X
Gray Squirrel			X		**White-footed Mouse**	X		X	X
Hispid Cotton Rat	X	X	X	X	**White-tailed Deer**	X	X	X	X
House Mouse	X	X	X	X	**Woodchuck**	X	X	X	X
Little Brown Myotis			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 often experiences damage or 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 1.3 summarizes the mammal species and resources types that could be damaged on TVA-managed lands.

Table 1.3 – Mammal species that WS could address on TVA properties and the resource type damaged by those species

Species	Resource[a]				Species	Resource			
	A	N	P	H		A	N	P	H
Bobcat	X	X		X	**Nine-banded Armadillo**	X		X	
Coyote	X	X	X	X	**Pine Vole**		X	X	
Eastern Chipmunk			X		**Prairie Vole**		X	X	
Feral Cat	X	X	X	X	**Raccoon**	X	X	X	X
Feral Dog	X	X	X	X	**Red Fox**	X	X	X	X
Feral Swine	X	X	X	X	**Southern Flying Squirrel**			X	
Fox Squirrel			X		**Striped Skunk**	X	X	X	X
Gray Fox	X	X	X	X	**Virginia Opossum**	X	X	X	X
Gray Squirrel			X		**White-tailed Deer**	X	X	X	X
Meadow Vole		X	X		**Woodchuck**	X		X	X
Mink	X	X	X	X					

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

The TVA is responsible for the management of 293,000 acres of public land and 11,000 miles of public shoreline along the Tennessee River system. All of those lands support TVA's goals of power generation and transmission, public recreational use, flood control, and economic development of the Tennessee River Valley. The TVA operates hydroelectric dams, coal-fired power plants, nuclear power plants, solar facilities, and a combustion turbine site in Alabama. The TVA also owns or maintains electrical power substations, switching stations, and the associated transmission lines and rights-of-way easements in Alabama. 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 primarily have occurred to property, human safety, and operational reliability of the electrical system. Woodchucks and voles 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 these impoundments.

Raccoons, opossums, fox, coyotes, bobcats, feral cats, and feral dogs all reside on TVA-managed lands. These animals frequently become overpopulated or lose their fear of people, sometimes resulting in transmission of zoonotic diseases and aggressive behavior toward people. Many of these lands are considered public or recreational lands and those people using these lands expect the TVA to manage mammal populations and reduce the possibilities of disease transmission and attacks 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.

All of these damage issues and others occur throughout TVA owned and managed properties. The TVA has requested assistance from WS to address wildlife damage in the past and may request assistance with additional mammal damage issues in the future. For several years, this cooperative relationship has allowed WS to address TVA's requests for assistance by conducting operational control of these species at 71 different Alabama sites. As the populations of many of those species increase and thrive in those areas managed or owned by the TVA, both WS and TVA expect increases in the need for mammal damage management in the future.

Need for Mammal Damage Management to Protect Human Health and Safety

Zoonoses (*i.e.*, diseases of animals that can be transmitted to people) are often a major concern of cooperators when requesting assistance with managing threats from mammals. Disease transmission could occur from direct interactions between people 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 people. Table 1.4 shows common diseases that could affect people that wild mammals can transmit in addition to diseases that could affect other animals, including domestic species. Those threats include viral, bacterial, mycotic (fungal), protozoal, and rickettsial diseases.

Table 1.4 - Wildlife diseases in the Eastern United States that pose potential health risks through transmission to people (Beran 1994, Davidson 2006)[†]

Disease	Causative Agent	Hosts[‡]	Human Exposure
Anthrax	*Bacillus antracis*	cat, dog	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.	cat	ingestion
Chlamydioses	*Chlamydophilia felis*	cat	inhalation, direct contact
Typhus	*Rickettsia prowazekii*	opossum	inhalation, ticks, fleas
Sarcoptic mange	*Sarcoptes scabiei*	red fox, coyote, dog	direct contact
Trichinosis	*Trichinella spiralis*	raccoon, fox	ingestion, direct contact
Rabies	*Lyssavirus* spp.	mammals	direct contact
Visceral larval	*Baylisascaris procyonis*	raccoon, skunk	ingestion, direct contact
Leptospirosis	*Leptospira interrogans*	mammals	ingestion, direct contact
Echinococcus	*Echinococcus multilocularis*	fox, coyote	ingestion, direct contact
Toxoplasmosis	*Toxoplasma ondii*	cat, mammals	ingestion, direct contact
Spirometra	*Spirometra mansonoides*	bobcat, raccoon, fox	ingestion, direct contact
Giardiasis	*Giardia lamblia, G. duodenalis*	mammals	ingestion, direct contact

[†]Table 1.4 is not an exhaustive list of wildlife diseases considered infectious to people. 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. The use of the general term "*mammals*" as the host species denotes zoonoses that could infect a broad range of mammals. 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 (2006).

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 people, from animals acting out of character by roving in human-inhabited areas during daylight, or from animals showing no fear when people 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 people by mammals. Thus, the risk of disease transmission would be the primary reason for requesting assistance from WS. Situations in Alabama in which 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 people to the threat of rabies posed by skunks that den under buildings or from companion animals interacting with infected skunks.
- Threats of parasitic infections to people from *Giardia* spp. that could occur 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 roost 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 people, pets, and livestock. 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 people. Indirect threats to people occur from exposure to 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 effectively can be prevented in people when exposure is identified early and treated. In addition, 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 the CDC received occurred 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 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 people (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 during 1994 in Concord, New Hampshire when a kitten from a pet store 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 Alabama (USDA 2009*a*). 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, the raccoon variant of 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 2009*a*). If this combined barrier were breached by raccoon variant rabies, research suggests that raccoon populations would be sufficient for rabies to spread westward 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 1982, Glueck et al. 1988, Hasbrouck et al. 1992, Mosillo et al. 1999).

The raccoon variant of 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 occurs in the Midwest and California; however, different variants of rabies can infect skunks throughout North America, 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 often manifest 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, including Alabama. WS began enhanced surveillance of road-killed and trapped raccoons in Alabama during 2001, near previous breaches in counties west and north of, and bordering the Coosa and Alabama Rivers. Historically, the disease had occurred to the south and east of these rivers, with several isolated breaches of the river. Surveillance in 2001 and early 2002 resulted in little evidence of raccoon rabies in areas near previous river breaches, indicating those rivers were probably the leading edge of the epizootic strain. Past cases west of those rivers were likely isolated events that did not result in raccoon rabies becoming established. However, in August 2002, a new breach was detected by the Alabama Department of Public Health (ADPH) when a rabies-positive skunk (species unreported) in Cherokee County, west of the Coosa River, was typed and verified as the raccoon rabies variant. WS intensified enhanced surveillance through road-kill surveys and trapping raccoons, within a 1-mile radius of the Cherokee County breach and broadened overall surveillance efforts statewide. The autumn of 2002 marked the second year of WS' cooperative participation in the National ORV project. Specimens were also collected from sick animals as far west as the Mississippi/Alabama border. Support and participation from cooperators increased in 2002, as many law enforcement officers and health department employees submitted specimens for testing. Results from the surveillance revealed a spreading from the historic front of raccoon rabies in northeast Alabama. Emphasis was then placed on active surveillance in this area to determine if the disease was moving and if it had become established.

Majumdar et al. (2005) implicated increasing populations of raccoons in certain areas to outbreaks of distemper. Distemper has not been identified as transmissible to people. However, people 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 people and can act aggressively, which increases the risk to people, livestock, or companion animals from bites. Distemper can also occur in coyotes, red fox, and gray fox with symptoms that are similar to those symptoms 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 people 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 non-native species that have detrimental effects 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 freely or unrestrained 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. Those zoonoses 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 also are 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. Feral cat colonies have become established at several TVA sites and facilities, including public recreation areas, requiring removal by WS' personnel to ensure public safety and biological diversity.

Several known diseases that are infectious to people, 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 people 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 children in Florida were hospitalized with encephalitis that was associated with cat scratch fever (AVMA 2004). In another example, 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 people with this bacterium. People 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 primary animal transmitting rabies to people (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 vehicles and aircraft striking swine. Feral swine are potential reservoirs for at least 30 viral and bacterial diseases (Samuel et al. 2001, Williams and Barker 2001, Davidson 2006) and 37 parasites (Forrester 1991) that are transmissible to people. Brucellosis, salmonellosis, toxoplasmosis, trichinosis, tuberculosis, and tularemia are some of the common diseases that feral swine could carry that are also known to infect people (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.

Conflicts involving bats can include property damage, but primarily involve threats to people, 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 accumulate over many years, are likely to contain the fungus *Histoplasma capsulatum*, or with fungi species, such as molds, especially in warm, moist conditions. When people disturb fecal accumulations containing *H. capsulatum* and inhale spores from the fungus, 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 an increase of asthma attacks (Agency for Toxic Substances and Disease Registry 1998).

Bat bugs (*Cimex adjunctus*) are free-living ectoparasites of bats that feed on blood from bats. They will bite people 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 leave, bat bugs can seek other sources of food and may crawl about and invade living areas within a house and bite people (Jones and Jordan 2004). 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).

The intention of this brief discussion on zoonoses is to address the more commonly known zoonoses found in the United States for those species specifically addressed in this EA and is not an exhaustive discussion of all potential zoonoses. Limited information and understanding of disease transmission from wildlife to people exists for most infectious zoonoses. In most cases when human exposure occurs, the presence of a disease vector across a broad range of naturally occurring sources, including occurring in wildlife populations, can complicate determining the origin of the vector. A person with salmonella poisoning, for example, may have contracted salmonella bacterium from direct contact with an infected pet but also may have contracted the bacterium from eating undercooked meat or from other sources.

Disease transmission directly from wildlife to people is uncommon. However, the infrequency of such transmission does not diminish the concerns of those people fearful of exposure requesting assistance since disease transmission could occur. WS actively attempts to educate the public about the risks associated with disease transmission from wildlife to people through technical assistance and by providing technical leaflets on the risks of exposure.

In addition to disease transmission threats, WS also receives requests 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 people 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 increase 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. Overabundant wildlife that congregate into small areas because of the unlimited amount of food, water, and shelter can confound the prevalence of diseases.

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 people and human activity, a loss of apprehension occurs that can lead to threatening behavior toward people. 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 injuries, 90% were considered minor (*e.g.*, minor bites, scratches, and bruises) by Herrero (1985). Only 23 fatalities were recorded from 1900 to 1980 due to black bear attacks. Of those fatalities, 90% were likely associated with habituated, food-conditioned bears. The number of bear attacks could be considered low considering the geographic overlap of human and black bear populations. Black bear attacks on people in Alabama have not been reported. Attacks on people from gray fox, feral swine, feral cats, feral dogs, and raccoons have been reported in the last few years in Alabama.

Although attacks on people associated with those species addressed in this EA occurs rarely, requests for assistance to lessen the threat of possible attacks could occur from people in Alabama. Often, wildlife exhibiting threatening behavior or a loss of apprehension to the presence of people is a direct result and indication of an animal inflicted with a disease. Requests for assistance therefore could occur from a desire to reduce the threat of disease transmission and/or from fear of aggressive behavior from an animal that is less apprehensive of people or induced as a symptom of disease.

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 in Alabama.

Disease Surveillance and Monitoring

Public awareness and the health risks associated with zoonoses have increased in recent years. This EA addresses several zoonotic diseases associated with mammals. 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 Alabama 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 would occur after wildlife have been captured or lethally removed for other purposes). For example, WS may sample deer harvested during the annual hunting season or collect samples during other damage management programs for Chronic Wasting Disease. WS could collect ticks from the carcasses of raccoons after lethally removing the raccoon to alleviate damage. WS could sample feral swine harvested by hunters or during damage management activities to test for classical swine fever, swine brucellosis, pseudorabies, or other diseases.

Emergency Response Efforts

Both large-scale natural disasters (*e.g.*, hurricanes, tornadoes, floods) and small-scale localized emergencies (*e.g.*, release of exotic animals, traffic accidents involving animal transport vehicles) may occur in which WS' personnel could be requested to assist federal, state, and local governments in charge of responding to those situations. Those requests for assistance would be on extremely short notice and rare emergencies that would be coordinated by federal, state, and local emergency management agencies. For example, WS' personnel may be requested to participate in the lethal removal of cattle that were injured or were released from their transport vehicle at the scene of an accident to prevent those animals from endangering other drivers. WS could be asked to corral those animals that were uninjured and euthanize those animals that have been injured to reduce their suffering. In another example, WS'

personnel may be requested to assist local and state law enforcement in immobilization or lethal control of exotic animals that have been accidentally released in the aftermath of a hurricane or tornado.

Need for Mammal Damage Management at Airports

Airports provide ideal conditions for many wildlife species due to the large open grassy areas around runways and taxiways adjacent to brushy, forested habitat used as noise barriers. Access to most airport properties is restricted so mammal species living within airport boundaries are not harvestable during hunting and trapping seasons and 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 2012, there were 2,946 reported aircraft strikes involving terrestrial mammals in the United States (Dolbeer et al. 2013). The number of mammal strikes actually occurring is likely to be much greater, since Dolbeer (2009) estimated that entities reported 39% of actual civil wildlife strikes. Aircraft have collided with a reported 42 species of terrestrial mammals from 1990 through 2012, including white-tailed deer, raccoons, gray fox, red fox, cats, coyotes, opossums, river otters, and striped skunks. In addition, aircraft in the United States have struck 15 species of bats (Dolbeer et al. 2013). Of the terrestrial mammals reported struck by aircraft, 35% were carnivores (primarily coyotes), causing nearly $4.1 million in damages (Dolbeer et al. 2013). Deer accounted for 35% of the reported strikes involving terrestrial mammals in the United States causing over $45 million in damages (Dolbeer et al. 2013). Data also indicates that a much higher percentage of mammal strikes resulted in aircraft damage compared to bird strikes (Dolbeer et al. 2013). Costs of those collisions vary, but data from the Federal Aviation Administration (FAA) reveals that mammal strikes in the United States cost the civil aviation industry approximately 298,603 hours of down time and nearly $62 million in direct monetary losses between 1990 and 2012 (Dolbeer et al. 2013).

From 1990 through 2012, about 34% of terrestrial mammal strikes in the United States have resulted in damage compared to 9% for birds (Dolbeer et al. 2013). 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, which can increase the threat to human safety. Nearly 63% of the reported mammal strikes from 1990 through 2012 occurred at night, with 64% occurring during the landing roll or the takeoff run (Dolbeer et al. 2013).

According to reports filed with the FAA (2013), between 1990 and 2013, there have been 12 aircraft strikes involving white-tailed deer, 11 incidents involving bats (where bats were specifically identified), one incident involving coyotes, and one involving a domestic dog in Alabama. Airports in Alabama have requested assistance with managing threats to human safety and damage to property caused by mammals present inside the area of operations of an 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 would be the goal of cooperators requesting assistance at airports in Alabama given that a potential strike could 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 an 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 Damage to Agricultural Resources

Black bears, red fox, gray fox, bobcats, coyotes, deer, armadillos, opossum, river otters, skunks, and feral swine can cause losses or injury to crops, livestock (*e.g.*, sheep, goats, cattle, pigs, horses), and poultry (*e.g.*, chickens, turkeys, geese, ducks) through consumption or 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. Feral swine 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. Agricultural producers identified coyotes as the primary predator of livestock with 53.1% of cattle and calf losses attributed to coyotes. Producers also identified livestock losses associated with 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 Alabama, the NASS (2011) reported 1,000 cattle and 5,200 calves were killed in 2010 by animal predators. The economic loss from animal predators in Alabama was estimated at $2.5 million in 2010 (NASS 2011). Coyotes were attributed to 38.3% of the cattle losses and 48.4% of the calves lost in Alabama. Livestock producers in the State attributed dogs to 49.9% of the cattle and 26.0% of the calves lost (NASS 2011). NASS (2011) reported that mountain lion and bobcat predation in Alabama accounted for 1.5% of the calves lost to animal predators. Cattle producers in Alabama 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 32.1% of Alabama cattle producers along with 53.0% reporting the use of guard animals (NASS 2011).

Cattle producers in the United States indicated coyotes, dogs, and mountain lions and bobcats[6] caused 53.1%, 9.9%, and 8.6%, respectively, of the cattle and calf losses attributed to animal predators in 2010 (NASS 2011). As expected, those predators are known to prey on other livestock.

[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.

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 can be badly damaged when the bark is girdled, which may occur when feeding by rabbits and voles is severe. Similar damage can occur in nurseries that grow landscape ornamentals and shrubs.

River otters and, to a lesser extent, 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.

Diseases that may be communicable from feral cats to companion cats include feline panleukopenia (FPL) infection, feline calicivirus infection, feline reovirus infection, and feline syncytium-forming virus infection (Gillespie and Scott 1973). Of the four feline diseases, feline panleukopenia is considered the most serious. Reif (1976) found that during the acute stages of feline panleukopenia, fleas were vectors of this disease to other cats. FPL infection is cyclic in nature, being more prevalent in the July to September period.

Agricultural damage and threats caused by feral swine can occur to a variety of crops, livestock, and other agricultural resources (Beach 1993, Seward et al. 2004, West et al. 2009, Hamrick et al. 2011). Damage occurs from direct consumption of agricultural resources 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 in the search for food (Stevens 1996, West et al. 2009, Stevens 2010, Hamrick et al. 2011). 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 (West et al. 2009, Hamrick et al. 2011). 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 through rooting and wallowing activities (Beach 1993, West et al. 2009, Stevens 2010, Hamrick et al. 2011). Rooting activities can also lead to increased erosion and soil loss. Wallowing and rooting activities in watering areas for livestock can result in severely muddied water, algal blooms, oxygen depletion, bank erosion, soured water, and reduction in fish viability (Beach 1993). Since feral swine often travel in family groups, damage from rooting and wallowing can be extensive often encompassing several acres.

Additional risks associated with feral swine 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). Porcine reproductive and respiratory syndrome is a highly infectious virus that causes reproductive failure and respiratory disease in swine (USDA 2009*b*). The total cost of productivity losses due to porcine reproductive and respiratory syndrome in the domestic swine herd in the United States was estimated at $664 million annually during 2011 and represented an increase from the $560 million annual cost estimated in 2005 (Holtkamp et al. 2013). Pseudorabies is a viral disease associated with an extremely contagious herpes virus that can have negative effects on reproduction in domestic swine. 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). Brucellosis is a bacterial disease that can also have negative impacts on reproduction of swine.

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 carried by swine are also transmissible to other livestock, the primary concern is the potential transmission of diseases from feral swine to domestic swine. Many of the 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. A disease outbreak not only has negative economic implications to the individual livestock producer but an outbreak also could cause economic losses that can negatively affect the statewide swine industry. The WS program in Alabama could conduct disease surveillance in the feral swine population as part of the National Wildlife Disease Surveillance Program.

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 (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 (Witmer et al. 2003). In addition to large-scale commercial operations, small-scale "*backyard*" swine operations where domestic swine could interact with feral swine are also at risk (Saliki et al. 1998). With the large number of domestic swine in the State, the potential exists for severe economic losses to occur because of the transmission of infectious diseases between feral and domestic swine.

In addition to the potential for disease transmission, feral swine also predate livestock. Feral swine can kill calves, kids (goats), lambs, and poultry (Stevens 1996, West et al. 2009). Predation occurs primarily on young livestock but feral swine can also kill weakened or injured livestock. If feral swine populations continue to increase, WS could receive requests for assistance to address localized predation by feral swine. Since feral swine so thoroughly consume young prey, there is often little evidence remaining to suggest that a birthing and subsequent predation occurred. If a landowner is not alert to the possibility of feral swine predation, it is easy to overlook this as a cause for low production. Frequently, even when predation is considered, feral swine often escape suspicion because people generally underestimate their capabilities as a predator (Beach 1993).

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

- Coyotes attacking and killing calves, lambs, chickens, and domestic swine
- Raccoons, skunks, and armadillos 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
- River otters killing commercially raised catfish and sportfish
- White-tailed deer feeding on soybeans, corn, and strawberries

Need for Mammal Damage Management to Resolve Damage Occurring to Natural Resources

Natural resources can be those assets belonging to the public that government agencies, as representatives of the people, often manage and hold in trust. 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 Alabama are historic structures and places, parks and recreation areas; natural areas, including unique habitats or topographic features; threatened or endangered plants and animals; and any plant or animal populations that 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 another species' population. An example of this would be nest predation of a local ground-nesting bird population by mammalian predators, such as raccoons, opossum, armadillos, feral swine, feral cats, coyotes, or fox.

Massey (1971) and Massey and Atwood (1981) found that predators can prevent federally endangered least terns (*Sterna antillarum*) from nesting or cause them to abandon previously occupied sites. In another study, mammalian predators adversely affected the nesting success of least terns on sandbars and sandpits (Kirsch 1996). In Alabama, WS has conducted predator removal efforts to protect the endangered Alabama beach mouse (*Peromyscus polionotus ammobates*) and the Perdido Key beach mouse (*Peromyscus polionotus trissyllepsis*) at the request of, and in cooperation with, the United States Fish and Wildlife Service (USFWS).

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. 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. Langham (1990) found that mammals made up 74% of a feral cats diet in the farmlands of New Zealand, while 24% were birds. The American Bird Conservancy (2011) 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*". 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 (American Bird Conservancy 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 killed 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 similarly 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 and 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 were 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 was dependent on availability. Fitzgerald (1990) found that cats on the mainland of New Zealand fed most heavily on mammals while cats on the islands fed almost exclusively on birds (particularly seabirds). Liberg (1984) found that cats in southern Sweden fed predominantly on native mammals. Pearson (1971) found that cats were serious predators of California voles and that the greatest pressure on voles occurred when vole numbers were lowest.

Many cat populations rely heavily on people either for handouts and/or for garbage. A study on a southern Illinois farmstead concluded that well-fed cats preferred small rodents; however, they also consumed birds (George 1974). Small rodents may be 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 the predation of rodents by cats 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 (*Bubo virginianus*) and red-tailed hawks (*Buteo jamaicensis*).

Childs (1986) and Childs (1991) found that urban cat predation on rats was 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 typically is achieved via chemicals (poisons). Jackson (1951) found that feral and free-ranging cats in urban areas of Baltimore, Maryland were insignificant predators of Norway rats. 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.

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 preying on threatened species of reptiles. Domesticated cats have been identified as major nest and/or hatchling predators of sea turtles. A study by Seabrook (1989) 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 migrant birds (Wilcove 1985). Hawkins et al. (1999) conducted a two-year study 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. The California thrasher (*Toxostoma redivivum*) and California quail (*Callipepla californica*), both ground-nesting birds, were seen during surveys in the no-cat area; however, they were never seen in the cat area. In addition, more than 85% of the native deer 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).

Impacts from cat predation are not always direct, but may be 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 small rodents).

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 under buildings, both residential and nonresidential, and compromising foundations and footings. 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-managed properties, some of which are extremely sensitive and 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. WS may be requested to alleviate damage on some of those sites in the future to help protect the most sensitive resources.

Feral swine can cause damage to natural flora and fauna on private lands along with designated natural areas, such as parks and wildlife management areas in Alabama. Those sites suffer erosion and local loss of critical ground plants and roots as well as destruction of seedlings because of their feeding and other activity (Barrett and Birmingham 1994). Many experts in the fields of botany and herpetology have observed notable declines in some rare species of plants, reptiles, amphibians, and soil invertebrates in areas inhabited by feral swine (Singer et al. 1982). Many state and federal natural resource managers are now in the process of controlling swine numbers because of their known impact to endangered plants and animals (Thompson 1977). Feral swine can disturb large areas of vegetation and soils through rooting, and feral swine inhabiting coastal, upland, and wetland ecosystems can uproot, damage, and feed 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 fishes), and increase soil erosion and alter nutrient cycling (Singer et al. 1982, DeBenedetti 1986).

One of the more important seasonal food resources used by feral swine is wild fruit and nut crops, especially oak mast (Wood and Roark 1980). Mast crops, such as beechnut (*Fagus* spp.), acorns (*Quercus* spp.), and hickory nuts (*Carya* spp.), are an important food source for deer, turkey, black bear, and squirrels (Knee 2011). Oak mast is an important food source for white-tailed deer and wild turkey (*Meleagris gallopavo*). Each adult feral swine can consume up to 1,300 pounds of mast per year (Knee 2011). When feral swine actively compete for mast, resident deer and wild turkey may enter the winter with inadequate fat reserves, thus threatening the viability of these native wildlife species (Beach 1993). They can also compete for acorns and hickory nuts with native wildlife during years of poor mast production (Campbell and Long 2009). In years of poor mast production, feral swine were found to have negative effects on white-tailed deer populations due to competition for acorns (Wood and Roark 1980). Due to their acute sense of smell, feral swine more rapidly and efficiently consume fallen mast crop (Beach 1993). Feral swine also have the ability to change to other food sources when acorns were depleted, which deer are often unable to do (Beach 1993). Consumption of hard mast by feral swine in forests also reduces the potential for forest regeneration, further affecting the food chain necessary to maintain species diversity and stable populations (Campbell and Long 2009).

Feral swine compete with over 100 species of native wildlife for important and limited natural food supplies, and will consume animal material year round, including earthworms, arachnids, crustaceans,

insects, gastropods, fish, amphibians, reptiles, birds, and mammals (Mayer and Brisbin 2009). The rooting behavior of feral swine has been identified as the cause of the near extirpation of northern short-tailed shrews (*Blarina brevicuada*), and southern red-backed voles (*Clethrionomys gapperi*) in areas with intensive rooting due to the removal of leaf litter, which is crucial for the survival of the shrew and vole (Singer et al. 1984). Feral swine will often search out and excavate food caches used by small mammals, potentially affecting their ability to survive (Campbell and Long 2009).

Feral swine can cause direct mortality through predation on native wildlife species. Feral swine are known to feed on many smaller animals (some threatened or endangered), and will consume voles, shrews, turtles, amphibians, and shrub- or ground-nesting birds (Campbell and Long 2009). Many species, including quail, turkey, and shorebirds, are at risk of predation by nest destruction and the consuming of eggs (Campbell and Long 2009). A study conducted in northern Texas found that feral swine consumed 23.5% and 11.5 % of simulated Northern bobwhite (*Colinus virginianus*) nests in each of the study areas. Researchers concluded feral swine nest predation could be a contributing factor in Northern bobwhite population declines (Timmons et al. 2011).

Plant forage makes up approximately 88% of a feral swine's dietary composition and is consumed year-round (Mayer and Brisbin 2009). This high dependence on vegetation may be why feral swine can cause the greatest damage to environmentally sensitive areas (Campbell and Long 2009). Feral swine can reduce recruitment of saplings, increase the spread of invasive plants, prevent forest regeneration, reduce seedlings and seedling survival, and eliminate understory (Campbell and Long 2009). Rooting behavior by feral swine in beech forest understory was found to be so severe that recovery was unlikely to occur (Bratton 1975). Where feral swine reduced herbaceous and belowground vegetation, recovery time was expected to take more than three years (Howe et al. 1981). Feral swine reduce the amount of vegetative ground cover and leaf litter, reducing the critical microclimatic conditions necessary for seedling establishment and growth in forests (Chavarria et al. 2007).

In terrestrial plant communities, disturbance can threaten native communities by promoting the spread of invasive, exotic plant species (Tierney and Cushman 2006). Following disturbance through feeding activities by feral swine, percent cover of native perennial grasses recovered at a consistently slower rate than exotic grasses (Tierney and Cushman 2006). Tierney and Cushman (2006) also found that removing or reducing the size of feral swine populations is an effective technique for restoring native perennial grasses.

Habitat damage by feral swine is most pronounced in wet environments (Engeman et al. 2007). Wet soils may make it easier for feral swine to obtain the foods they favor, such as the roots, tubers, and bulbs that are characteristic of many wetland plants. Choquenot et al. (1996) found that there appeared to be a strong correlation between soil moisture and rooting damage. Aquatic macrophytes are a key component of habitat in wetlands, providing both an important food resource and structural complexity to the waterscape for associated biota (Thomaz et al. 2008). Macrophytes are an aquatic plant that grows in or near water and are emergent, submergent, or floating. The destruction of wetland vegetation by feral swine was also found to alter production and respiration regimes causing anoxic (depleted of dissolved oxygen) conditions (Doupe et al. 2010). Lower dissolved oxygen levels caused chronic sub-lethal effects for the associated biota.

Feral swine can affect lakes, ponds, streams, and wetlands, since their rooting and wallowing activities near water sources may increase water turbidity in streams and wetlands, and increase soil erosion and alter nutrient cycling (Singer et al. 1982, DeBenedetti 1986). Increases in water turbidity reduce water quality and can affect native fishes (DeBenedetti 1986). Doupe et al. (2010) found that feral swine foraging in wetland floodplains disrupted physical, chemical, and biological environments by increasing turbidity, destroying aquatic macrophytes, and by causing the proliferation of bare ground and open

water. Feral swine spend considerable time in aquatic habitat foraging or wallowing (Mersinger and Silvy 2007). They are known to forage both in and out of water to obtain wetland roots and bulbs (Doupe et al. 2010). Due to their foraging behavior, feral swine are more likely to disturb the wetland substrate and water body.

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 a watershed. Kaller et al. (2007) used DNA fingerprinting to determine that feral swine contribute detectable *E. coli* into aquatic ecosystems. Additionally, some species of freshwater mussels and aquatic insects were negatively affected by feral swine fecal coliforms within the watershed (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 negatively affect certain herbaceous and woody species and on overall plant community structure (Waller and Alverson 1997). These changes can lead to adverse effects on other wildlife species, which depend on those 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, deer browsing disturbed 98 species of threatened or endangered plants, many of them orchids and lilies (Ness 2003).

The alteration and degradation of habitat from over-browsing by deer can have a detrimental effect on the health of local deer populations 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, escape cover, and nesting. In certain areas, higher deer densities reduced species richness and abundance of intermediate canopy nesting songbirds (deCalesta 1997). Intermediate canopy-nesting birds declined 37% in abundance and 27% in species diversity at higher deer densities. Five species of birds disappeared from areas with 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 no longer could be found in a research preserve stocked with high densities of ungulates and that the densities of several other bird species 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 animal and insect species.

WS has received numerous requests in the past for assistance in resolving mammal damage and conflicts caused to natural resources. As part of the proposed program, WS could provide assistance, upon request, involving target mammal species to any requestor experiencing such damage throughout Alabama.

Need for Mammal Damage Management to Alleviate Property Damage

Mammals cause damage to a variety of property types in Alabama 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. 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, homes, and many other places. Armadillos often cause damage to lawns and turf while digging for grubs and insects. Feral swine can root up turf in neighborhoods and golf courses. Coyotes can attack companion animals. These damages

were caused by numerous species, including woodchuck, opossum, raccoon, roof rats, bats, squirrels, voles, moles, feral swine, and white-tailed deer.

Feral swine can damage landscaping, golf courses, roads, drainage ditches, and cause erosion by feeding in those areas. Feral swine dig or root in the ground with their nose in search of desired roots, grubs, earthworms, and other food sources. 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 can also pose a threat to property when motor vehicles and aircraft strike swine. Mayer and Johns (2007) collected data on 179 feral swine-vehicle collisions involving 212 feral swine. Mayer and Johns (2007) suggested that vehicular accidents with feral swine are costly due to their mass; and that potentially, the total annual cost of feral swine-vehicle collisions in the United States can be as high as $36 million, roughly $1,173 per vehicle (Mayer and Johns 2007).

Deer can damage and destroy landscaping and ornamental trees, shrubs, and flowers by browsing on those trees and plants. Developing rural areas into residential areas could enhance deer habitat in those areas. Fertilized lawns, gardens, and landscape plants in those residential areas may serve as high quality sources of food for deer (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 can damage ornamental trees and shrubs from antler rubbing, which can result in broken limbs and bark removal. While large trees may survive antler-rubbing damage, smaller trees often die or they become scarred to the point that they are not aesthetically acceptable for landscaping.

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 estimated damage to vehicles associated with vehicles striking deer was $1,500 per strike (Conover et al. 1995). Estimated damage costs associated with deer collisions in 2011 were $3,171 per incident, which was an increase of 2.2% over the 2010 estimate (State Farm Mutual Automobile Insurance 2011). An estimated 26,050 deer-vehicle collisions occurred in Alabama from July 1, 2011 through June 30, 2012 (State Farm Mutual Automobile Insurance 2012). 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 26,050 from July 2011 through June 2012, deer-vehicle collisions resulted in over $82.6 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 requested to provide assistance to reduce local deer populations on TVA properties.

Often, deer-vehicle collisions go unreported, especially when there was no recovery of a deer carcass or when little vehicle damage occurred. 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).

Burrowing activities of woodchucks can severely damage levees, dikes, earthen dams, landfills, and other structures (Federal Emergency Management Agency 2005). Woodchucks burrowing into roadbeds and embankments could potentially weaken or cause the collapse of those structures. Woodchucks also cause

damage by chewing underground utility cables, sometimes resulting in power outages. Additionally, woodchuck burrows may cause damage to property when tractors and other equipment drop into a burrow or roll over due to a burrow.

WS has received numerous requests in the past for assistance in resolving property damage caused by mammals. As part of the proposed program, WS could provide assistance, upon request, involving target mammal species to any requestor experiencing such damage throughout Alabama.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

This EA documents the need for mammal damage management, the issues associated with meeting that need, and alternative approaches to address those issues and to meet the need for action. WS mission is to provide federal leadership with managing damage and threats of damage associated with animals (see WS Directive 1.201). WS would only provide assistance when the appropriate property owner or manager requested WS' assistance. WS could receive a request for assistance from a property owner or manager to conduct activities on properties they own or manage, which could include federal, state, tribal, municipal, and private land within the State of Alabama.

Appendix B of this EA discusses the methods available for use or recommendation under each of the alternative approaches evaluated[7]. The alternatives and Appendix B also discuss how WS and other entities could recommend or employ methods to manage damage and threats associated with mammals in the State. Therefore, the actions evaluated in this EA are the use or recommendation of those methods available under the alternatives and the employment or recommendation 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 lethal removal of target mammal species under the alternatives would only occur when agreed upon by the requester and when permitted by the ADCNR, when required, and only at levels permitted.

Federal, State, County, City, and Private Lands

WS could continue to provide damage management activities on federal, state, county, municipal, and private land in Alabama when WS receives a request 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 on property they own or manage, 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, the scope of this EA analyzes actions that could occur on federal lands, when requested.

Native American Lands and Tribes

The WS program in Alabama would only conduct damage management activities on Native American lands when requested by a Native American Tribe. WS would only conduct activities after WS and the Tribe requesting assistance signed a Memorandum of Understanding (MOU), work initiation document,

[7] Appendix B contains a complete list of chemical and non-chemical methods available for use under the identified alternatives. 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.

or other comparable document. Therefore, the Tribe would determine what activities would be allowed and when WS' assistance was required. 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 likely occur. 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 Tribe requesting WS' assistance approved the use of those methods. Therefore, the activities and methods addressed under the alternatives would include those activities that WS could employ on Native American lands, when requested and when agreed upon by the Tribe and WS.

Period for which this EA is Valid

If the preparation of an Environmental Impact Statement (EIS) is not warranted, based on the analyses associated with this EA, WS would conduct reviews of activities conducted under the selected alternative to ensure those activities occurred within the parameters evaluated in this EA. This EA would remain valid until WS and the TVA, in consultation with the ADCNR, determined that new needs for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, WS and the TVA would supplement this analysis or conduct a separate evaluation pursuant to the NEPA. Under the alternative analyzing no involvement by WS, no review or 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 Alabama 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 lethal removal of mammals under the alternatives would only occur when permitted by the ADCNR, 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 Alabama where WS and the appropriate entities entered into a MOU, work initiation document, or other comparable document. The EA also addresses the potential impacts of mammal damage management in areas where WS and a cooperating entity could sign additional agreements in the future. Because the need for action would be 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 those additional efforts and analyzes the impacts of those efforts as part of the alternatives.

Many of the mammal species addressed in this EA occur statewide and throughout the year in the State; therefore, damage or threats of damage could 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 departments, police departments, emergency clean-up organizations, and insurance companies. Although WS and the TVA could predict some locations where mammal damage would occur, WS and the TVA could not predict every specific location or the specific time where such damage would occur in any given year. 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 WS would receive such a request for assistance would be 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 Alabama. The standard WS Decision Model (Slate et al. 1992; see WS Directive 2.201) would be the site-specific procedure for individual actions that WS could conduct 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 in accordance with WS Directive 2.210.

The analyses in this EA would apply to any action that may occur in any locale and at any time within Alabama. In this way, WS and the TVA believes the two agencies meet the intent of the NEPA with regard to site-specific analysis and that this is the only practical way for WS and the TVA to comply with the NEPA and still be able to accomplish their missions.

Summary of Public Involvement

WS, in cooperation with the TVA, initially developed the issues associated with conducting mammal damage management in consultation with the ADCNR. WS and the TVA defined the issues and identified the preliminary alternatives through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS implementing regulations for the NEPA, WS and the TVA will make this document available to the public for review and comment. WS and the TVA will make the document available to the public through legal notices published in local print media, through direct notification of parties that have requested notification, or that WS and the TVA have identified as having a potential interest in the reduction of threats and damage associated with mammals in the State. In addition, WS will post this EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml for review and comment.

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 and the TVA will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. WS and the TVA would fully consider new issues, concerns, or alternatives the public identifies during the public involvement period to determine whether WS and the TVA should be revisit the EA and, if appropriate, revise the EA prior to issuance of a Decision.

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

WS' 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 ORV programs to eliminate or stop the spread of raccoon rabies in a number of eastern states (including Alabama) and gray fox and coyote rabies in Texas (USDA 2009*a*). WS determined the action would not have a significant impact on the quality of the human environment.

WS' Environmental Assessment – Reducing Aquatic Rodent Damage Through an Integrated Wildlife Damage Management Program in the State of Alabama: 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 Alabama (USDA 2002). 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 methods approach to managing damage associated with beaver, nutria, and muskrats in which a variety of methods would be used or recommended to reduce damage. 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.

Draft Environmental Impact Statement: Feral Swine Damage Management: The APHIS and cooperating agencies are in the process of preparing a programmatic EIS to address feral swine damage management in the United States, American Samoa, Mariana Islands, United States Virgin Islands, Guam, and Puerto Rico. When the EIS is completed, WS would review this EA for consistency with the material in the EIS and Record of Decision and supplement this EA, if needed, pursuant to the requirements of the NEPA, and the NEPA implementing regulations of the USDA and the APHIS.

TVA's Natural Resource Plan (NRP): The 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: The 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 EIS has been incorporated by reference into this EA (TVA 2011*b*).

1.5 AUTHORITY OF FEDERAL AND STATE AGENCIES

Below are brief discussions of the authorities of WS, the TVA, and other agencies, as those authorities relate to conducting wildlife damage management.

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 when 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). The 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.

The TVA operates three hydroelectric dams, two coal-fired power plants, one nuclear power plant, two solar facilities, and one natural gas-fueled combustion turbine site in Alabama. The TVA also owns or maintains 79 substations and switching stations, and nearly 2,370 miles of transmission lines in Alabama serving 483,000 households and 97,000 commercial and industrial customers.

In addition, the TVA manages eight reservoirs in Alabama totaling nearly 208,000 acres with more than 2,950 miles of shoreline. The TVA also manages recreational, natural, and cultural resources on more than 90,000 acres of public land in Alabama. The TVA conducts and requests assistance from WS to provide wildlife damage management on land and at facilities owned by the TVA. The TVA also makes its public lands available for use for continuation and expansion of the WS' ORV program across the states within the Tennessee River Basin and Valley.

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.

Alabama Department of Conservation and Natural Resources

The ADCNR authority in wildlife management is given pursuant to the authority of Title 9 of the Code of Alabama 1975, the official regulations of the Alabama Wildlife Commission and applicable federal laws. This legislation covers general provisions; licenses, permits and stamps; wildlife; fish; and wild animals.

Alabama Department of Agriculture and Industries (ADAI)

The Pesticide Program of the ADAI enforces state laws pertaining to the use and application of pesticides; its statutory authority arises from the Code of Alabama 1975. The ADAI Administrative Code, Chapter 80-1-13 (Section 2-27-8, Section 2-27-57) monitors the use of pesticides in a variety of pest management situations. It also licenses private and commercial pesticide applicators and pesticide contractors. Under this Act (Section 2-27-1) the program licenses restricted use pesticide dealers and registers all pesticides for sale and distribution in the State of Alabama.

Alabama Department of Public Health

The ADPH statutory authority in public health is given within the Code of Alabama 1975, the official regulations of the Alabama Department of Public Health. This legislation covers various aspects of disease management and prevention, including rabies (Chapter 420-4-4) among other zoonotic diseases.

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 applicable federal, state, and local laws and regulations in accordance with WS Directive 2.210. Below are brief discussions of those laws and regulations that would relate to damage management activities that WS could conduct in the State.

National Environmental Policy Act

All federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). WS follows the CEQ regulations implementing the NEPA (40 CFR 1500 et seq.) along with the USDA (7 CFR 1b) and the 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 that federal agencies must accomplish 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. In part, the CEQ, through regulations in 40 CFR, Parts 1500-1508, regulate federal activities that could affect the physical and biological environment. In accordance with regulations of the CEQ and the USDA, the APHIS has published guidelines concerning the implementation of the NEPA (see 44 CFR 50381-50384).

Pursuant to the NEPA and the 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 WS and the TVA infuse the policies and goals of the NEPA into agency actions. WS and the TVA prepared this EA by integrating as many of the natural and social sciences as warranted, based on the potential effects of the alternatives, including the potential direct, indirect, and cumulative effects of the alternatives.

Endangered Species Act (ESA)

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 and the TVA conducts consultations with the USFWS pursuant to Section 7 of the ESA 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.

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. The EPA and the ADAI regulate pesticides that could be available to manage damage associated with mammals in the State.

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

The NHPA and its implementing regulations (see 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 Section 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 would be available cause major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor would involve 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 were used that could result in effects on the character or use of historic properties. Therefore, the methods that would be available under the alternatives would not generally be the types of methods that would have the potential to affect historic properties. If WS and/or the TVA planned an individual activity with the potential to affect historic resources under an alternative selected because of a decision on this EA, WS and/or the TVA would conduct the site-specific consultation, as required by Section 106 of the NHPA, as necessary.

The use of noise-making methods, such as firearms, 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, WS would only use such methods 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. WS and/or the TVA would conduct site-specific consultation as required by the Section 106 of the NHPA, as necessary, in those types of situations.

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 agencies are to discontinue work until the agency has made a reasonable effort to protect the items and notify the proper authority.

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 drugs used for 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 United States Drug Enforcement Agency to possess controlled substances, including controlled substances used for 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 animal drugs 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 was administered that must lapse before an animal may be used for food) for specific drugs. Animals that people might consume within the withdrawal period must be identifiable (*e.g.*, use of ear tags) and labeled with appropriate warnings.

Airborne Hunting Act

The Airborne Hunting Act, passed in 1971 (Public Law 92-159), and amended in 1972 (Public Law 92-502) added to the Fish and Wildlife Act of 1956 as a new section (16 USC 742j-l) that prohibits shooting or attempting to shoot, harassing, capturing or killing any bird, fish, or other animal from aircraft except for certain specified reasons. Under exception [see 16 USC 742j-l, (b)(1)], state and federal agencies are allowed to protect or aid in the protection of land, water, wildlife, livestock, domesticated animals, human life, or crops using aircraft.

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. This EA will evaluate activities addressed in the alternatives for their potential impacts 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. The EPA through the FIFRA, the ADAI, the United States Drug Enforcement Agency, MOUs with land managing agencies, and WS' Directives would regulate chemical methods that could be available for use by WS pursuant to the alternatives and the TVA would allow to be used on properties they own or manage. WS and the TVA would properly dispose of any excess solid or hazardous waste. WS and the TVA do not anticipate the alternatives 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 activities conducted pursuant to the alternatives would adversely affect children. For these reasons, WS and the TVA conclude that it would not create an environmental health or safety risk to children from implementing the alternatives. Additionally, the need for action identified a need to reduce threats to human safety, including risks to children; therefore, cooperators could request WS' assistance with reducing threats to the health and safety of children posed by mammals.

Invasive Species - Executive Order 13112

Executive Order 13112 establishes guidance for 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.

Title 9 of the Code of Alabama 1975 and Other State Regulations

Title 9 of the Code of Alabama 1975 provides the state laws and regulations pertaining to the take of mammals within the State. Chapter 11: Fish, Game and Wildlife; Articles 1, 2, 8, 8a, 18 and 19 specifically address mammals.

Specific traps and sizes are to be identified by the ADCNR in its annual Hunting and Trapping Guides (Division of Wildlife and Freshwater Fisheries 2014). The most recent regulations printed in the trapping guide state that all steel foothold traps for land sets must have an outside measurement of six inches or less. They shall not have teeth or serrated edges along the inside jaws. Conibear traps or killer type traps (body grips) shall not exceed five inches in spread for utilization on land sets. Steel cable snares are also prohibited on land, except that powered foot snares less than 5.5 inches are legal. Traps must have a tag affixed bearing the name, address, and license number of the owner (Division of Wildlife and Freshwater Fisheries 2014).

All traps set in or beneath the water must be checked every 72 hours; all traps other than water sets must be checked at least once every 24 hours. Foothold traps larger than six inches, Conibear traps (body grips) larger than five inches, and all neck snares must be placed in the water.

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 Alabama, 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 ADCNR 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 ADCNR is responsible for managing wildlife in the State of Alabama, including those mammal species addressed in this EA. The ADCNR 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 ADCNR, which would ensure the ADCNR has the opportunity to incorporate any activities WS' conducts 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 when requested, 2) should WS conduct disease surveillance and monitoring in mammal populations when requested, 3) should WS, in cooperation with the TVA, implement an integrated methods approach, including technical assistance and direct operational assistance, to meet the need for action in Alabama, 4) if not, should WS attempt to implement one of the alternatives to an integrated methods strategy, and 5) would the proposed action or the other alternatives result in effects 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 occur during the discussion of the environmental effects in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Those mammal species addressed in this EA are capable of utilizing a variety of habitats in the State. Most species of mammals addressed in this EA occur throughout the year across the State where suitable habitat exists for foraging and shelter. Damage or threats of damage caused by those mammal species could occur statewide in Alabama 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 MOU, work initiation document, or another comparable document were signed between WS and a cooperating entity.

Upon receiving a request for assistance, WS could conduct activities to reduce mammal damage or threats on federal, state, tribal, municipal, and private properties in Alabama. 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, dams, 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 were a threat to human safety and to property; areas where mammals negatively affect wildlife, including T&E species; and public property where mammals were negatively affecting historic structures, cultural landscapes, and natural resources. Chapter 4 also contains additional information on the affected environment.

In addition, mammal damage management could occur at facilities owned or managed by the TVA when mammal species addressed in this assessment damage or pose threats of damage to property, to natural resources, to human safety, or to the reliability of electric system transmission. Damage management activities could be conducted at any of the nine TVA power generation facilities, 79 TVA electrical substations, or along any of the 2,370 circuit miles of transmission lines and right-of-way easements owned by the TVA in Alabama. Activities could be conducted along Guntersville, Wheeler, Wilson, and Pickwick reservoirs in northern Alabama, along with Bear Creek, Upper Bear Creek, Little Bear Creek, and Cedar Creek in northwestern Alabama, including facilities and areas associated with those reservoirs. In addition, activities could be conducted on the 90,000 acres of recreational, natural, and cultural resources owned or managed by the TVA in Alabama.

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.

Neither state nor federal laws protect some wildlife species, such as most non-native invasive species. State authority or law manages most mammal species 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 anyone to lethally remove or take those species at any time when they are committing damage. The ADCNR has the authority to manage wildlife populations in the State.

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 would be an environment that includes those resources as other non-federal entities manage or affect those resources in the absence of the federal action. 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 remove mammals to alleviate damage without the need for a permit when those species are non-native or are unregulated by the ADCNR. In addition, other entities could remove mammals to alleviate damage during the hunting and/or trapping season, and/or through the issuance of permits by the ADCNR. In addition, most methods available for resolving damage associated with mammals would also be available for use by other entities. 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 WS' takes no action, another 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 ADCNR. 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 regarding potential adverse effects that might occur from a proposed action. Federal agencies must consider such issues during the NEPA decision-making process. Initially, WS, in cooperation with the TVA, developed the issues related to managing damage associated with mammals in Alabama in consultation with the ADCNR. In addition, WS and the TVA will invite the public to review and comment on the EA to identify additional issues.

Chapter 4 discusses the issues, as those issues relate to the possible implementation of the alternatives, including the proposed action. WS and the TVA evaluated, in detail, the following issues:

Issue 1 - Effects of Mammal 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. Lethal and non-lethal methods would be available to resolve mammal damage or threats to human safety. Non-lethal methods could disperse, translocate, or otherwise make an area unattractive to target species causing damage, which could reduce the presence of those species at the site and potentially the immediate area around the site where an entity employed those methods. Employing lethal methods could remove a mammal or those mammals responsible for causing damage or posing threats to human safety. Therefore, the use of lethal methods could result in local population reductions in the area where damage or threats were occurring. The number of individual animals from a target species that could be removed from the population using lethal methods would be dependent on the number of requests for assistance received, the number of individual animals involved with the associated damage or threat, the efficacy of methods employed, and the number of individuals the ADCNR permits to be removed.

The analysis will measure the number of individual animals lethally removed in relation to that species' abundance to determine the magnitude of impact to the populations of those species from the use of lethal methods. Magnitude may be determined either quantitatively or qualitatively. Determinations based on population estimates, allowable harvest levels, and actual harvest data would be quantitative. Determinations based on population trends and harvest trend data, when available, would be qualitative.

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 ADCNR, when required. 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.

Under certain alternatives, WS could employ methods available to resolve damage and reduce threats to human safety that target an individual animal of a mammal species or a group of animals after applying the WS' Decision Model (Slate et al. 1992) to identify possible techniques. Chapter 4 analyzes the effects on the populations of target mammal populations in the State from implementation of the alternatives addressed in detail, including the proposed action.

Issue 2 - Effects of Mammal Damage Management Activities 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. Appendix B describes the methods available for use under the alternatives.

There are also concerns about the potential for adverse effects to occur to non-target wildlife from the use of chemical methods. Chemical methods that would be available for use to manage damage or threats associated with those mammal species addressed in this EA include immobilizing drugs, euthanasia chemicals, reproductive inhibitors, fumigants, rodenticides, and taste repellents. Chemical methods available for use to manage damage and threats associated with mammals in Alabama 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 consultations with the USFWS pursuant to Section 7 of the Act to ensure compliance with the ESA. Consultations are also conducted 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. Chapter 4 discusses the potential effects of the alternatives on this issue.

Issue 3 - Effects of Mammal Damage Management Activities 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 could use and would 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 potentially would 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 could include immobilizing drugs, euthanasia chemicals, fumigants, reproductive inhibitors, rodenticides, and repellents. The EPA through the FIFRA and the ADAI through State laws would regulate pesticide use. The United States Drug Enforcement Agency and the United States Food and Drug Administration would regulate immobilizing drugs and euthanasia chemicals. In addition, the use of all chemical methods by WS would be subject to Alabama laws and WS' Directives.

Immobilizing drugs that could be available 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 wildlife professionals often use in combination with ketamine to calm nervousness, irritability, and excitement in wildlife during the handling and transporting of wildlife. Euthanasia chemicals could include sodium pentobarbital, Beuthanasia-D®, Fatal-Plus™ and potassium chloride, all of which WS would administer after anesthetizing an animal.

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 registered to manage a local deer population in the State, Gonacon™ would only be available for use by WS and/or the ADCNR, and agents under their direct supervision. The application of Gonacon™ to manage local deer herds could only occur after the ADCNR authorizes the use of the reproductive inhibitor.

Rodenticides would include products containing the active ingredient zinc phosphide, warfarin, brodifacoum, bromadiolone, or diphacinone, which could be available to address damage and threats associated with those small rodent species addressed in this EA. Some rodenticides require a restricted-

use pesticide applicators license from the ADAI to purchase and apply those products. According to the EPA, zinc phosphide, when ingested, reacts with the acids in the gut releasing phosphine gas, which interferes with cell respiration leading to the death of the animal (EPA 1998). Rodenticides containing zinc phosphide are generally restricted-use pesticides, which, if available, could be purchased and applied by appropriately licensed people, and would not be products that were restricted to use by WS only. Warfarin, brodifacoum, bromadiolone, and diphacinone are anticoagulant rodenticides that prevent the clotting of blood. Products containing the active ingredients warfarin, brodifacoum, bromadiolone, or diphacinone are currently or could be registered for use in Alabama and are not generally restricted-use pesticides; therefore, a pesticide applicators licenses is not required to purchase and apply those products. Those active ingredients are discussed in this EA as possible methods that could be available under the alternatives, since products are or could be available containing those active ingredients and are or could be registered for use in the State.

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 for mammals are not generally restricted-use products; therefore, a person does not need a pesticide applicators license to purchase or apply those products. People generally apply repellents directly to affected resources, which elicits an adverse taste response when the target animal ingests the treated resource or the ingestion of the repellent causes 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 be present). WS would only employ or recommend for use those rodenticides and repellents that were available for use in the State (*i.e.*, registered with the EPA pursuant to the FIFRA and registered with the ADAI for use in Alabama).

Gas cartridges could be available to fumigate burrows and den sites of woodchucks, coyotes, fox, and skunks 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. WS would place the cartridges inside active burrows and dens at the entrance, ignite the cartridge, and seal the entrance to the burrow or den with dirt, which allows the burrow or den to fill with carbon monoxide.

Products containing the active ingredient aluminum phosphide are used either as a fumigant or as a rodenticide. Fumigants containing aluminum phosphide as the active ingredient are formulated as tablets, which are placed inside rodent burrows and the burrows are sealed up. The aluminum phosphide in the tablet reacts with the moisture in the soil releasing phosphine gas. Since burrows are sealed after placing the tablets, the burrow fills with toxic phosphine gas. When used as a rodenticide, products containing aluminum phosphide are formulated as pellets and are present as bait for ingestion. When the pellet is ingested, the aluminum phosphide reacts with the acid in the stomach releasing phosphine gas. Products containing the active ingredient aluminum phosphide are registered for use in the State, primarily as fumigants. Products containing aluminum phosphide are restricted use pesticides and would be available to any licensed applicator.

Another concern would be the potential for immobilizing drugs used in animal capture and handling to cause adverse health effects in people that hunt and consume the species involved. Among the species that WS could capture and handle under the proposed action, this issue would be a primary concern for wildlife species that people hunt or trap and consume as food.

Most methods available to alleviate damage and threats associated with mammals would be 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 localized area, such as removing bushes to eliminate shelter locations or planting vegetation that was less palatable to certain mammal species. 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 cage traps, foothold traps, body-gripping traps, cable restraints, cannon nets, shooting, or the recommendation that a local population of mammals be reduced during the annual hunting and/or trapping seasons.

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 Alabama would be available for use under any of the alternatives and by any entity, when permitted. Chapter 4 further discusses the risks to human safety from the use of non-chemical methods as this issue relates to the alternatives. Appendix B provides a complete list of non-chemical methods available to alleviate damage associated with mammals.

Another concern is the threat to human safety from not employing methods or not employing the most effective methods to reduce the threats that mammals could pose. The need for action in Chapter 1 addresses the risks to human safety from diseases associated with certain mammal populations. 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 concerns occur when 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. Chapter 4 further evaluates those concerns in relationship to the alternatives.

Issue 4 - Effects of Mammal Damage Management Activities on the Aesthetic Value 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. People generally regard wildlife 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 likely started when people began domesticating animals. The public today 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 people 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 originate from experiences, such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals (*e.g.*, 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 WS should capture and translocate all animals to another area to alleviate damage or threats those animals pose. In some cases, people directly affected 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 people should never kill wildlife. 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.

In some cases, the presence of overabundant mammal species offends people, 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 people or other wildlife. In those situations, the presence of overabundant species can diminish their overall enjoyment of other animals 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 people can interpret 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."*

The AVMA (1987) has previously described suffering 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 can occur when a person does not take action 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 in animals can be indicators of pain.

However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

The AVMA has previously stated "*...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 using AVMA accepted methods of euthanasia when killing all animals, including wild and invasive animals. The AVMA has stated, "[f]*or 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).

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 must 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*" (Kreeger et al. 1988). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991, Sharp and Saunders 2008, Sharp and Saunders 2011).

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. Chapter 4 further discusses the issue of humaneness and animal welfare. Chapter 3 discusses SOPs intended to alleviate pain and suffering.

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 woodchuck, gray squirrel, fox squirrel, eastern cottontail, raccoon, river otter, mink, striped skunk, coyote, gray fox, red fox, bobcat, opossum, feral swine, and white-tailed deer.

Potential impacts could arise from the use of non-lethal or lethal damage management methods. Non-lethal methods used to alleviate damage caused by those mammal species could reduce mammal densities through dispersal in areas where damage or the threat of damage was occurring. Similarly, lethal methods used to reduce damage associated with those mammals could lower densities in areas where damage was 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 or trapping access was restricted (*e.g.*, airports, TVA facilities, and recreational areas) or had been ineffective. The use of non-lethal or lethal methods often disperses mammals from areas where damage was 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

WS, the TVA, and the ADCNR identified additional issues during the scoping process of this EA. WS and the TVA considered those additional issues but a detailed analysis did not occur. Discussion of those additional issues and the reasons for not analyzing those issues in detail occur below.

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

The appropriateness of preparing an EA instead of an EIS was a concern WS and the TVA identified during the scoping process. Wildlife damage management falls within the category of actions in which the exact timing or location of individual activities can be difficult to predict well enough ahead of time to describe accurately such locations or times in an EA or even an EIS. Although WS could predict some of the possible locations or types of situations and sites where some kinds of wildlife damage would occur, the program cannot predict the specific locations or times at which affected resource owners would determine a damage problem had 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 the 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 has been to determine if the proposed action or the other alternatives could 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 WS and the TVA made a determination through this EA that the proposed action or the other alternatives could have a significant impact on the quality of the human environment, then WS and the TVA would publish a notice of intent to prepare an EIS and this EA would be the foundation for developing the EIS. Based on previous requests for assistance, the WS program in Alabama would continue to conduct mammal damage management in a very small area of the State where damage was occurring or likely to occur.

WS' Impact on Biodiversity

WS and the TVA do not attempt to eradicate any species of native wildlife in the State. WS and the TVA operate in accordance with federal and state laws and regulations enacted to ensure species viability. WS would use available methods 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.

As stated previously, WS would only provide assistance under the appropriate alternatives after receiving a request to manage damage or threats. Therefore, if WS provided direct operational assistance under the alternatives, WS would provide assistance on a small percentage of the land area of Alabama. In addition, WS would only target those mammals identified as causing damage or posing a threat. WS would not attempt to suppress wildlife populations across broad geographical areas at such intensity

levels for prolonged durations that significant ecological effects would occur. The goal of WS would not be to manage wildlife populations but to manage damage caused by specific individuals of a species. The management of wildlife populations in the State is the responsibility of the ADCNR and activities associated with many of the mammal species addressed in the EA require authorization from the ADCNR. Therefore, those factors would constrain the scope, duration, and intensity of WS' actions under the alternatives.

Often of concern with the use of certain methods is that mammals that WS lethally removes would only be replaced by other mammals after WS completes activities (*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). The ability of an animal population to sustain a certain level of removal and to return to pre-management levels demonstrates that limited, localized damage management methods have minimal impacts on species' populations.

For example, studies suggest coyote territories would not remain vacant for very long after removing coyotes from an area. Gese (1998) noted that adjacent coyote packs adjusted territorial boundaries following social disruption in a neighboring pack, thus allowing for complete occupancy of the area despite removal of breeding coyotes. Blejwas et al. (2002) noted that a replacement pair of coyotes occupied a territory in approximately 43 days following the removal of the territorial pair. Williams et al. (2003) noted that temporal genetic variation in coyote populations experiencing high turnover (due to removals) indicated that "*...localized removal effort does not negatively impact effective population size...*".

Chapter 4 evaluates the environmental consequences of the alternatives on the populations of target and non-target species based on available quantitative and qualitative parameters. The permitting of lethal removal by the ADCNR would ensure cumulative removal levels would occur within allowable levels to maintain species' populations and meet population objectives for each species. Therefore, 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 WS or other entities should establish a threshold of loss before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. In some cases, cooperators likely tolerate some damage and economic loss 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 could lead to property damage and could threaten passenger safety if a catastrophic failure of the aircraft occurred 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 determined that a forest supervisor could establish a need for wildlife damage management if the 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 WS should not provide assistance at the expense of the taxpayer or that activities should be fee-based. Funding for WS' activities could occur from federal appropriations and through cooperative funding. Funding for WS' activities would occur through cooperative service agreements with individual property owners or managers. WS receives a minimal federal appropriation for the maintenance of a WS program in Alabama. The remainder of the WS program would mostly be fee-based. WS would provide technical assistance to requesters as part of the federally funded activities; however, the majority of funding to conduct direct operational assistance in which WS' employees perform damage management activities would occur 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 WS and the TVA are considering. 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. Therefore, the cost of methods can often influence the availability of methods to resolve damage, which can influence the effectiveness of methods. Discussion of cost effectiveness as it relates to the effectiveness of methods occurs in the following issue.

Effectiveness of Mammal Damage Management Methods

Defining the effectiveness of any damage management activities often occurs in terms of losses or risks potentially reduced or prevented. Effectiveness can also be dependent upon how accurately practitioners diagnose the problem, the species responsible for the damage, and how people implement actions 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 people, 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 return to pre-management levels eventually does not mean individual management actions were unsuccessful, but that periodic

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

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.

WS often receives comments that lethal methods would be ineffective because additional mammals would likely 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 WS or other entities used lethal methods. 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 WS or other entities no longer used those methods. The common factor when employing any method would be that mammals would return if suitable conditions continued 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 continued to exist that attract mammals to an area where damage was occurring.

Therefore, any method that disperses or removes mammals from areas would only be temporary if habitat containing preferred habitat characteristics continued 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. Some people view dispersing and translocating mammals 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 temporary 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, temporary 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 an evaluation of the damage situation using the WS Decision Model, the most effective methods could be employed individually or in combination based on prior evaluations of methods or combinations of methods in other damage management situations. Once employed, methods could 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

Wildlife control agents and private entities could be contacted to reduce mammal damage when deemed appropriate by the resource owner. In addition, WS could refer persons requesting assistance to agents and/or private individuals under all of the alternatives fully evaluated in the EA.

WS Directive 3.101 provides guidance on establishing cooperative projects and interfacing with private businesses. WS Directive 2.345 outlines WS' policy regarding requests for assistance involving rodent species in urban areas. WS would only respond to requests for assistance and would not respond to public bid notices. When responding to requests for assistance, WS would inform requesters that other service providers, including private entities, might be available to provide assistance.

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 remove 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 removal 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 remove some species. To reduce risks to human safety and property damage from bullets passing through mammals, the use of firearms would be applied in such a way (*e.g.*, caliber, bullet weight, distance) to ensure the bullet does not pass through mammals. Mammals that were removed using firearms would occur within areas where retrieval of 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 firearm, 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.

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 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. Based on current information, the risks associated with lead projectiles that could be deposited into the environment from WS' activities due to misses, the projectile 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.

Effects on Human Health from Consumption of Deer Meat Donated by WS

Of concern under this issue would be the consumption of deer meat donated to a charitable organization after being lethally removed by WS. Of recent concern is the potential for lead and other contaminants to be present in meat that has been processed for human consumption. The potential for the spreading of zoonotic diseases in deer processed and donated for human consumption is also a concern. Under the proposed action alternative, meat from deer lethally removed during damage management activities could be donated to charitable organizations for human consumption. Only meat from deer would be donated under the proposed action alternative. WS could recommend the donation or consumption of meat under the technical assistance only alternative but would not be directly involved with damage management activities under that alternative.

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 Stewart and Veverka (2011) recommended removing the loins prior to processing to ensure that fragments were 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 or would be processed to avoid those areas that could contain lead fragments.

If WS donated deer for human consumption, WS' policies pertaining to the testing or labeling of meat would be followed in order to address potential health concerns. Deer donated for human consumption may be tested for exposure to substances such as organophosphate and carbamate insecticides, lead, mercury, arsenic, organochlorines, and organic chemicals prior to distribution. Deer immobilized using immobilizing drugs or euthanized using euthanasia chemicals would not be donated for human consumption with disposal of carcasses occurring pursuant to WS Directive 2.515. Deer taken by any method for disease sampling or in an area where zoonotic diseases of concern were known to be prevalent and of concern to human health after consuming processed deer meat would not be donated for consumption and would be disposed of by deep burial or incineration. WS' adherence to policy would not result in adverse effects to human health from the donation of deer meat.

Donation of Feral Swine Taken Through Management Activities for Human Consumption

Under the Federal Meat Inspection Act, all swine must be inspected prior to entering into any establishment in which they are to be slaughtered. Inspections are carried out under the Food Safety and Inspection Services (FSIS) under the USDA. The FSIS has ruled that all swine are amenable to the Federal Meat Inspection Act and even if donated, are considered to be in commerce; therefore, all animals must be processed under inspection at an official establishment. This would entail examining the animal alive, at rest and in motion from both sides before passing the animal for slaughter.

In most instances, it would be difficult to trace the origins of feral swine or determine fitness for human consumption due to the potential for feral swine to carry disease (Wyckoff et al. 2009). Transporting live feral swine to slaughter facilities also increases the potential for spreading disease to domestic swine at facilities were swine are being held prior to slaughter. Therefore, feral swine will not be donated to food banks.

Potential for Feral Swine to Disperse to Other Areas Due to Management Activities

Methods involving the exclusion, pursuit, shooting, and/or harassment of feral swine could lead to the abandonment of localized areas traditionally used by swine in Alabama. If feral swine were dispersed by WS under the alternatives, damages and threats could arise in other areas.

Under the alternatives where WS would be involved with managing damage, WS would evaluate the damage or threat situation to determine the appropriate methods. Activities conducted under the alternatives would be coordinated between WS, the TVA, the ADCNR, and local entities to monitor feral swine populations in areas where dispersal may occur. The potential for methods to disperse feral swine would be considered as part of the evaluation of the damage situation and would be incorporated into the decision-making process associated with the alternatives to determine the methods to employ and recommend. The use of methods that would likely result in the exclusion, harassment, or dispersal of feral swine (*e.g.*, shooting, propane cannons, pyrotechnics) could be used in those situations where damage, threats of damage, and/or threats to human safety would require immediate resolution.

In those situations where feral swine could disperse to areas where damage could occur, individual feral swine could also be radio collared to locate and monitor movements of feral swine. Radio collaring could be used to track movements and locations of feral swine. The tracking of feral swine in relationship to damage management activities would also provide the ability to monitor movements and potential dispersal to other areas. Feral swine often form large groups that allow one individual of the group to be captured, collared, released, and allowed to return to the group. By collaring one individual, the movement and location of an entire group could be monitored. Radio telemetry would be available to monitor the movements of feral swine and to respond as necessary to swine potentially dispersing.

Coordination between agencies and local entities would ensure any dispersing feral swine were identified and addressed when they cause damage or threaten human safety. The limited use of methods that disperse feral swine should further ensure they would not be displaced to other areas within Alabama. In addition, the passiveness of the primary methods proposed for use should limit dispersal of feral swine.

WS is also considering the use of aircraft to aid in alleviating or preventing feral swine damage. Under the proposed action alternative, aerial operations could include the use of aircraft for surveillance and monitoring, as well as, WS' employees shooting feral swine from aircraft. Surveillance and monitoring activities would use aircraft to locate feral swine, to determine the size of a local population, and when using radio telemetry, to locate radio collared swine.

The use of aircraft could rapidly reduce feral swine densities in an area (Saunders 1993, Choquenot et al. 1999, Campbell et al. 2010). Studies conducted in Australia found that shooting feral swine from an aircraft reduced local populations of swine by 65 to 80% and surviving feral swine could continue to cause damage and pose disease risks (Saunders and Bryant 1988, Hone 1990, Saunders 1993). Choquenot et al. (1999) found the efficiency of aerial gunning was influenced by feral swine density in the area. Saunders and Bryant (1988) found feral swine "*...became attuned to the significance of a hovering helicopter and* [feral swine] *modified their behaviour* [sic] *to avoid detection*." Dexter (1996) concluded that harassment caused by the use of aircraft in New South Wales, Australia had little effect on the movements of surviving swine since no statistically significant differences were observed in the hourly distanced moved by surviving feral swine, the home ranges of surviving feral swine, and their positions within their home ranges. Campbell et al. (2010) stated the use of aircraft to shoot feral swine "*...had only minor effects on the behavior of surviving swine*..." and the use of aircraft to remove feral swine "*...should be considered a viable tool*..." when managing disease outbreaks. Based on available information, feral swine are not likely to disperse long-distances due to damage management activities.

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, would be 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 Alabama 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 Alabama. 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 some of the mammal species addressed in this EA can only legally occur under authorization by the ADCNR and only at levels authorized, unless those mammal species are afforded no protection, in which case, no authorization for lethal removal would be required.

Property owners or managers requesting assistance from WS could 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 to address those mammals responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should occur 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 could 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 received a request for direct operational assistance, WS would conduct site visits to assess the 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 (see WS Directive 2.101). When receiving requests for assistance associated with mice, rats, voles, chipmunks, squirrels, and woodchucks, the WS program in Alabama would follow WS Directive 2.345.

Non-lethal methods that would be available for use by WS under this alternative include, but are not limited to minor habitat modification, behavior modification, lure crops, visual deterrents, live traps, translocation, exclusionary devices, frightening devices, immobilizing drugs, reproductive inhibitors, and chemical 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 harvest during hunting and/or trapping seasons, fumigants, euthanasia chemicals, rodenticides, and shooting, including the use of firearms from aircraft. 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.

Discussing methods does not imply that all methods would be used or recommended by WS to resolve requests for assistance and does not 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 were employed. Long-term solutions to managing mammal damage could 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 (see 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 some situations, a 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 to 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, the only function of WS 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 could 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 could 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 removed would only be replaced by other mammals either after 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 individuals of a target mammal species present at a specific location where damage was occurring by targeting those mammals causing damage or posing threats. The intent of lethal methods would be to manage damage caused by those individuals of a mammal species and not to manage entire mammal populations.

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 harvest levels during those seasons is the responsibility of the ADCNR. 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 this alternative 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 people experiencing damage associated with mammals when those persons request assistance from WS.

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 2009 through FY 2013, WS conducted 568 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 could be initiated when the problem could not be effectively resolved through technical assistance alone and there was a written MOU, work initiation document, 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 resolve problems effectively, especially if chemical methods were necessary or if the problems were complex.

The following examples serve as illustrations of WS' operational damage management assistance projects. The examples are intended to present realistic examples of on-going projects only and are not an inclusive or all-encompassing list of all projects conducted by WS in Alabama.

Management of Wildlife Hazards to Aircraft and Air Passengers in Alabama

Upon receiving a request for assistance, WS evaluates wildlife hazards at an airport, prepares a Wildlife Hazard Assessment that identifies wildlife hazards, and assists the airport in developing a Wildlife Hazard Management Plan to address those hazards and threats.

Direct operational activities consist of various harassment techniques, and live capture and lethal removal techniques aimed at removing potentially injurious wildlife. WS' personnel also provide ongoing technical advice to airport managers regarding methodologies to reduce the presence of wildlife in areas of operations within airport, including providing technical advice on various habitat management projects implemented by airport personnel. In addition, WS promotes improved mammal strike record keeping,

maintains a program of mammal identification, and monitors mammal numbers at participating airports to assist in developing an effective damage management program.

Management of Mammals That Threaten Power Generation and Transmission in Alabama

Upon receiving a request for assistance, WS conducts site visits and evaluates damage caused by various mammals on properties and facilities owned or managed by the TVA. Once WS' evaluation is complete and mammal damage is addressed through technical assistance or direct operational activities, each damage site then becomes part of a monitoring schedule for wildlife damage. Periodic monitoring of those known damage sites allows WS to better manage wildlife damage issues for the TVA by quickly identifying the repopulation of mammals that has caused specific damage in the past, identifying signs that damage is about to occur again (*e.g.*, woodchucks may open up burrows), and addressing the target species prior to damage occurring. Direct operational activities may consist of utilizing body-grip traps and padded foothold traps to remove woodchucks burrowing in earthen levees or flooding sensitive areas. Activities could include live traps to capture mammals, such as raccoons, fox, and skunks that pose threats to power transmission by chewing, denning, or otherwise shorting out electrical circuits. Assistance could include identifying species and installing exclusion mechanisms to keep bats from roosting in high human traffic areas of power production facilities or removing aggressive mammals that threaten TVA personnel safety or are depredating on protected T&E species that are nesting on property owned or managed by the TVA.

Management of Feral Swine in Alabama

WS evaluates agricultural damage or disease transmission caused by feral swine. Direct operational activities consist of various lethal removal techniques, including corral trapping, snaring, and shooting. In some cases, WS works with adjoining landowners to establish large cooperative relationships suitable for aerial operations to pursue feral swine with aircraft. WS' personnel demonstrate techniques for excluding feral swine from specific areas and utilize harassment techniques to provide time for agricultural crops to mature and become less attractive.

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 (see 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 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 Alabama, under this alternative, would follow the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997). 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 were available. Under this approach, resource owners and others directly affected by mammal damage or conflicts would have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request direct operational 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 would be 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 was provided, and if the requested direct control was compatible with WS' recommendations.

Private Property Decision-Makers

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 concerns, 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 were involved in the decision-making process would be a decision made by that individual. Direct operational assistance could be provided by WS if requested, funding was provided, and the requested management was in accordance with WS' recommendations.

Public Property Decision-Makers

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 was 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. 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 were 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. Those 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 recommended 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, reproductive inhibitors, and shooting from aircraft. 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 ADCNR or those persons under the supervision of the ADCNR. 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 would include collecting information about the species involved, the extent of the damage, and previous methods that the cooperator had attempted to resolve the problem. WS would then provide information on appropriate methods that the cooperator could 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 2009 and FY 2013, WS has conducted 568 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 were 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 ADCNR, other governmental agencies, and/or 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 could occur despite the lack of involvement by WS. The take of mammals by other entities could occur after authorization by the ADCNR, when required, and during the hunting and/or trapping seasons. Landowners, agricultural leaseholders and their designated agents can lethally remove coyotes, fox, skunks, and feral swine at any time when those species are causing damage in accordance with appropriate regulations and permits (ADCNR 2013). All methods described in Appendix B would be

available for use by those persons experiencing damage or threats under this alternative except for the use of Gonacon™, immobilizing drugs, euthanasia chemicals, and shooting from an aircraft. Gonacon™ would not be used by WS under this alternative but would be available to the ADCNR, if registered for use in the State. Immobilizing drugs and euthanasia chemicals could only be used by WS or appropriately licensed veterinarians.

Under this alternative, those persons experiencing damage or threats of damage could contact WS; however, WS would immediately refer the requester to the ADCNR and/or to 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 further 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 failed 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 could be evaluated. The proposed action (Alternative 1) and the technical assistance only alternative (Alternative 2) would be similar to a non-lethal before lethal alternative because WS would use or recommend non-lethal methods before lethal methods (see WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not contribute 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 were considered non-lethal would be employed by WS. No intentional lethal removal 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 ADCNR, local animal control agencies, or private businesses or organizations.

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 was necessary, which could then become hazardous and pose threats to the safety of people 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 with allowing bats to exit a structure but prevent re-entry. Once bats have exited the structure, structural repairs could be completed to 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.

Live-capture and Translocation of 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 ADCNR and/or the property owner where the translocated mammals would be placed prior to live-capture and translocation. Live-capture and translocation could be conducted as part of the alternatives analyzed in detail. However, the translocation of mammals could only occur under the authority of the ADCNR. Therefore, the translocation of mammals by WS would only occur as directed by the ADCNR. When requested by the ADCNR, 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, translocation by other entities could occur under Alternative 3.

Generally, translocating mammals that have caused damage to other areas following live-capture 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 (see WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, threat of spreading diseases, 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 ADCNR, 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 tool for wildlife population management 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 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, chemical 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 reproductive inhibitors become available to manage a large number of mammal populations and if an inhibitor has proven effective in reducing localized mammal populations, the use of the inhibitor could be evaluated as a method available to managing damage. 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™ was not registered for use in the State during the development of this EA. 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 require large expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation. Compensation most likely would be below full market value and give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies. In addition, providing compensation would 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 Alabama. 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, large-scale population suppression would not be realistic or practical to consider as the basis of the WS' program. Problems with the concept of suppression would be similar to those described above for eradication. Typically, WS' activities in Alabama 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 agencies, such as the ADCNR, 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 across 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 programs 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 would not currently be reasonable, especially with many feral animals being self-sufficient and not reliant on people to survive. Additionally, some individuals within a population can be trap-shy. Capturing or removing trap-shy individuals often requires implementing other methods.

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 people from direct contact during either sterilization or the risk of exposure after the animal was released. Once live-captured, performing sterilization procedures during field operations on anesthetized animals could be difficult. Sanitary conditions could 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 could increase the threat from handling and transporting the animal. A mobile facility could be used; however, a mobile facility would still require additional handling and transporting of the

live-captured animal 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 was not 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 Alabama 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.

- 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 United States Drug Enforcement Agency, United State Food and Drug Administration, and WS' directives and procedures.

- All controlled substances would be registered with the United States Drug Enforcement Agency or the United State Food and Drug Administration.

[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.

- 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.

- WS' employees participating in any aspect of aerial wildlife operations would be trained and/or certified in their role and responsibilities during the operations. All WS' personnel would follow the policies and directives set forth in WS' Directive 2.620; WS' Aviation Operations Manual; WS' Aviation Safety Manual and its amendments; Title 14 CFR; and Federal Aviation Regulations, Part 43, 61, 91, 119, 133, 135, and 137.

- 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 ADCNR, 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 Alabama, or even across major portions of Alabama, would not be conducted.

- Non-target animals live-captured in traps would be released unless it was 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 Mammal Damage Management Activities on Target Mammal Populations

- Lethal removal of mammals by WS would be reported and monitored by WS and the ADCNR to evaluate population trends and the magnitude of WS' removal 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 of Mammal Damage Management Activities 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.

- 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 was possible and safe to do so.

- Personnel would monitor live-capture methods or live-capture methods would be checked at least once a day or in accordance with Alabama laws and regulations. This would help ensure non-target species were released in a timely manner or were prevented from being captured.

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

- WS has consulted with the USFWS and the ADCNR to evaluate activities to resolve mammal damage and threats to ensure the protection of T&E species.

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

Issue 3 - Effects of Mammal Damage Management Activities 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 were not possible, then activities would be conducted during periods when human activity was low (*e.g.*, early morning).

- Shooting would be conducted during times when public activity and access to the control areas were 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, the United States Drug Enforcement Agency, the United States Food and Drug Administration, and/or the ADAI, as appropriate.

- WS would adhere to all established withdrawal times for mammals when using immobilizing drugs for the capture of mammals that were agreed upon by WS, the ADCNR, and veterinarian authorities. Although unlikely, in the event that WS was requested to immobilize mammals during a time when harvest of those mammal species was 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 a tag. Tags would be 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 of Mammal Damage Management Activities on the Aesthetic Value 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 work initiation document, 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 target mammals causing damage.

- WS' personnel would check methods frequently to ensure mammals captured would be addressed in a timely manner to minimize the stress of being restrained.

- When deemed appropriate using the WS' Decision Model, WS' use of lethal methods would comply with WS' directives (*e.g.*, see WS Directive 2.505, WS Directive 2.430, and WS Directive 2.401).

- 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 ADCNR.

- WS' lethal removal (killing) of mammals would be reported to and monitored by the ADCNR to ensure WS' removal was 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 when selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2. 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 ADCNR, and the TVA.

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

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 shooting from an aircraft, immobilizing drugs, euthanasia chemicals, and Gonacon™. 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 habitat/behavior modification, pyrotechnics, visual deterrents, live traps, translocation, cable restraints, exclusionary devices, frightening devices, nets, immobilizing drugs, reproductive inhibitors, and chemical 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 could 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.

The continued use of many non-lethal methods can often lead 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 available under the alternatives would be the reproductive inhibitor commonly known as Gonacon™. The reproductive inhibitor Gonacon™ is currently not registered for use in Alabama. However, the product 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 ADAI administers training and testing required for applicators to purchase and apply restricted-use pesticides in the State. Gonacon™ could be employed by WS and/or the ADCNR, if registered for use in the State, under Alternative 1. Only the ADCNR or their designated agents could use Gonacon™ if Alternative 2 or Alternative 3 were selected.

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.

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 ADCNR to ensure activities occurred within management objectives for those species. WS would submit annual activity reports to the ADCNR. The ADCNR would have the opportunity to monitor the total removal of mammals from all sources and would factor in survival rates from predation, disease, and other mortality data. Ongoing contact with the ADCNR 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 removal 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.

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 live-capture followed by euthanasia, shooting, body-gripping traps, fumigants, cable restraints, rodenticides, and the recommendation of harvest during the hunting and/or trapping seasons, where appropriate. All of those methods would be available for use by WS or for recommendation by WS under Alternative 1. Lethal methods could 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 were to be euthanized 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 removal 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 remove 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 annually 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 removal that could occur under Alternative 1.

Rodenticides could also be employed to target specific or localized populations of small rodents where damage or threats of damage were occurring. Chemical methods that could be available under the alternatives to manage damage associated with certain mammal species would include zinc phosphide, aluminum phosphide, gas cartridges, warfarin, brodifacoum, bromadiolone, and diphacinone. In most cases, those chemical methods would not be restricted to use by WS only; therefore, when registered for use in the State as a restricted-use pesticide, those products would be available for use by licensed pesticide applicators under any of the alternatives. Rodenticides containing warfarin, brodifacoum, bromadiolone, and diphacinone have been registered with the EPA and are registered for use in the State or could be registered for use in the State. Determination of the number of small rodents killed from the use of rodenticides can be difficult since most small rodents killed by those methods die underground.

Removal of small rodents by WS would be done at specific isolated sites (*e.g.*, airports, orchards, islands).

Most lethal methods would be employed 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 could 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.

The use of firearms could reduce the number of mammals using a location (similar to dispersing mammals) by lethally removing those target animals causing damage or posing a threat of damage. The capture of mammals using live-traps and subsequently euthanizing those mammals would be employed to reduce the number of mammals using a particular area where damage was occurring. Similarly, the recommendation that mammals be harvested during the regulated hunting and/or trapping season for those species in the State would be intended to manage those populations in the area where damage was occurring.

Often of concern with the use of lethal methods is that mammals that were lethally removed 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 target animals present at a location where damage was occurring by targeting those animals causing damage or posing threats. The return of mammals to areas where methods were previously employed does not indicate previous use of those methods were ineffective since the intent of those methods were to reduce the number of mammals present at a site where damage was occurring or could occur at the time those methods were employed.

The use of most lethal methods would be 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 is 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 could disperse those mammals to other areas potentially leading to a reduction in damage at the location where those mammals were dispersed. 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 leading to a reduction in the damage occurring at that location.

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 harvest during those seasons is the responsibility of the ADCNR. 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 removal 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.

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 reduce damage and threats associated with mammals in the State.

The analysis of each species includes an estimate of annual removal as compared to statewide population estimates of the species. The statewide population is estimated using the most current reliable information possible. Frequently, there is no current reliable information available for the species and conservative estimates are calculated based upon habitat availability and species use of those habitats. Habitat availability was calculated using the 2006 National Land Cover Dataset (NLCD) created through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a partnership of federal agencies, consisting of the United States Geological Survey, the National Oceanic and Atmospheric Administration, the EPA, USDA-Natural Resources Conservation Service, the United States Forest Service, the National Park Service, the USFWS, the Bureau of Land Management, the National Aeronautics and Space Administration, and the Office of Surface Mining.

The 2006 NLCD was created from satellite imagery that was digitally rendered to produce a land-cover database comprised of three elements: land cover, impervious surface, and canopy density. These elements were then combined to create a digital map of the United States in which each pixel, covering 30 m^2 each, is classified into one of 29 different land classes. The State of Alabama includes 15 of the 29 possible classes and this information is presented in Table 4.1. The land class data presented in Table 4.1 serves as the basis for current population estimates as presented in each species' population information and effects analysis.

Table 4.1: Alabama Land Cover Area by Class as calculated from 2006 NLCD with Definitions.

Land Cover Class	Area in Alabama (km^2)	Area in Alabama (mi^2)	Definition
Open Water	2,810.9	1,085.7	Areas of open water, less than 25% cover of vegetation or soil.
Developed, Open Space	6,450.5	2,491.5	Mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover.
Developed, Low Intensity	1,968.5	760.3	Mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% of total cover.
Developed, Medium Intensity	608.9	235.2	Mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover.
Developed, High Intensity	205.3	79.3	Highly developed areas, people reside or work in high numbers. Impervious surfaces account for 80% to 100% of the total cover.
Barren Land	343.4	132.7	Barren areas of bedrock, desert, pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Deciduous Forest	31,758.5	12,266.7	Dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
Evergreen Forest	27,690.1	10,695.3	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.
Mixed Forest	11,227.9	4,336.8	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
Shrub/Scrub	12,116.2	4,679.9	Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.
Grassland/ Herbaceous	5,120.9	1,978.0	Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
Pasture/Hay	16,329.4	6,307.2	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
Cultivated Crops	6,814.0	2,631.9	Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.

Land Cover Class	Area in Alabama (km^2)	Area in Alabama (mi^2)	Definition
Woody Wetlands	9,898.7	3,823.4	Areas where forest or scrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
Emergent Herbaceous Wetlands	446.2	172.4	Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
Total Area of All Land Cover Classes	**133,789.4**	**51,676.1**	

Population and density information specific to Alabama for many of the target species is not available and is not known. Frequently, population information is not available for a species and conservative estimates can be calculated based upon the density of a species, the availability of habitat, and a species use of the habitats available. To evaluate the potential impacts to a target species population and to evaluate the magnitude of the potential impacts from activities that could be conducted by WS under the proposed action alternative, a statewide population estimate for many of the target species has been calculated using available information from published literature and other sources. Population estimates were primarily derived from available density data for individual species, when available, and the land classification most likely to contain that particular species. When density data was available, the population estimates were based on those species occupying a certain percentage of the land classifications that likely represented suitable habitat for a particular species. Since information on actual populations and densities was not available for most target species in Alabama, calculating a statewide population estimate based on a species only occupying a certain percentage of the available habitat was used during the evaluation to estimate a minimum population or a worst-case scenario to evaluate the magnitude of WS' potential annual lethal removal.

For example, the statewide population of gray fox was estimated based on the species occupying only 50% of the habitat types where the species could be found within the State, which excluded urban areas. Gray fox can be found statewide in a variety of habitats, including urban areas, so gray fox occupying only 50% of the land area of the State is unlikely. However, similar to many of the target species, gray fox occupying only 50% of certain land classifications was used to provide a minimum population estimate to evaluate potential impacts based on a worst-case scenario.

The analysis of potential impacts on each of the species populations includes the anticipated annual lethal removal by WS, which was based on previous requests for assistance and in anticipation of additional efforts to manage damage or threats of damage in the future. The anticipated number of animals from a species' population that WS could lethally remove annually was then compared to the calculated statewide population estimate for a species to determine the magnitude of lethal removal on the estimated statewide population of a species under a worst-case scenario.

In addition to the annual lethal removal that could occur from WS during damage management activities using lethal methods, many of the target mammal species can also be harvested during annual hunting and/or trapping seasons in the State. To evaluate potential cumulative impacts, harvest data is also included in the effects analysis for many of the mammal species. Most harvest data available in Alabama is based on an annual mail survey conducted by the ADCNR that samples licensed hunters and/or trappers to obtain estimates of actual harvest. The harvest estimates are based on a representative sample of licensed hunters and/or trappers and does not include those hunters/trappers that are not required to hold a license (*e.g.*, landowners hunting on their own property). In addition, the harvest estimates based on the

mail survey do not include illegal harvest of mammals or mammals that were legally removed to alleviate damage. Therefore, each harvest estimates likely represents a value that deviates from the actual harvest (Metzler 2013). However, the harvest information based on the mail survey is the best available information.

As discussed previously, the analysis to determine the magnitude of impact from lethal removal 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. 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.

BAT POPULATION INFORMATION AND EFFECTS ANALYSIS

Bats are the only mammals that can truly fly. They are exceeded only by rodents as the most numerous mammals, both in number of species and number of individuals (Greenhall and Frantz 1994, National Audubon Society 2000). Bat bodies are generally well furred and their forelimbs are enlarged and developed as wings with membranes attached to four greatly elongated fingers, which spread when in flight and draw together when at rest. The "*thumb*" projects from the end of the "*forearm*" as a small but sharp claw that is used as the animal crawls about. Wing membranes are often naked and translucent (National Audubon Society 2000). The motion of bats in the air appears to be more of a swimming motion, where they rotate their wings to catch air with the membrane, as opposed to birds that flap their wings (National Audubon Society 2000). Although most North American bats have small eyes, their visual acuity is good (Humphrey 1982). However, insectivorous bats locate food and avoid objects by means of echolocation, which is similar to radar or sonar (Humphrey 1982). While flying, the bat emits through its nose or mouth a continuous series of supersonic sounds. These sounds bounce off objects and are picked up by the bats complex ears (National Audubon Society 2000).

Bats are nocturnal, leaving the roosts around dusk and usually flying to a stream, pond, or lake, where they obtain a drink by skimming the surface and dipping their lower jaw into the water. Bats in North America are virtually all insectivorous, feeding on a variety of flying insects, many of which are harmful to people (Greenhall and Frantz 1994). Insectivorous bats obtain food by various means of capturing their prey, mostly while in flight. During these feeding flights, they often fly close to animals, including people and sometimes cause alarm (National Audubon Society 2000).

Among the 40 species of bats found north of Mexico, only a few cause problems for people. Bats that congregate into groups are called colonial bats, while those bats that live alone are known as solitary bats. The colonial species most often encountered in and around buildings in the United States are the little brown myotis, the big brown bat, the Brazilian free-tailed bat, the evening bat, the pallid bat (*Antrozous pallidus*), and the Yuma myotis (*Myotis yumanensis*) (Greenhall and Frantz 1994). Solitary bats typically roost in tree foliage or under bark. However, occasionally solitary bats are found associated with buildings, some only as transients during migration (Greenhall and Frantz 1994).

Conflicts involving bats can include property damage, but primarily involve threats to people, pets, 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). Bat rabies has always occurred at low levels within bat populations and researchers estimate that less than 1% of all bats are rabid. About 6% of all bats submitted for rabies testing were submitted

because they could be easily captured, were obviously weak or sick, or had been captured by a cat or dog (CDC 2011). 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 are thick, 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 *Histoplasma 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 people in the absence of their primary hosts. The main means of dispersal for bat bugs is phoresy (*i.e.*, hitching a ride on a bat to a new location by clinging to the fur of their host animal). 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 are eliminated or their hosts have vacated an area, bat bugs will seek other sources of food and may crawl about and invade living areas within a 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).

At least sixteen species of bats are known to occur in Alabama (Mirarchi 2004). Some of those bat species are listed as threatened, endangered, or as species of management concern by federal and state agencies. Table 4.2 identifies the bat species found in Alabama and provides information related to their occurrence in the State and provides information on their roosting/rearing/hibernating behaviors. Several bat species in Alabama are known to roost, raise young, or hibernate in various human structures. Such behavior sometimes causes human/bat conflicts, especially perceived or actual threats of rabies, by people who encounter bats in such locations, especially when bats enter the living space of a home.

From FY 2009 to FY 2013, WS responded to 56 requests for technical assistance associated with bats. Those persons requesting assistance reported $54,000 in damages caused by bats, primarily from damage to property. Most requests for assistance have been addressed through technical assistance. More than 90% of requests for assistance were associated with bats that had wandered into the living or working spaces of buildings, or were roosting in various structures. Most requests for assistance were resolved by providing an escape route for the intruding bat, by capturing the bat and releasing it, or by excluding bats from buildings. From FY 2009 through FY 2013, one bat was hand captured inside a building and euthanized by WS in Alabama for rabies testing. In addition, WS live-captured and released two bats between FY 2009 and FY 2013 to reduce threats to human safety.

Bat damage would be handled by WS primarily through various technical assistance projects or referral to other entities. Program activities would continue to recommend the use of non-lethal methods, such as exclusion and live capture/release. To reduce the possibility of adversely affecting a bat maternity colony, WS would implement and recommended to persons receiving technical assistance that all exclusion be conducted from September to early November, when practicable. Many bat species, except big brown bats, would have migrated at that time, and the rearing of young would have been completed. Therefore, activities conducted after this date would be highly unlikely to disturb maternity colonies of

any species during critical young-rearing periods. Conducting exclusionary and other projects during those months would also give big brown bats, or other species that overwinter in Alabama, an opportunity to find alternate roost sites before the onset of extremely cold weather.

Table 4.2 - Bats found in Alabama, their occurrence, and habitat characteristics

Common Name	Scientific Name	Occurrence in Alabama	Roosting/Rearing/Hibernating Habitat	Status in Alabama*
Little Brown Myotis	*Myotis lucifugus*	Statewide	Tree cavities, underneath rocks, piles of wood, crevices, occasionally in caves, and a variety of human-made structures	PN
Southeastern Myotis	*Myotis austroriparius*	Southern and western half, most common southern tier	Primarily a cave dwelling species, it occasionally roosts in buildings, culverts, wells, natural tree cavities, and bridges	PN
Gray Myotis	*Myotis grisescens*	Statewide, except SW	Occupies deep caves near permanent water in winter and summer	PN, FE, SE
Northern Long-eared Myotis	*Myotis septentrionalis*	Statewide, except SW	Summer - tree holes, birdhouses, behind loose bark, shutters of buildings. Prefers forested ridges and riparian woodlands. Winter – caves, mines, crevices in walls or ceilings.	PN
Small-footed Myotis	*Myotis leibii*	May occur in NE, occurs in adjacent areas of TN & GA. Maps often depict in AL, but no known occurrences	Roost in rock bluffs, buildings, and turnpike tunnels during the spring and summer. They hibernate during winters in caves and mines, hanging near the opening, or moving deeper as winter temperatures drop.	PN
Indiana Myotis	*Myotis sodalis*	Rare. Occurs in N and E half of AL, population declines across range	Hibernates in caves, mostly in tight clusters. In summer, females form small maternity colonies in tree hollows and behind loose bark	PN, FE, SE, CHD
Silver-haired Bat	*Lasionycteris noctivagans*	Probably found statewide, except for southern tier of counties	Probably present as a winter resident, or in spring and autumn migration, but apparently not in summer. In winter, hibernates in a variety of shelters, including buildings, caves, mines, crevices, and hollow trees	PN
Tri-colored Bat	*Perimyotis subflavus*	Found statewide and common	Occupies hollow trees, tree foliage, caves, mines, rock crevices, and buildings.	PN
Big Brown Bat	*Eptesicus fuscus*	Found statewide and common.	Roosts typically in human-made structures, but also in caves, mines, hollow trees, and crevices, or behind loose bark. Commonly inhabits bat houses, attics, and louvered attic vents.	PN
Eastern Red	*Lasiurus*	Found	Roosts in a variety of trees, but	PN

Common Name	Scientific Name	Occurrence in Alabama	Roosting/Rearing/Hibernating Habitat	Status in Alabama*
Bat	*borealis*	statewide and common.	frequently uses clumps of Spanish moss.	
Seminole Bat	*Lasiurus seminolus*	Found statewide	Common in mixed coniferous and deciduous woodlands; often associated with Spanish moss	PN
Hoary Bat	*Lasiurus cinereus*	Poorly known. Statewide, few records of this large species in Alabama.	Roosts in trees or shrubs, usually three to five meters (9-15 feet) above ground	PN
Northern Yellow Bat	*Lasiurus intermedius*	Rare and poorly known. Only a few records from the S tier of counties.	This relatively large bat inhabits coniferous and deciduous woodlands near permanent water. Often roosts in clumps of Spanish moss, but also in trees.	PN
Evening Bat	*Nycticeius humeralis*	Found statewide, but more common in southern half.	Primary habitat is deciduous forest where it roosts in hollow trees, under loose bark, and in human-made structures, such as outbuildings, churches, belfries, and attics.	PN
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*	Poorly known. Found statewide, but among least-known bats in region.	In summer, roost sites may be behind loose bark, in caves, crevices, and hollow trees, and in unoccupied buildings, abandoned mines and wells, and other human-made structures.	PN
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	Poorly known. Possibly found statewide, but most occur in S half	Occurs only in human-made structures. Essentially nonmigratory and does not hibernate, but summer and winter roosts may be in different localities.	PN

*Codes: F = Federal listing, S = State listing, E = Endangered, PN = Protected Non-game, CHD = Critical Habitat Determined

Most requests for WS' operational assistance would likely occur in relation to bats inhabiting human-occupied buildings. Bat species that may be addressed by WS when they occur in structures include the big brown bat, Brazilian free-tailed bat, evening bat, little brown myotis, Rafinesque's big-eared bat, silver-haired bat, and the tri-colored bat. Those species of bats can be found in buildings and other man-made structures. Bat species that are listed by the USFWS pursuant to the ESA and by the ADCNR are not generally associated with man-made structures and so it is unlikely that any federally or state listed bat species would be encountered by WS during activities to address bats. 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, any lethal removal by WS would not be additive to mortality that would likely occur in the absence of involvement by WS.

Based on previous requests for assistance and in anticipation of receiving requests for assistance in the future, it is possible that WS could kill up to five bats each year statewide, in any species combination, consisting of big brown bat, Brazilian free-tailed bat, evening bat, little brown myotis, Rafinesque's big-eared bat, silver-haired bat, and the tri-colored bat. If the need arises, WS would consult with a qualified biologist to identify bats positively prior to removing them in order to eliminate any chance of addressing a T&E species. If a threatened or endangered bat were encountered, WS would contact the USFWS and/or the ADCNR 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.

Regionally, some bats species are being adversely impacted by the fungal disease 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 removal 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.

BLACK BEAR POPULATION INFORMATION AND EFFECTS ANALYSIS

The American black bear is the smallest and most widely distributed of the three North American bear species (Pelton 1982). This species is a compact, heavily structured mammal with relatively massive legs and feet. Adult male black bear weigh from 120 to 280 kg (265 to 617 lbs) and measure from 130 to 190 cm (51 to 61.7 inches) in length from the tip of the nose to the tip of the tail. Adult females weigh from 45 to 192 kg (100 to 400 lbs) and measure from 110 to 170 cm (45 to 67 inches) in total length. Their normal coloration is black with a brownish muzzle and frequently, a white V-shape across the throat or chest (Kolenosky and Strathearn 1987). Black bears mate in June and July and produce litters of one to five cubs, with two cubs usually the normal litter size. Although black bears are primarily nocturnal, they may be seen at any time. They occupy ranges of 20 to 25 km^2 (8 to 10 mi^2), and sometimes up to 40 km^2 (15 mi^2). The home range of the male black bear is about double that of the female.

Black bears are powerful swimmers and climb trees for protection or food. Although they are in the order Carnivora, their diet includes all types of vegetation, including twigs, buds, leaves, nuts, roots, fruit, corn, berries, and newly sprouted plants. Black bear will rip open trees with beehives to feast on honey, honeycomb, bees, and larvae. They will also tear apart rotting logs for grubs, beetles, crickets, and ants. The black bear wades in streams or lakes, snagging fish with its jaws or pinning them with a paw. The black bear's diet also includes small to medium-size mammals or other vertebrates, and even livestock, such as cattle, sheep, and goats. Bears are often a problem around open dumpsites, becoming dangerous as they lose their fear of people. Occasionally, people have been killed by black bears (National Audubon Society 2000, Herrero et al. 2011). It has been suggested that habituated, food-conditioned bears pose the greatest threat to people and such bears are usually found in association with campgrounds and sites where people regularly feed them (Herrero 1985, Kolenosky and Strathearn 1987). However, Herrero et al. (2011) found that most encounters with bears drawn into close contact with people by food or garbage only result in threat displays and rarely lead to physical attacks.

In North America, black bear densities range from 0.1 to 1.3 bears per km^2 depending on the region and habitat. Densities are greatest in highly diverse forests at a relatively early stage of development. In unhunted and lightly hunted populations, the annual survival rate of an adult female black bear is about 80% to 90% with adult male survival slightly less. As hunting pressure increases, the number of males decreases more rapidly than that of females because of their greater vulnerability to hunting (Fraser et al. 1982). The statewide population of black bear for neighboring Tennessee was estimated to be between 750 to 1,500 bears and is believed to be increasing (Vaughan and Pelton 2003).

Black bears were once found statewide in Alabama but today, their range is restricted to areas in Baldwin, Mobile, and Washington Counties, with confirmed reports of bears occurring in the northeastern part of the State, which are likely transient bears from surrounding states (ADCNR 2014*a*). Bears are most often encountered in woodland and swampland habitats in areas where they occur today (ADCNR 2014*a*). The ADCNR (2014) considers the black bear to be of "*highest conservation concern*" within the State.

Black bear are protected in Alabama and there is no hunting or trapping season. No black bears have been killed by WS in Alabama. WS' personnel have occasionally received requests for assistance associated with black bears, but WS has previously provided only technical assistance and referred people to the ADCNR for further action. Between FY 2009 and FY 2013, WS conducted six technical assistance projects associated with black bears in the State. Any direct damage management actions conducted by WS to address black bear damage in Alabama under the proposed action alternative would be conducted as part of a coordinated effort with the ADCNR to meet state wildlife resource management objectives. Such projects would usually involve live-capture and translocation of bears causing damage. Translocation would occur to locations determined by the ADCNR with suitable habitat; therefore, the translocation of bears would not be expected to adversely affect bear populations in the State.

BOBCAT POPULATION INFORMATION AND EFFECTS ANALYSIS

The bobcat, also called "*wildcat*", is a medium-sized member of the North American cat family, and they may be mistaken for a large bob-tailed domestic cat by some people. This species is actually two to three times larger than most domestic cats and appears more muscular and fuller in body. Their fur is dense, soft, short and generally yellowish to reddish-brown in color with numerous black spots and black-tipped guard hairs on the back and white with black spots on the belly. Forelegs are tawny with black bars. The species gets its common name from its characteristic stubby or "*bobbed*" tail. The tail is generally only 9 to 20 cm (3.5 to 8 inches) in length with two or three black bars and a black tip above, while the underside is pale or white (Larivière and Walton 1997). Their upper legs have dark horizontal bands. The face has thin, black lines stretching onto broad cheek ruff and their ears are tufted. Males are generally larger than females. The length of bobcats ranges from 47.5 to 125 cm (19 to 49 inches), while their weight ranges between 4.1 and 18.3 kg (9 to 40 lbs) (Larivière and Walton 1997).

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, woodrats, 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. They also resort to scavenging. They 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.

Ruell et al. (2009) reported bobcat densities ranged from 0.65 to 1.09 bobcats per square mile (0.25 to 0.42 bobcats per km^2) in coastal southern California in both large open habitat and in habitat surrounded by human development. Lawhead (1984) reported bobcat densities of 0.66 per square mile (0.26 bobcats per km^2) in Arizona with a preference for riparian habitat. Bobcats in southern Illinois were reported to have a population density of 0.70 bobcats per square mile (0.27 bobcats per km^2) (Nielsen and Woolf 2001), while Anderson (1987) provided population density estimates of 0.13 to 0.26 bobcats per square mile (0.05 to 0.10 bobcats per km^2). Bobcats reach densities of about one 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 one per 1.3 km^2 (1 per ½ mi^2) in coastal plains to about one cat per 10.7 km^2 (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 Bailey's (1972) study of bobcats in southeastern Idaho. 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 occur statewide in Alabama and they are considered common (ADCNR 2014*b*). Bobcats can be found throughout the State in a variety of habitats, including bottomland hardwood forests, swamps, farmlands, and dense understory (ADCNR 2014*b*). Bobcats are considered a species of "*lowest conservation concern*" in the State (ADCNR 2014*b*). The statewide bobcat population is currently unknown and density information for Alabama is currently not available. Given that bobcats are distributed throughout all rural habitats (excluding developed areas and open water), the cumulative area of these classifications in Alabama is about 121,745 km^2 (47,000 mi^2) (see Table 4.1). If bobcats only occupied 50% of those land classifications in the State and the density of bobcats in the State was estimated at a low of 0.13 bobcats per square mile to a high of 1.09 bobcats per square mile, the statewide population could be estimated at between approximately 3,060 and 25,600 individuals. Bobcats can be found in a variety of habitats, including some developed areas, so bobcats occupying only 50% of the land area of the State would be unlikely. However, similar to the other furbearing species, the analysis will evaluate bobcats occupying only 50% of certain land classifications to provide a minimum population estimate to determine the magnitude of the proposed removal by WS under a worst-caste scenario.

Bobcats are classified as both a game animal and a furbearing animal in Alabama and may be harvested during hunting and trapping seasons. During the hunting and trapping season, the ADCNR allows an unlimited number of bobcats to be harvested during the length of the season with no possession limit during the length of the season. Between the 2009 and the 2013 hunting seasons, the ADCNR estimated that hunters harvested 39,058 bobcats in the State (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an average of 7,800 bobcats harvested per year by hunters only. Bobcats can also be harvested during the annual trapping season in the State. During the 2012-2013 hunting and trapping seasons, the ADCNR estimated that hunters harvested 12,324 bobcats in the State (Metzler 2013) and trappers harvested 258 bobcats (M. Sievering, ADCNR pers. comm. 2014).

WS conducted five technical assistance projects from FY 2009 through FY 2013 associated with damage or threats caused by bobcats. Those requests for assistance were primarily associated with threats to aviation safety and threats of rabies transmission. From FY 2009 through FY 2013, WS intentionally removed five bobcats to reduce strike risks at airports. In anticipation of additional efforts, WS reasonably expects the total removal of bobcats would not exceed five bobcats annually in Alabama to resolve requests to manage damage to resources and threats to human health and safety. If the number of bobcats harvested during the 2012-2013 hunting and trapping seasons were representative of harvest that could occur in the future, the cumulative removal by hunters, trappers, and WS, if WS' removal reached five bobcats, would represent 49.2% of a statewide population estimated at 25,600 bobcats. If the annual removal by WS of five bobcats was combined with the average number of bobcats harvested in the State by hunters from 2009 through 2013, the cumulative removal would represent 30.5% of the a statewide population estimated at 25,600 bobcats. However, the actual statewide population likely exceeds 25,600 bobcats given the parameters used to derive the estimate. In addition, the annual harvest exceeds the lowest population estimate, which indicates bobcat densities in the State exceed 0.13 bobcats per square mile.

If bobcats occupied all of those land classifications in the State that represented suitable habitat for bobcats and the density of bobcats in the State was estimated at 1.09 bobcats per square mile, the

statewide population could be estimated at 51,200 individuals. If the statewide population of bobcats were 51,200 bobcats, the cumulative harvest would represent 24.6% of the population based on the 2013 harvest of bobcats and WS' removal reaching five bobcats. If the average number of bobcats harvested annually by hunters between 2009 and 2013 were more representative of the annual harvest, the cumulative removal would represent 15.2% of a statewide population estimated at 51,200 bobcats.

As stated previously, the ADCNR, with management authority over bobcats in the State, places no restrictions on the number of bobcats that can be harvested annually during the length of the hunting and trapping seasons, which provides an indication the statewide density is sufficient that overharvest is unlikely to occur. In addition, the removal of five bobcats by WS would represent 0.04% of the number of bobcats harvested by hunters and trappers during the 2012-2013 harvest seasons and 0.1% of the average number of bobcats harvested by hunters in the State between 2009 and 2013. The proposed removal of bobcats by WS in the State would be of low magnitude when compared to the number of bobcats harvested by hunters and trappers in the State.

NEW WORLD RODENT POPULATION INFORMATION AND EFFECTS ANALYSIS

The New World rodents are those rodents that do not live in close association with people and inhabited North America prior to colonial settlement by Europeans. New World rodents found in Alabama that WS could receive requests for assistance with include the eastern harvest mouse, deer mouse, white-footed mouse, cotton mouse, rice rat, and the hispid cotton rat. Some of the New World rodents will occasionally nest in buildings, do cause some damage to reseeding programs, consume and contaminate agricultural crops on a limited basis and play a role in the transmission of zoonotic diseases. However, they typically live in areas away from human activity, do not live in large colonies, and do not cause the same level of damage that Old World rodents can. WS has previously addressed requests for assistance associated with those species through technical assistance. Technical assistance was provided through the identification of species causing damage and collection for research purposes in small mammal studies, primarily conducted in association with airports and airport safety.

The eastern harvest mouse is a small mouse that weighs nine to 14 g (1/3 to ½ oz), with a rich brown color above and a paler belly and underside of the tail (National Audubon Society 2000). It is found primarily in old fields, roadside ditches, honeysuckle thickets, and wet meadows with spotty dense vegetation (Gottschang 1965). Nests of harvest mice are made of finely shredded grasses and are globular in shape. They are usually built on the ground in thick clumps of grass (Kaye 1961). The eastern harvest mouse can breed at three months of age and will have multiple litters of two to five young each year (National Audubon Society 2000). Population densities vary greatly and range from 8.75 to 44.4 per hectare (3 to 17 per acre) (Stalling 1997). The range of the eastern harvest mouse in Alabama is poorly known. Historically, the harvest mouse was considered common in old fields, containing dense weeds and grasses in the State; however, the population may be declining today (ADCNR 2014*b*). If a population decline were occurring, changes in agricultural practices would likely be factors contributing to the decline. The ADCNR (2014) considered the eastern harvest mouse to be a species of "*moderate conservation concern*" in the State.

The white-footed mouse is a medium-sized mouse that weighs 15 to 30 g (1/2 to 1 oz), with rich reddish brown on upperparts and white belly and feet. They are found primarily in warm, dry forests and brush lands, and may be found in brushy areas adjacent to agricultural crops (National Audubon Society 2000). They will nest nearly anywhere including, abandoned bird or squirrel nests, old logs, underground, in stumps, and in buildings. White-footed mice have two to four litters per year with two to six young in each litter. Young females can breed at 10 weeks of age. Population densities vary from ten to 30 mice per hectare (4 to 12 per acre) (National Audubon Society 2000). The range of the white-footed mouse in the State is also poorly known; however, the mouse is considered common in the woodlands of the

northern two-thirds of the State (ADCNR 2014*b*). The white-footed mouse can be found in wooded areas with fallen logs, brush piles, and rocks along with wooded fencerows and streams. The ADCNR (2014) considers the white-footed mouse to be a species of "*lowest conservation concern*" within the State.

The deer mouse is sometimes difficult to distinguish from the white-footed mouse. It is similar in size at 18 to 35 g (2/3 to 1 ¼ oz) and is extremely variable in color ranging from pale grayish buff to deep reddish brown, but will always have a distinct difference between dark upper and light undersides. They occupy nearly every dry land habitat within their range (National Audubon Society 2000). Nesting occurs in burrows that occur in trees, stumps, buildings, and underground. Deer mice have two to four litters per year with three to six young. Females can breed at five to six weeks of age and population densities vary from 25 to 37 per hectare (10 to 15 per acre) (National Audubon Society 2000). Information associated with the deer mouse in the State is currently not available (ADCNR 2014*b*).

The cotton mouse is a large mouse that weighs 28 to 51 g (1 to 1 ¾ oz), with a dark brown upper body and lighter underside. They are found in swamplands and forested areas along streams and agricultural borders (National Audubon Society 2000). Nesting occurs in trees, buildings, and under logs. They regularly climb trees. Cotton mice have more than four litters per year with three to four young per litter. Population densities range from two to four per hectare (0.8 to 1.6 per acre) (Wolfe and Linzey 1977). The cotton mouse is considered common within the State and can be found statewide in bottomland hardwood forests, dense underbrush, old fields, upland forests, hammocks, and swamps (ADCNR 2014*b*). The ADCNR (2014*b*) considers the cotton mouse to be a species of "*lowest conservation concern*".

The rice rat is a medium sized rat that measures 226 to 305 mm and weighs 40 to 80 g (1.4 to 2.8 oz). The body is grayish-brown, the belly is gray or tawny, and the tail is long, scaly, and paler above than below. Rice rats are primarily nocturnal and semi-aquatic (National Audubon Society 2000). A fair portion of their diets includes freshwater mussels, baby turtles, fiddler crabs, snails, and insects, as well as seeds and succulent plants (Wolfe 1982). They inhabit marshy areas primarily of grasses and sedges. Nesting occurs on high ground at the base of debris. Rice rats have from one to seven young several times per year and females can breed at seven weeks of age (National Audubon Society 2000). The rice rat can be found statewide in Alabama and is considered common in wet meadows and dense vegetation along ditches, ponds, swamps, streams, and marshes. The ADCNR has classified the rice rat as a species of "*lowest conservation concern*".

The hispid cotton rat is a medium sized rat that weighs 113 to 198 g (4 to 7 oz) and measures 80 to 320 mm. The body is covered in long coarse hair mixed with buff and black above, whitish below (National Audubon Society 2000). This rat prefers dense, grassy areas, which may include salt marshes, grasslands, brushy pastures, canal banks, roadsides, agricultural crop edges with areas of dense broom sedge, and honeysuckle. Hispid cotton rats usually have five to six young per litter and as many as nine litters per year. The young become sexually mature at 40 days old. Overall populations of cotton rats fluctuate from year to year but are found regularly at 25 to 30 per hectare (10 to 12 per acre) (National Audubon Society 2000). The hispid cotton rat can also be found statewide but are more commonly found in grassy areas associated with fields and along roadways. Populations of the hispid cotton rat can fluctuate greatly between years, but they are generally considered abundant in densely vegetated habitats of the State (ADCNR 2014*b*). The ADCNR considers the hispid cotton rat to be a species of "*lowest conservation concern*".

Of all of the New World rodents, the hispid cotton rat is the species most likely to cause damage to crops, including cotton, rice, alfalfa, grains, vegetables, fruits, squash, sugarcane, corn, sweet potatoes, and melons. Large populations can cause damage to canal banks as well (Espinoza and Rowe 1979). The hispid cotton rat has been extending its range northward over the last 50 to 100 years. They were

captured during 2008 in central Virginia – the first record of this species in Virginia (Francl and Meikle 2009).

From FY 2009 through FY 2013, WS provided no technical assistance nor was WS requested to provide direct operational assistance to address New World rodent damage. Although those species do not cause direct hazards to aviation safety, they serve as prey attractants to raptors and mammalian predators that may pose serious threats to aircraft safety. Typically, any lethal removal by WS would be associated with small mammal trapping surveys at airports/airbases or with operational activities associated with managing a prey base to reduce hazards created by avian or mammalian predators in the aircraft operations area. Removal could also occur to alleviate agricultural damage at agricultural facilities. The level of WS' involvement in those activities may vary considerably from year to year depending on the number of requests for assistance received. Based upon anticipated requests for WS' assistance, it is possible that WS could kill up to 50 individuals each year of any of the New World rodents under the proposed action alternative. When receiving requests for assistance associated with mice and rats, the WS program in Alabama would follow WS Directive 2.345.

Although population estimates are not available, New World rodents are generally prolific breeders and are generally abundant throughout their range. Due to the species' relatively high reproductive rates, the limited removal that could occur, and because management activities would be restricted to specific local sites, WS' activities under the proposed action would have minimal impacts on overall populations of those species in the State.

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 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). They sometimes breed with domestic dogs producing hybrids called "*coydogs*" (National Audubon Society 2000). The size of coyotes varies from 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. 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 their most common prey species. Other items in the coyote's diet include carrion, rodents, deer (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 prey on small domestic pets, such as cats and dogs (Voigt and Berg 1987).

Coyotes breed between January and March and are able to breed prior to reaching one year of age (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 causing large annual variations in total number of coyotes breeding. In a Texas study, 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 one 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).

The coyote is probably the most extensively studied carnivore (Bekoff 1982), and considerable research has been conducted on population dynamics. Coyote densities as high as two per km^2 (5 per mi^2) have been reported in the southwestern and west-central United States, but are lower in other portions of the country, including eastern North America; although, few studies have accurately determined densities (Voigt and Berg 1987). Although coyote densities vary based on local habitat quality, Knowlton (1972) published that density estimates of 0.5 to 1.0 coyotes per mi^2 would likely be applicable to coyote densities across much of their range. However, methods for estimating carnivore populations are crude and often produce estimates with broad confidence intervals (Crawford et al. 1993).

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 determine absolute coyote densities accurately over large areas is prohibitive (Connolly 1992) and the cost 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) (Knowlton 1972, USDI 1979). Although coyote densities vary considerably between habitat types and vary based on numerous environmental variables, Knowlton (1972) concluded that coyote densities might 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 over the entire range of the coyote in the United States. Such an estimate is speculative but represents some the best available information for estimating coyote populations.

Population modeling information 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).

Actual population or density estimates for coyotes in Alabama are not available. Coyotes are common throughout the State and inhabit a variety of habitats. Given that coyotes are distributed throughout all rural habitats (excluding developed areas and open water), the cumulative area of these classifications in Alabama is about 121,745 km^2 (47,000 mi^2) (see Table 4.1). If coyotes only occupy 50% of the rural habitat in Alabama and the density of coyotes in the State ranges from 0.5 coyotes per square mile to five coyotes per square mile, the statewide population could be estimated to range from 11,800 coyotes to a high of 117,500 coyotes.

Coyotes can be found statewide in Alabama and are common in all habitats, including urban habitats, and they are considered a species of "*lowest conservation concern*" (ADCNR 2014*b*). Coyotes are classified as a both a game animal and a furbearing animal in Alabama with a continuous open harvest season and no limit on the number of coyotes that can be harvested (ADCNR 2013). Between 2009 and 2013, an estimated 206,653 coyotes have been harvested by hunters in the States (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an average harvest of 41,331 coyotes per year in the State. During the 2012-2013 hunting/trapping seasons, Metzler (2013) estimated that 44,519 coyotes were harvested by hunters in the State and 603 coyotes were harvested by trappers (M. Sievering, ADCNR pers. comm. 2014). Based on the number of coyotes harvested between 2009 and 2013 during the hunting/trapping seasons, the statewide population exceeds 11,800 coyotes. There are no indications that coyote populations in the State are showing rapid declines from overharvest. The ADCNR (2013) continues to allow coyotes to be harvested in the State during hunting and trapping season with no limit on the number of coyotes that hunters and trappers can harvest. In addition, the ADCNR has classified the coyote as a species of "*lowest conservation concern*" and indicated that coyotes are "*common in all habitats*" statewide, including urban areas (ADCNR 2014*b*).

Between FY 2009 and FY 2013, WS conducted 77 technical assistance projects associated with damage and threats of damages caused by coyotes, which includes those projects where WS provided information on managing damage or threats caused by coyotes. Requests for assistance were primarily associated with threats to human safety and predation of animals. WS also provided direct operational assistance associated with coyotes from FY 2009 through FY 2013, primarily at airports where coyotes posed strike risks to aircraft. During direct operational assistance projects, WS lethally removed 81 coyotes from FY 2009 through FY 2013, which is an average annual removal of 16 coyotes. The highest annual lethal removal occurred during FY 2013 when WS removed 34 coyotes to alleviate damage or threats of damage in the State. In addition, WS dispersed nine coyotes to alleviate the threat of damage between FY 2009 and FY 2013.

Based on the number of requests for assistance received previously and the number of coyotes killed by WS to resolve damage, WS could removal up to 50 coyotes annually under the proposed action to alleviate damage. As stated previously, hunters and trappers in the State harvested 45,122 coyotes in the State during the 2012-2013 hunting/trapping seasons, while hunters have harvested an average of 41,331 coyotes per year from 2009 through 2013. If WS had lethally removed 50 coyotes during 2013, the removal would have represented 0.1% of the coyotes harvested during the 2012-2013 hunting/trapping seasons and 0.1% of the average number of coyotes harvested per year from 2009 through 2013. If the average annual harvest of coyotes by hunters from 2009 through 2013 and the harvest of coyotes by trappers during 2013 were representative of future harvest, the cumulative removal of coyotes by hunters, trappers, and WS would represent 35.7% of the estimated statewide population. Removal of 35.7% of the estimated population would be below the 70% harvest level required to cause population declines

calculated by Connolly and Longhurst (1975) and Connolly (1995). However, the statewide population of coyotes likely exceeds 117,500 coyotes given the parameters used to calculate the estimate. Similar to the other furbearing species, the analysis estimated a statewide coyote population based on coyotes occupying only 50% of some land classifications that is intended to provide a minimum population estimate, which can be used to evaluate the magnitude of the proposed removal by WS under a worst-case scenario.

Although exact population estimates for coyotes in Alabama and annual harvest rates are not available, the unlimited harvest allowed by the ADCNR for the species during hunting and trapping seasons indicates the species is not at risk of overharvesting. Since the statewide population could reasonably be expected to be higher than 117,500 coyotes, the proposed removal of 50 coyotes annually and the cumulative harvest of coyotes would actually be a smaller percentage of the actual statewide population.

EASTERN CHIPMUNK POPULATION INFORMATION AND EFFECTS ANALYSIS

The eastern chipmunk is a ground-dwelling animal, typically 13 to 15 cm (5 to 6 inches) long and weighing 90 g (3 oz). Their tail is eight to 10 cm (3 to 4 inches) long and hairy, but it is not bushy (Williams and Corrigan 1994). Generally found in forested habitats, chipmunks have large, fur-lined internal cheek pouches for carrying nuts and seeds. They have black and white facial stripes, and five dark stripes separated by four pale ones, on the back and sides of their bodies. Chipmunks cache a great deal of food in the form of seeds, nuts, fruits, and sometimes, green vegetation and insects. They hibernate in the winter, but awaken about every two weeks to feed, since they do not store body fat before hibernation.

They are daytime animals, and are usually most active in early morning and late afternoon. They live mostly on the ground, but their nests may be in an underground burrow, or a hollow tree limb (National Audubon Society 2000). Burrows are often well hidden near objects, such as stumps, woodpiles, brush piles, basements, and garages or other buildings. The burrow entrance is usually about five cm (2 inches) in diameter with no obvious mounds of soil around them (Williams and Corrigan 1994, National Audubon Society 2000). Chipmunks can be found across most of the eastern United States, except the extreme south and along the southeastern seaboard (Williams and Corrigan 1994, National Audubon Society 2000).

Eastern chipmunks have two mating periods that occur during early spring and again during the summer or early fall. There is a 31-day gestation period, producing two to five young (Williams and Corrigan 1994). First year females not breeding in early spring may produce litters in late July or August (National Audubon Society 2000). The young are sexually mature within one year. Adults may live up to three years (Williams and Corrigan 1994).

Population densities of eastern chipmunks typically are five to 10 animals per hectare (2 to 4 per acre) (Burt and Grossenheider 1976), and may be as high as 24 chipmunks per hectare (10 per acre) if sufficient food and cover are available. Home ranges often overlap among individuals and are usually less than 92 m (100 yards) across (Williams and Corrigan 1994).

Throughout their North American range, chipmunks are considered minor agricultural pests. Most conflicts with chipmunks are nuisance problems. However, when chipmunks are present in large numbers they can cause structural damage by burrowing under patios, stairs, retention walls, or foundations. They may also consume flower bulbs, seeds, or seedlings as well as birdseed, grass seed, and pet food that is not stored in rodent-proof storage containers (Williams and Corrigan 1994).

In Alabama, chipmunks are considered common and can be found statewide, except for the extreme southwestern and southeastern regions of the State. Chipmunks can be found in wooded areas of the State that have dense canopies and sparsely covered forest floors. They can also be found in open brushy habitats, along wooded ravines and streams, and in wooded urban areas (ADCNR 2014*b*). The ADCNR (2014*b*) considered the chipmunk to be a species of "*lowest conservation concern*".

Chipmunks are not classified as a protected non-game species in Alabama and can be lethally removed when causing damage. No statewide population estimates are currently available for chipmunks. Therefore, the best available information will be used to estimate statewide populations. Chipmunks are most likely to utilize deciduous forest as preferred habitat. There are approximately 31,750 km^2 (12,267 mi^2) of deciduous forest in Alabama (see Table 4.1). If only 50% of that land classification supported chipmunks, under a worst-case scenario, with a conservative estimate of one chipmunk per acre, and assuming that only one chipmunk occupied a home range and no home ranges overlapped, the conservative statewide population could be estimated at 3.9 million chipmunks. This would be a worst case scenario since chipmunk populations are likely to inhabit a much larger portion of those lands, they typically occur at much higher densities, and no urban or suburban lands were included in the calculations where chipmunks are frequently found.

Between FY 2009 and FY 2013, WS live-captured one chipmunk to alleviate damage in the State and released the animal into appropriate habitat. Based upon anticipated requests for WS' assistance, it is possible that WS could kill up to 20 chipmunks each year in the State under the proposed action alternative. When receiving requests for assistance associated with chipmunks, the WS program in Alabama would follow WS Directive 2.345. Removing 20 chipmunks would represent 0.001% of the estimated statewide population annually and would be of low magnitude when compared to the actual statewide population of chipmunks. WS anticipates the annual removal of up to 20 chipmunks to represent a much smaller percentage of the actual statewide population, since the population estimate was derived from a small portion of the land area occupied by chipmunks in the State.

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 the cottontail rabbit species. Of the nine species of cottontails found north of Mexico, only swamp rabbits (*Sylvilagus aquaticus*), Allegheny cottontails (*Sylvilagus obscurus*), and eastern cottontails can be in Alabama. Damage associated with rabbits is almost, without exception, caused by the eastern cottontail (Craven 1994).

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 nearly the same size and color. These animals 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. They are rarely found in dense forest or open grasslands, but fallow crop fields, such as those in the Conservation Reserve Program 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).

The eastern cottontail can be found statewide in Alabama and is considered common throughout the State (ADCNR 2014*b*). Eastern cottontails are also the most abundant rabbit species with the widest distribution in the State (ADCNR 2014*b*). The ADCNR (2014*b*) considered the eastern cottontail to be a species of "*lowest conservation concern*". Cottontails are considered a game animal by the ADCNR with a regulated hunting season. During the hunting season, eight rabbits can be harvested each day and eight harvested rabbits can be in possession during the length of the season. Between the 2009 and 2013 hunting season, an estimated 681,399 rabbits were harvested in the State (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an average annual harvest of 136,280 rabbits. During the 2013 hunting season, hunters harvested an estimated 101,544 rabbits in the State (Metzler 2013).

The statewide population of cottontail rabbits in the State is currently unknown. Therefore, the best available information will be used to estimate a statewide population. The land cover classifications most likely to encompass suitable cottontail rabbit habitats are mixed forest, shrub/scrub, and hay/pasture, which cumulatively total approximately 39,700 km^2 (15,300 mi^2) in Alabama (see Table 4.1). If only 50% of those lands supported cottontails, under a worst case scenario, with a conservative estimate of one rabbit per acre, and assuming that only one rabbit occupied a home range and no home ranges overlapped, the conservative statewide populations could be estimated at nearly 4.9 million rabbits. This would be a worst-case scenario since rabbit populations are likely to inhabit a much larger portion of those lands, and rabbits typically occur at much higher densities.

From FY 2009 through FY 2013, WS conducted one technical assistance project in Alabama to address eastern cottontail damage. During direct operational assistance to address aircraft strike risks associated with avian and mammalian predators caused by high densities of rabbits at airports, WS lethally removed eight cottontail rabbits from FY 2009 through FY 2013. Those rabbits were removed as part of an integrated management plan at airports to protect human health and safety and aircraft. In addition, one cottontail was lethally removed unintentionally and one cottontail was live-captured unintentionally and released during other damage management activities conducted from FY 2009 through FY 2013.

Based on previous requests for assistance and in anticipation of additional efforts to address damage, WS could lethally remove up to 30 rabbits annually to alleviate damage or threats of damage. If the population of cottontail rabbits in the State remained at least stable, WS' removal of up 30 cottontails annually would represent 0.001% of the minimum statewide population of 4.9 million rabbits. However, WS anticipates that removal of up to 30 rabbits annually would represent a much smaller percentage of the actual statewide population since the population is likely much higher than 4.9 million rabbits. If WS had lethally removed 30 rabbits during 2013, the removal would have represented 0.03% of the estimated harvest of rabbits in the State during the 2013 season and 0.02% of the average number of rabbits harvested in the State from 2009 through 2013. Cottontails could also be lethally removed unintentionally during other damage management activities conducted by WS; however, WS does not anticipate the cumulative lethal removal of cottontails to exceed 30 rabbits annually.

Studies show that even if hunters harvest as many as 40% of the rabbits available in autumn, the rabbit population the following year would not be adversely affected because of the tremendous reproductive potential of rabbits (Fergus 2006). Therefore, WS' proposed removal would not adversely affect the ability to harvest rabbits during the annual regulated hunting season in the State.

EASTERN MOLE POPULATION INFORMATION AND EFFECTS ANALYSIS

Moles may be distinguished from voles or shrews with which they are often confused by noting certain characteristics. They have a hairless, pointed snout extending nearly 13 mm (0.5 inches) in front of the mouth opening. The small eyes and the openings of the ear canals are concealed in the fur and there are

no external ears. The forefeet are very large and broad, with palms wider than they are long and the toes are webbed to the base of the claws, which are broad and depressed. The hind feet are small and narrow, with slender, sharp claws. In North America, there are seven species of moles. Three of those mole species occur east of the Rocky Mountains. In Alabama, the eastern mole is the most common and widespread mole species.

The eastern mole exhibits distinct sexual dimorphism, males are generally larger than females. Male eastern moles measure 103 to 208 mm (4.06 to 8.19 inches); females measure 129 to 168 mm (5.08 to 6.61 inches). Male eastern moles weigh 40 to 140 g (1.41 to 4.94 ounces); females weigh from 32 to 90 g (1.13 to 3.17 ounces) (Smithsonian National Museum of Natural History 2012). The eastern mole is grayish brown, darker above and paler or browner beneath and when viewed from different angles, the hair often has a silvery sheen. There is often an orange strip on the belly of eastern moles from skin gland secretions. The orange strip on the belly usually appears brighter in males (Schwartz and Schwartz 2001). The fur is short, fine, and directionless, it can lay flat facing forward or backward, depending on whether the animal is moving forward or backward through a tunnel (Smithsonian National Museum of Natural History 2012). Gestation is from four to six weeks and litter size ranges from two to five, young leave the nest at four weeks of age (Yates and Schmidly 1978, Schwartz and Schwartz 2001). The eastern mole has the largest range of any North American mole, occurring from Northeastern Mexico north to the upper Midwest and Southern Ontario, Canada and east from Florida to Southern New England where favorable soils are found (Yates and Schmidly 1978, Smithsonian National Museum of Natural History 2012). Eastern mole habitat includes meadows, pastures, lawns, open woodlands, gardens, and stream banks where the soil is loose and well drained but moist (Schwartz and Schwartz 2001). Population densities ranging from 4.9 to 7.4 eastern moles per ha (2 to 3 moles per acre) were reported by Schwartz and Schwartz (2001) as being high, while Hartman and Krentz (1993) reported 1.3 to 3.0 eastern moles per ha (0.5 to 1.2 per acre) in South Carolina.

Moles eat several kinds of invertebrates including earthworms, grubs, beetles, beetle larvae, centipedes, ants, wasps, spiders, and flies, among others. They also eat seeds and some other plant materials. The most common mole damage are tunnels in gardens, lawns, golf courses and other grassy areas, resulting from their incessant search for food. They can eat between 70% and 100% of their body weight each day (Godfrey and Crowcroft 1960, Holbrook and Timm 1986, Henderson 1994). Moles can also store food as well (Henderson 1994).

Eastern moles live in the seclusion of underground burrows, coming to the surface only rarely, and then often by accident. Researchers believe moles are solitary. On several occasions, two or even three moles have been trapped at the same spot, but that does not necessarily mean they had been living together in a particular burrow. Networks of runways made independently occasionally join otherwise separate burrows (Godfrey and Crowcroft 1960, Henderson 1994).

During the mating season, male moles will seek out a female in her burrow to mate (National Audubon Society 2000). Moles have few natural enemies, which allows them to maintain populations by producing only one annual litter of two to six (National Audubon Society 200) or three to five offspring (Henderson 1994) each year. The gestation period of moles is approximately 42 days and young are born primarily in March and early April (Henderson 1994). Home range estimates for moles range from 1,385 to 114,486 square feet (Yates and Pedersen 1982).

The distribution of the eastern mole in the State is poorly known; however, they can be found statewide and are common in many areas (ADCNR 2014*b*). The eastern mole is found throughout all of Alabama where they inhabit open fields, waste areas, lawns, gardens, and sometimes forests in well-drained loose soils. No population estimates are currently available for moles in Alabama. However, eastern moles are considered a species of "*low conservation concern*" (ADCNR 2014*b*). Since moles can generally be

found in non-forested areas and if moles were only found in rural areas, the cumulative area of the most likely habitat classifications (grasslands, pastures/hay) would be approximately 21,500 km^2 (8,300 mi^2) (see Table 4.1). If only 50% of those land classifications supported moles, with a density estimate of 0.5 to 1.2 moles per acre, assuming that only one mole occupied each home range, and home ranges do not overlap, a statewide mole population could be estimated to range from 1.3 million moles to 3.2 million moles.

From FY 2009 through FY 2013, WS conducted one technical assistance project associated with the eastern mole. Damages were reported to landscaping, turf and flowers, and property caused by the burrowing and digging behavior of moles. No direct operational assistance was provided by WS from FY 2009 through FY 2013 associated with moles and no moles were lethally removed by WS in Alabama.

WS anticipates continuing to address most requests for assistance associated with moles by providing people with technical assistance. When dealing with most requests for assistance associated with moles, WS would refer those persons to other entities for direct operational assistance. However, WS could be requested to address moles directly through operational assistance. If WS was requested to provide operational assistance with managing damage associated with moles, WS anticipates that up to 50 moles could be lethally removed annually.

If the mole population ranged from1.3 million to 3.2 million moles statewide, the potential lethal removal of up to 50 moles by WS annually would represent a small percentage of the population and would be of low magnitude. The number of moles lethally removed by other entities to alleviate damage in the State is not currently available. However, the cumulative removal of moles is not expected to reach a level where adverse effects would occur to the population of eastern moles in Alabama.

FERAL AND FREE-RANGING CAT POPULATION INFORMATION AND EFFECTS ANALYSIS

Feral cats are domesticated cats living in the wild. They are small in stature, weighing from three to eight pounds (1.4 to 3.6 kg), standing eight 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 four km^2 (1.5 mi^2). After several generations, feral cats can be considered 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). American birds face an estimated 117 to 157 million exotic predators in the form of free-ranging domestic cats, which are estimated to kill at

least one billion birds every year in the United States. Cats have contributed to declines and extinctions of birds worldwide, with feral cats considered one of the most important drivers of global bird extinctions (Dauphine and Cooper 2009).

Feral and free-ranging cats also pose a health and safety threat to household pets. Feral and stray cats are at increased risk of feline immunodeficiency virus, feline leukemia, feline panleukopenia virus, also known as feline distemper, and rabies. All of these diseases can be transmitted to unvaccinated pet cats allowed to free-range. The feline panleukopenia virus is highly contagious and the virus may survive in the environment for up to a year. In addition, the virus may be transmitted to indoor cats through indirect routes, such as on shoes (Berthier et al. 2000, Truyen et al. 2009). Feral and free-ranging cats serve as a reservoir for wildlife and human diseases, including cat scratch fever, histoplasmosis, leptospirosis, mumps, plague, rabies, ringworm, salmonellosis, toxoplasmosis, tularemia, and various parasites (Fitzwater 1994).

The number of feral cats in Alabama is unknown. Feral and free-ranging 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 as providing some benefit to the natural environment by eliminating predation and competition from an introduced species.

Requests for assistance received by WS involving feral cats have primarily been associated with human safety threats associated with cats and damage to property. During direct operational assistance projects conducted by WS from FY 2009 through FY 2013, WS lethally removed four feral cats intentionally across the State. In addition, 30 feral or free-ranging cats were intentionally live-captured and released unharmed or were relinquished to a local animal control facility for care and to determine their adoptability. Between FY 2009 and FY 2013, 89 cats were unintentionally live-captured by WS across the State during other damage management activities, primarily activities associated with the ORV program (USDA 2009*a*). Those cats unintentionally live-captured were released unharmed or relinquished to a local animal control facility.

In most cases, WS would employ live-capture methods to alleviate damage or threats of damage associated with feral or free-ranging cats. Once live-captured, WS would transfer custody of the cats to a local animal control facility. After relinquishing the feral or free-ranging cats to a local animal control facility, the care and the final disposition of the cat would be the responsibility of the animal control facility. However, in some cases, WS may be requested to remove feral cats to alleviate damage or threats. In anticipation of WS receiving requests to remove feral cats, up to 100 feral cats could be lethally removed by WS annually. Feral cats could also be lethally removed unintentionally during other damage management activities; however, WS does not anticipate the cumulative lethal removal of feral cats to exceed 100 cats annually. Based upon the above information, WS' limited removal of feral cats would have minimal effects on local or statewide populations Alabama. Some local populations may be temporarily reduced at a local site if cats were removed using non-lethal or lethal methods. In those cases where feral cats were causing damage or were creating a nuisance and complete removal of the local population could be achieved, this could be considered as providing some benefit to the natural environment since feral cats are not considered part of the native ecosystem.

FERAL AND FREE-RANGING DOG POPULATION INFORMATION AND EFFECTS ANALYSIS

Like domestic dogs, feral dogs can manifest themselves in a variety of shapes, sizes, colors, and even breeds. McKnight (1964) noted German shepherds, Doberman pinschers, and collies as breeds that 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 people, 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 people 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 people. Since many feral dogs have been pursued, shot at, or trapped by people, their aggressive behavior toward people is not surprising. For example, a feral dog caught in Arkansas had numerous lead pellets imbedded under the skin, which Gipson (1983) indicated was likely a testament to the relationship between some people and feral dogs.

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 gathering sites 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 the tracks 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 where people permit their dogs to roam free or where people 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, with size likely 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 km^2 (50 mi^2) or more (Green and Gipson 1994).

Feral dogs are often found in forested areas or scrublands 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 (1983) 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. Gipson (1983) indicated 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 (1975) 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. Nesbitt (1975) 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 to requesters associated with dogs during 15 projects from FY 2009 through FY 2013. Most requests for assistance were referred to a local animal control facility since requesters were usually unable to determine if a dog was feral or a free-ranging pet. From FY 2009 through FY 2013, WS lethally removed five feral dogs during damage management activities in Alabama. WS has also live-captured and released 27 feral dogs during damage management activities conducted from FY 2009 through FY 2013 and dispersed 24 feral dogs using non-lethal methods. In addition, WS live-captured two feral dogs unintentionally between FY 2009 and FY 2013, which were released unharmed. Based on previous requests for assistance and in anticipation of additional efforts, WS could lethally remove up to 100 feral dogs per year under the proposed action alternative. Feral dogs could also be lethally removed unintentionally during other damage management activities; however, WS does not anticipate the cumulative lethal removal of feral dogs to exceed 100 dogs annually.

In most cases, WS would employ non-lethal harassment methods to disperse feral dogs or 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 Alabama. Any activities involving lethal control actions by WS would be restricted to isolated individual sites. Some local populations may be temporarily reduced because of removals 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.

FERAL SWINE POPULATION INFORMATION AND EFFECTS ANALYSIS

Feral swine, also known as "*wild pigs*", "*wild boars*," and "*feral hogs*", are medium-sized hoofed mammals that look like domestic pigs. They 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. These tusks curl out and up along the sides of the mouth. Lower canines are also prominent but smaller. Young feral swine have pale longitudinal stripes on the body until they are six 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 lbs.), while females may weigh 35 to 150 kg (77 to 330 lbs.). Feral swine mate any time of year but peak breeding times usually occur from January through February and again in early summer. Litter sizes are usually three to 12 piglets (National Audubon Society 2000). Given adequate nutrition, wild swine populations can double in just four months. Feral swine may begin to breed before six months of age and sows can produce two litters per year (Barrett and Birmingham 1994). Feral swine are found in variable habitats in much of the United States. Populations are usually clustered around areas with ample food and water supplies. 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. Populations are usually clustered around areas with ample food and water supplies.

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 tree seedlings, and erosion of soils (Barrett and Birmingham 1994). Food sources for feral swine includes acorns, hickory nuts, pecans, beech nuts, and a wide variety of vegetation including roots, tubers, grasses, fruit, and berries, but feral swine 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 deer fawns (National Audubon Society 2000). They 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 Table 1.3).

In Alabama, feral swine are classified as a game animal with no closed season and no limits on the number that can be harvested (ADCNR 2013). Between 2009 and 2013, hunters harvested an estimated 494,346 feral swine in the State (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an annual harvest of 98,869 feral swine in the State. During the 2013 hunting season, an estimated 151,537 feral swine were harvested in the State (Metzler 2013). The total feral swine population in Alabama is unknown; however, they can be found in every county of the State (Wild Hog Working Group 2012). It is anticipated that feral swine populations in Alabama will continue to increase due to their prolific breeding behavior, adaptability, and additional swine being illegally released into the wild.

Feral swine damage may be addressed by WS in response to requests by federal agencies, state agencies, or the public in Alabama. Agricultural producers may request assistance with managing damage to standing crops or disease threats to domestic livestock. Natural resource managers may request assistance to protect natural areas, parks or recreation areas, or T&E species. Public health agencies may request assistance in reducing feral swine densities where disease threats to people may be present (see Table 1.3). WS may use any legal methods among those outlined by Barrett and Birmingham (1994) and West et al. (2009) as suitable for feral swine damage management, including the use of aircraft to shoot feral swine.

Between FY 2009 and FY 2013, WS conducted 200 technical assistance projects associated with feral swine in Alabama. Those persons requesting assistance reported damage to agricultural crops, landscaping, turf, and golf courses. Damages occur primarily from the rooting and wallowing behaviors

of feral swine. From FY 2009 through FY 2013, WS removed a total of 794 feral swine to reduce damage and for disease surveillance in Alabama. Removal of a small number of feral swine or a single individual will sometimes reduce damage considerably where natural resources, agriculture, or property is affected (Barrett and Birmingham 1994). However, damage may increase dramatically in areas where feral swine have ample resources and opportunity to expand.

Based on previous requests for assistance and the likely continued spread of feral swine in Alabama, WS anticipates that up to 5,000 feral swine could be killed annually in the State to alleviate damage associated with requests for assistance and for disease surveillance. However, such population reduction is not expected to affect the overall statewide population feral swine because of the high reproductive rates exhibited by these animals (Barrett and Birmingham 1994). Damage management activities associated with feral swine would target single animals or local populations of feral swine at sites where their presence was causing unacceptable damage or threats to agriculture, human health and safety, natural resources, or property. Feral swine are not native to North America, including Alabama. The National Invasive Species Council specifically lists feral swine as an invasive species pursuant to Executive Order 13112. Executive Order 13112 directs federal agencies to address invasive species to the extent practicable and permitted by law. In addition, the ADCNR (2014) has stated, "[e]*very opportunity for eradication should be undertaken*" concerning feral swine.

Any damage management activities involving lethal methods by WS would be restricted to isolated individual sites. Some local populations may be temporarily reduced because of damage management activities aimed at reducing damage at a local site. In those cases where feral swine were causing damage or they posed a threat of damage and complete removal of the local population could be achieved, this could be considered as providing some benefit to the natural environment since feral swine are not considered part of the native ecosystem.

FOX AND GRAY SQUIRREL POPULATION INFORMATION AND EFFECTS ANALYSIS

Fox squirrels and gray squirrels are similar in behavior and appearance with a few exceptions. The fox squirrel is considerably larger than the gray squirrel and shows more color variation within its populations than do gray squirrels; however, both species exhibit melanistic and albino phases. Fox squirrels measure 48 to 73 cm (19 to 29 inches) long and weigh from 544 to 1,362 g (1 1/5 to 3 lbs). Gray squirrels measure 41 to 51 cm (16 to 20 inches) long and weigh from 567 to 794 g (1 ¼ to 1 ¾ lbs) (National Audubon Society 2000).

Both squirrel species are found throughout most of the eastern United States, including Alabama. They inhabit mixed hardwood forests, especially those containing nut trees, such as oak and hickory. While they are commonly referred to as tree squirrels, they spend quite a bit of time on the ground foraging. Squirrels feed on a wide variety of foods and adapt quickly to unusual food sources. Typically, they feed on wild tree fruits and nuts in fall and early winter. Acorns, hickory nuts, walnuts, and Osage orange fruits are favorite fall foods. Nuts are often cached for later use. In late winter and early spring, they prefer tree buds. In summer, they eat fruits and succulent plant materials. Fungi, corn, and cultivated fruits are taken when available. They may also chew bark during high population peaks, when food is scarce and may eat insects and other animal matter (Jackson 1994*a*).

Gray squirrels produce young during early spring but may actually produce at any time until early September (National Audubon Society 2000). Older adults may produce two litters per year (Burt and Grossenheider 1976, Jackson 1994*a*). The gestation period is 42 to 45 days, and about three young comprise a litter. Young begin to explore outside the nest at about 10 to 12 weeks of age (Jackson 1994*a*). Home ranges of squirrels range from 1.2 to over 40 acres in size (Flyger and Gates 1982) with gray squirrels generally occupying home ranges up to seven acres and fox squirrels occupying areas from

seven to 40 acres in size. In south Alabama, the average home range of fox squirrels was found to be 68 acres, with the average home range for males being 94 acres and the average home range for females being 29 acres (ADCNR 2014*c*).

Both fox and gray squirrel populations periodically increase and decline. Gray squirrels have been documented to have mass emigrations of thousands or millions of individuals moving simultaneously, during which time many die. Although fox squirrels have been described as participating in these migrations, they are not as frequent or extensive in number. Squirrels are vulnerable to numerous parasites and diseases such as ticks, mange mites, fleas, and internal parasites. Squirrel hunters often notice bot fly larvae, called "*wolves*" or "*warbles*", protruding from the skin of animals killed. Larvae do not impair the quality of the meat for eating. In addition to being a food source for some people, squirrels are also prey for hawks, owls, snakes, and several mammalian predators. Predation seems to have little effect on squirrel populations. Typically, about half the squirrels in a population die each year and wild squirrels over four years old are rare, while captive individuals may live 10 years or more (Jackson 1994*a*).

Gray squirrel densities fluctuate based on available food sources but long-term densities tend to be stable (Gurnell 1987). Manski et al. (1981) found gray squirrel densities were typically less than 1.2 squirrels per acre in continuous areas of woodlands in North Carolina. Doebel and McGinnes (1974) found gray squirrel densities in small woodlots of less than 10 ha in area can be as high as 16 squirrels per ha. In urban parks, Manski et al. (1981) found gray squirrel densities can be more than 8.4 squirrels per acre. A three acre park in Washington, D.C. had a density of 50 squirrels per ha (20 per acre) (Hadidian et al. 1987).

The gray squirrel and the fox squirrel can be found statewide and the ADCNR (2014) has classified the gray squirrel as a species of "*lowest conservation concern*" and the fox squirrel as a species of "*low conservation concern*". However, statewide population estimates for the gray squirrel and the fox squirrel are currently not available. To determine a statewide population, the best available information will be used to estimate populations. The rural land cover classifications most likely to encompass suitable squirrel habitats are deciduous, evergreen, and mixed forests, which cumulatively total approximately 70,677 km^2 (27,300 mi^2) in Alabama (see Table 4.1). If only 50% of those land classes supported squirrels, under a worst-case scenario, with an estimate of one fox squirrel per every 68 acres and one gray squirrel per every 7 acres, the conservative statewide populations could be estimated to be approximately 128,500 fox squirrels and nearly 1.3 million gray squirrels in Alabama. Those estimates would be based on only one squirrel of each species occupying a home range and no home ranges overlapping. This would be a worst-case scenario since both squirrel populations are likely to inhabit a much larger portion of the land classes in the State, squirrels typically occur at much higher densities, and no urban or suburban lands were included in the calculations where squirrel densities are likely to be high.

Fox squirrels and gray squirrels are considered small game species by the ADCNR in Alabama with a regulated hunting season. During the development of this EA, the daily harvest limit on the number of squirrels that could be harvested during the season was eight, while eight harvested squirrels could be possessed during the length of the season (ADCNR 2013). Between 2009 and 2013, hunters harvested an nearly 2.2 million squirrels in the State (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an average annual harvest of 440,000 squirrels. During the 2013 hunting season, an estimated 417,656 squirrels were harvested in the State (Metzler 2013). Harvest data combines the two squirrel species (gray squirrel and fox squirrel). Harvest totals that only represent gray squirrels or fox squirrels are not currently available.

Between FY 2009 and FY 2013, WS conducted 12 technical assistance projects associated with gray squirrels. No technical assistance projects were conducted by WS associated with fox squirrels from FY

2009 through FY 2013. WS did not received requests for direct operational assistance associated with gray squirrels and fox squirrels from FY 2009 through FY 2013. During activities conducted by WS from FY 2009 through FY 2013, one gray squirrel was captured unintentionally during other damage management activities and was released unharmed.

Requests for direct operational assistance would primarily be associated with squirrels causing damage to gardens, vegetables, turf and flowers, electrical utilities, and residential buildings. Squirrels could also be live-captured and released or lethally removed unintentionally as non-targets during other damage management activities targeting other mammal species.

Based on efforts that could occur from requests for direct operational assistance, up to 50 gray squirrels and up to 10 fox squirrels could be lethally removed by WS annually under the proposed action alternative, including those squirrels that could be lethally removed unintentionally during other damage management activities. When receiving requests for assistance associated with squirrels, the WS program in Alabama would follow WS Directive 2.345.

If up to 10 fox squirrels were lethally removed by WS, the removal would represent 0.01% of a fox squirrel population estimated at 128,400 squirrels under a worst-case scenario. If up to 50 gray squirrels were lethally removed by WS, the lethal removal would represent 0.004% of the estimated gray squirrel population in the State under a worst-case scenario. If the proposed removal of squirrels were combined, the total removal of 60 squirrels would represent 0.01% of the estimated number of squirrels harvested in the State during the 2013 hunting season and would represent 0.01% of the average number of squirrels harvested in the State per year from 2009 through 2013.

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, this secretive carnivore is seldom seen. This species 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 about three to seven kilograms (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, this species is 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). They 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 occupy a 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. Estimates based on knowledge of the species, experience, and intuition may be as accurate as those estimates based on recognized methods, such as mark-recapture studies. Published estimates of gray fox density vary from 1.2 to 2.1 per km^2 (3.1 to 5.4 per mi^2) depending on location, season, and method of estimation (Errington 1933, Gier 1948, Lord 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 (Follmann 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 hectares (500 acres), and many exceeded 500 hectares (1,235 acres).

Gray fox feed on a wide variety of plant and animal matter, but feed on a wider variety of plant and animal matter 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 take 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 can be found statewide and are common in forested areas of Alabama (ADCNR 2014*b*); however, current population and density estimates are not available. Gray fox are considered a species of "*lowest conservation concern*" in Alabama (ADCNR 2014*b*). Given the habitat preferences of gray fox, the most likely land cover types that would support gray fox are deciduous forest, mixed forest, shrub/scrub, and woody wetlands. The cumulative area of those classifications in Alabama is 65,000 km^2 (25,100 mi^2) (see Table 4.1). If gray fox only occupied 50% of those land classifications in the State and the density of gray fox in the State were 3.1 gray fox per square mile, the statewide population could be estimated at 38,900 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 almost 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 evaluate the magnitude of the proposed removal by WS.

Gray fox are classified as both a game animal and a furbearing animal in Alabama with annual hunting and trapping seasons (ADCNR 2013). Gray fox can be harvested during annual open hunting and trapping seasons without a limit on the number that can be harvested during the trapping season. During the hunting season, one fox can be harvested per day with one harvested fox in possession during the length of the season. The total number of gray fox harvested annually in the State is currently not available. During the 2013 trapping season, an estimated 248 gray fox were harvested in the State (M. Sievering, ADCNR pers. comm. 2014) and Metzler (2013) estimated that 787 fox (red fox and gray fox) were harvested by hunters during the 2013 hunting season. Between 2009 and 2013, hunters have

harvested an estimated 11,280 fox (red fox and gray fox) in the State (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an average annual harvest of 2,256 fox.

Requests for assistance associated with gray fox received by WS have been primarily associated with disease threats and threats to aviation. During direct operational assistance projects, WS lethally removed one gray fox from FY 2009 through FY 2013. In addition, WS live-captured and released 28 gray fox as target animals between FY 2009 through FY 2013, with one gray fox live-captured unintentionally during other damage management activities but released unharmed.

Based on previous requests received by WS to reduce damage and in anticipation of additional efforts, WS could intentionally remove up to 20 gray fox annually under the proposed action to address requests to alleviate damage and threats of damage. Using the lowest population estimate of 38,900 fox, the removal of 20 gray fox by WS would represent 0.1% of the estimated statewide population. In addition, the removal of up to 20 gray fox annually by WS would represent 0.9% of the average number of fox harvested during the hunting season, if all fox harvested were gray fox. If all the fox harvested during the 2013 hunting season were gray fox and the harvest during the 2013 hunting/trapping season was representative of harvest that could occur in the future, the cumulative removal by hunters, trappers, and WS, if WS' removal reached 20 fox, would represent 2.7% of a statewide population estimated at 38,900 gray fox. Gray fox could also be lethally removed unintentionally during other damage management activities conducted by WS; however, WS does not anticipate the cumulative lethal removal of gray fox to exceed 20 fox annually.

Since the statewide population of gray fox is likely higher than 38,900 fox, WS' annual removal of gray fox and the cumulative harvest would represent a lower percentage of the actual statewide population. Like other mammal species addressed in this EA, the unlimited number of fox allowed to be harvested annually by the ADCNR during the trapping seasons provides an indication that gray fox populations maintain sufficient densities within the State to sustain unlimited harvest and that overharvest is unlikely.

MEADOW, PINE, AND PRAIRIE VOLE POPULATION INFORMATION AND EFFECTS ANALYSIS

Voles, also called meadow mice or field mice, are compact rodents with stocky bodies, short legs, and short tails. Their eyes are small and their ears are partially hidden. Their underfur is generally dense and covered with thicker, longer guard hairs. They are usually brown or gray, though many color variations exist (O'Brien 1994, National Audubon Society 2000).

There are 23 species of voles in the United States (O'Brien 1994), and the genus *Microtus* to which meadow, pine, and prairie voles belong, contains 15 species (National Audubon Society 2000) or 17 (Jones et al. 1992) species. Of those species, the meadow, pine, and prairie voles are relatively abundant, with meadow voles being the most widely distributed *Microtus* species in the United States. Meadow voles measure 14 to 19 cm (5 ½ to 7 ½ inches) and their fur is gray to yellow-brown, obscured by black-tipped hairs. Northern subspecies may also have some red in their fur. The underparts are gray, at times washed with silver or buff (O'Brien 1994). Pine voles measure 10.5 to 14.5 cm (4 1/8 to 5 ¾ inches) and have reddish brown short soft fur above with grayish, washed with buff coloration below (National Audubon Society 2000). The pine vole utilizes tunnel systems that are usually one to several inches below ground. Prairie voles measure 13 to 18 cm (5 to 7 inches), and have gray to dark brown fur mixed with gray, yellow, or hazel-tipped hairs, giving a peppery appearance. Underparts are gray to yellow-gray. It is the most common vole in prairie habitats.

Meadow voles range from Alaska and Canada south and east to northern Washington, Idaho, Utah, New Mexico, Wyoming, Nebraska, northern Missouri, northern Illinois, Kentucky, Tennessee, northeastern

Georgia, and South Carolina. Prairie voles range from southeastern Alberta, southern Saskatchewan and southern Manitoba south to northwestern New Mexico, northern Oklahoma, northern Arkansas, Tennessee, and western West Virginia. There have been isolated populations documented in southeastern Texas and southwestern Louisiana. Both species are found together in some habitats, since meadow voles live primarily in lush, grassy fields, marshes, swamps, woodland glades, and mountaintops, while prairie voles live principally in dry grass prairie or mixed grassy-weedy situations. As a rule when these two species occur together, meadow voles inhabit the moist areas, while prairie voles inhabit the drier (National Audubon Society 2000). Meadow and prairie voles are active day and night, constructing many tunnels and surface runways with numerous burrow entrances. A single burrow system may contain several adults and young (O'Brien 1994).

The pine vole is found in the eastern United States ranging from New England to central Iowa, north to central Wisconsin, and in the southern states except for most coastal areas. Habitat for the pine vole is deciduous woodlands with thick leaf litter or thick herbaceous ground cover and sometimes park-like grassy areas (National Audubon Society 2000).

Voles feed on a variety of green vegetation, including grasses, forbs, and tubers, and in late summer they store seeds, tubers, bulbs, and rhizomes (O'Brien 1994, National Audubon Society 2000). They eat bark at times, primarily in fall and winter, and will eat crops, especially when their populations are high. Occasional food items include snails, insects, and animal remains. Voles may cause extensive damage to orchards, ornamentals, and tree plantings due to their girdling of seedlings and mature trees while feeding on bark. This usually occurs in fall and winter. Field crops such as alfalfa, clover, grain, potatoes, and sugar beets may be damaged by voles. Their activities in such crops may interfere with crop irrigation by displacing water and causing levees and checks to wash out. They can also ruin lawns, golf courses, and ground covers. Voles can also act as attractants for raptors and other predators at airports, where those species can pose aircraft strike hazards.

Voles may breed throughout the year, but most commonly in spring and summer (O'Brien 1994), and may do so all year long in the southern United States (National Audubon Society 2000). In the field, they have one to five litters per year, and meadow voles have produced up to 17 litters per year in a laboratory (O'Brien 1994). Litter sizes range from one to 11, but usually average three to six. The gestation period is about 21 days and young are weaned by the time they are 21 days old. Females mature in 35 to 40 days and life spans of voles are short, probably two to 16 months. In one population studied, there was 88% mortality during the first month of life (O'Brien 1994).

Large population fluctuations are characteristic of voles and generally peak every two to five years, but cycles are not predictable. Population densities are variable. Cole and Batzli (1979) found that prairie vole populations averaged 38 per hectare (15 per acre) in prairie, 132 per hectare (52 per acre) in bluegrass, and 244 per hectare (99 per acre) in alfalfa. Among meadow voles, an Ontario, Canada population ranged from 80 to 400 per hectare (32 to 162 per acre) over one year, while an Illinois population ranged from five to 15 per hectare (two to six per acre), also over one year. Much higher densities may be reached during population irruptions. A wide variety of predators feed on voles. Voles are relatively easy for most predators to catch and are active, and therefore available, day and night throughout the year. Despite their vulnerability and availability, voles are not usually "*controlled*" by predators, because they have a high reproductive potential. Postpartum breeding is common and females may breed as early as one week of age. Synchronous breeding also occurs. These factors enable voles to increase at a faster rate than predators are able to reduce them (Pearson 1985).

In Alabama, the range of the prairie vole is poorly known but they are most common in the north-central portion of the State in areas with dense grass, such as pastures, cemeteries, roadsides, and field edges (ADCNR 2014*b*). The pine vole can be found statewide, except in the southwestern portion of the State.

The pine vole can occupy a number of habitats in the State, including leaf litter of forests, grassy fields with brush and brambles, and beneath mats of dense vegetation (ADCNR 2014*b*). The ADCNR (2014*b*) considers the prairie vole to be a species of "*moderate conservation concern*" and the pine vole as a species of "*low conservation concern*". The poorly known range of the prairie vole in Alabama and the more restrictive habitat preferences of the prairie vole are likely the reasons for the "*moderate conservation concern*" classification. Information on the meadow vole in Alabama is currently not available (ADCNR 2014*b*).

From FY 2009 through FY 2013, WS did not receive requests for direct operational assistance associated with vole damage. Requests for assistance are primarily handled by providing technical assistance advice on methods for addressing damage. Those people requesting assistance have reported lawn and turf damage resulting from voles. Resources of concern included landscaping, turf and flowers, levees and irrigation ditches. When receiving requests for assistance associated with voles, the WS program in Alabama would follow WS Directive 2.345.

Determination of numbers of voles killed during damage management activities can be difficult when rodenticides, such as zinc phosphide treatments, are employed. This is because most animals killed by those methods die underground. Most activities conducted by WS to alleviate or prevent damage associated with voles would involve the use of zinc phosphide placed in or at vole burrow entrances. Activities conducted by WS could be associated with damage to earthen dams, since the integrity of those dams could be threatened by the burrowing of a high density of voles. In addition, WS could be requested to reduce vole densities at airports, where voles could act as attractants for avian and mammalian predators that pose aircraft strike risks and to reduce damage to landscape plants, seedlings, trees, shrubs, and other ground cover.

Based upon the above information, WS' lethal removal of voles would have no adverse effects on overall populations of the species in Alabama. Due to relatively high reproductive rates of vole species and because management activities would be restricted to specific local sites, WS' activities under the proposed action would have minimal impacts on overall populations of voles. The ADCNR has determined that there is no evidence to suggest that human mediated mortality resulting from damage management, including removal by WS, would be detrimental to the survival of the vole populations in the State of Alabama (M. Sievering ADCNR, pers. comm. 2012).

MINK POPULATION INFORMATION AND EFFECTS ANALYSIS

Mink are a member of the weasel family and are about 46 to 61 cm (18 to 24 inches) in length, including the somewhat bushy tail. These animals weigh about 0.7 to 1.4 kg (1.5 to 3 lbs). Females are about three-fourths the size of males. Both sexes are a rich chocolate-brown color, usually with a white patch on the chest or chin, and scattered white patches on the belly. The fur is relatively short with the coat consisting of a soft, dense under-fur concealed by glossy, lustrous guard hairs. Mink also have anal musk glands common to the weasel family, and can discharge a disagreeable musk if frightened or disturbed (Boggess 1994*a*). They also mark their hunting territory with this fetid musk, which is as malodorous as a skunk's musk, although it does not carry as far (National Audubon Society 2000).

Mink are found throughout North America, with the exception of the desert southwest and tundra areas (Eagle and Whitman 1987). They are shoreline dwellers and their one basic habitat requirement is a suitable permanent water area. This may be a stream, river, pond, marsh, swamp, or lake. They can make their dens in muskrat houses, bank burrows, holes, crevices, logjams, and abandoned beaver lodges. They are active mainly at night and are active throughout the year, except for brief intervals during periods of low temperature or heavy snow (Boggess 1994*a*). However, they may adjust hunting times to prey availability (National Audubon Society 2000).

Eagle and Whitman (1987) indicated mink population densities varied spatially based on habitat, and could be influenced temporally by weather, trapping, and intraspecific aggression. Mink are most abundant in those areas with stable aquatic habitat. Mink densities in Louisiana were found to be highest in swamps, followed by marshes, and drained bottomlands (Linscombe et al. 1982). In Montana, 280 mink were found inhabiting a 33 km^2 (12.8 mi^2) area during the initial year of a two-year study, which resulted in a population density of one mink per 11.8 ha (29.2 acres) (Mitchell 1961). However, Mitchell (1961) found only 109 mink in the same area the following year, resulting in a density of one mink per 30.3 ha (74.7 acres). Using mink tracks in snow, Marshall (1936), found 0.6 females in one km^2 (1.5/mi^2) of riverbank with a 1:1 sex ratio following heavy trapping in Michigan. During a study conducted in Iowa from 1933 to 1938, one to five mink families were found inhabiting a 180-ha (450 acres) marsh (Errington 1943). Intraspecific aggression between mink may have been a limiting factor for mink at the marsh (Errington 1943). In 1939, Errington (1943) found no mink families present in the same marsh. Over-trapping was suggested as the reason for the decline in the number of mink families found in the marsh (Errington 1943).

At a refuge in Wisconsin, McCabe (1949) estimated 24 mink inhabited 446 ha (1,100 acres) in 1944, which resulted in a density of one mink per 18.8 ha (46.3 acres). Over the next four years (1945 to 1948), McCabe (1949) found the number of mink ranged from seven to 10 individuals at the refuge. McCabe (1949) also suggested that the lower population estimates found after the initial year of the study in 1944 were due to higher levels of mink trapping and excessive poaching along the refuge borders. The number of mink observed during the study conducted by McCabe (1949) at the refuge was inversely related to the duration and depth of snow cover; however, the number observed was poorly related to food availability (rabbits [*Sylvilagus* spp.] and mice [*Peromyscus* spp.]). During a two-year study in Sweden, Gerell (1971) estimated the number of mink present in a 10,000-ha (25,000 acres) area at 11 and 16, respectively, which resulted in a density of one mink per 909 ha (2,245 acres) during the first year of the study and one mink per 625 ha (1,545 acres) in the second year. Along 1.9 km (1.2 miles) of stream in British Columbia, Ritcey and Edwards (1956) caught 11, six, and five mink over three years, respectively, which were similar densities of 1.5 to 3 mink per km (2.5 to 5 mink per mile) found along the coastal shoreline on Vancouver Island reported by Hatler (1976).

The distribution of mink and population status of mink in the State are currently poorly known; however, mink can be found statewide in Alabama usually near permanent water sources, such as wetland habitats and streams, rivers, lakes, and the coastline (ADCNR 2014*b*). Mink are considered common in many parts of Alabama, including the delta region in southern Alabama (ADCNR 2014*b*). Mink are considered a "*low conservation concern*" in the State (ADCNR 2014*b*). No population estimates or density estimates were available for mink in Alabama. Therefore, the best available information was used to estimate a statewide population. There are approximately 77,000 miles of perennial and intermittent streams and rivers in Alabama (Alabama Department of Environmental Management 2012), with 2,557,312 acres (see Table 4.1) to 2,651,000 acres (Hefner et al. 1994) acres of wetlands. If only 50% of the 2,557,312 acres of wetlands (lowest estimate) present in the State supported mink and if the population density of mink in the State was one mink per 74.7 acres, the number of mink inhabiting wetlands in the State would be 17,117 mink. If only 50% of the 77,242 miles of streams in the State supported mink and if the population density of mink were five mink per 1.2 miles of stream, the population inhabiting shoreline could be estimated at 160,900 mink. Combining the number of mink inhabiting wetlands and streams, the total statewide mink population could be estimated at 178,000 mink.

Mink are classified as furbearing animals in Alabama with a regulated trapping season (ADCNR 2013). During the open trapping season, there is no limit on the number of mink that can be harvested (ADCNR 2013). Trappers reported harvesting 19 mink in the State during the trapping season in 2013 (M. Sievering, ADCNR pers. comm. 2014).

To alleviate damage or threats of damage associated with mink, WS lethally removed four mink intentionally from FY 2009 through FY 2013. In addition, one mink was live-captured unintentionally and released during other damage management activities. Based upon additional efforts that could occur, up to five mink could be killed by WS each year to address damage or threats of damage. Removal of up to five mink by WS would represent 0.003% of the estimated statewide population of 178,000 mink in Alabama. Mink could also be lethally removed unintentionally during other damage management activities conducted by WS; however, WS does not anticipate the cumulative lethal removal of mink to exceed five mink annually.

Activities conducted under the proposed action alternative would target individual mink or local populations of mink at sites where they were causing damage to agriculture, human health or safety, natural resources, or property. Some local populations may be temporarily reduced because of WS' activities aimed at reducing damage at a local site. The unlimited harvest levels allowed by the ADCNR during the trapping season provides an indication that mink densities within the State are sufficient that overharvest from the trapping season and activities to alleviate damage would not likely occur.

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). Female armadillos produce one litter of young per year, which are genetically identical quadruplets (National Audubon Society 2000).

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

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

Armadillos occupy and exploit a variety of natural and human-modified terrestrial habitats in the United States and across their range, including those armadillos found Alabama. 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 has been summarized by Layne (2003), which 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 Alabama. Damage to landscaping is the most common resource being damaged by armadillos in Alabama. Sandy soils are conducive to digging and armadillos can be found in those areas in Alabama where sandy soils are present.

Armadillos were first documented in Alabama during the 1940s. Today, armadillos can be found in most of Alabama but are more common in the southern two-thirds of the State (Carver 2007), showing a generally increasing trend (M. Sievering, ADCNR, pers. comm. 2012). Population estimates for armadillos in the United States range from 30 to 50 million individuals (Gilbert 1995). However, population estimates in Alabama are not currently available.

Since a statewide population estimate for armadillos is not currently available, a population estimate will be derived based on the best available information for armadillos to provide an indication of the magnitude of removal proposed by WS to alleviate damage and threats of damage. 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). Based on the natural habitat types occupied by armadillos throughout their range summarized by Layne (2003), the cumulative area of those classifications in Alabama is about 93,500 km^2 (36,100 mi^2) (see Table 4.1). Using a population density estimated at 0.004 to 1.4 armadillos per acre and if armadillos only inhabited 25% of those land classifications in the State, the statewide population could range from approximately 23,100 armadillos to approximately 8 million armadillos. With an average of 0.25 armadillos per acre, the statewide population could be estimated at 1.4 million armadillos. As stated previously, the actual number of armadillos in the State is currently unknown. The range of armadillos only encompassing 25% of certain land classifications in the State was used to provide a minimum population estimate to determine the magnitude of the proposed removal by WS to alleviate or prevent damage based on the habitat requirements of armadillos.

Since FY 2009, the WS program in Alabama has conducted six technical assistance projects associated with armadillos. During those projects, people reported landscaping damages occurring to turf/flowers in yards and damage to golf courses. To address requests for assistance associated with armadillos, WS employed lethal methods to remove 36 armadillos from FY 2009 through FY 2013. In addition, WS lethally removed five armadillos unintentionally during other damage management activities in the State.

Based on previous requests for assistance received by WS and in anticipation of additional efforts, WS could lethally remove up to 100 armadillos annually in the State as part of efforts to alleviate and prevent damage. Given the range of population estimates in the State, the removal of 100 armadillos by WS annually would represent 0.4% of the statewide population based on a population estimated at 23,100 armadillos if the overall population remains at least stable. Armadillos could also be lethally removed unintentionally during other damage management activities conducted by WS; however, WS does not

anticipate the cumulative lethal removal of armadillos to exceed 100 armadillos annually. Although the number of armadillos lethally removed by other entities in the State to alleviate damage is unknown, the cumulative removal of armadillos, including the proposed removal of up to 100 armadillos annually by WS, is likely of low magnitude when compared to the statewide population of armadillos.

OLD WORLD RODENT POPULATION INFORMATION AND EFFECTS ANALYSIS

Old World rodents are those rodents introduced to North America during colonization by Europeans. They are frequently referred to as "*commensal*" rodents due to their habits of "*living with or in close association with humans*". In Alabama, this group of rodents includes the Norway rat, the roof rat, and the house mouse. All three species are non-native, invasive species in Alabama.

The Norway rat is a stocky burrowing rodent that weighs an average of 454 g (1 lb). Their fur is coarse and usually brownish or reddish gray above and whitish gray on the belly. Black colorations can occur in some locations. They are also called the brown rat, house rat, barn rat, sewer rat, gray rat, or wharf rat and are slightly larger than the roof rat. Norway rats make a network of interconnecting tunnels for nesting and are colonial. They may burrow to make nests under buildings and other structures, beneath concrete slabs, along stream banks, around ponds, in garbage dumps, and at other locations where suitable food, water, and shelter are present (Timm 1994). Norway rats live in close association with people (Burt and Grossenheider 1976, Timm 1994, National Audubon Society 2000), and in urban areas they live in and around residences, in cellars, warehouses, stores, slaughterhouses, docks and sewers. On farms, rats may inhabit granaries, barns, livestock buildings, silos, and kennels (Timm 1994). In summer, rats may inhabit cultivated fields (National Audubon Society 2000), developing extensive colonies of several hundred individuals at such sites.

Norway rats are found throughout the United States and southern Canada, and the Pacific Coast north to Alaska. They may be found in this range wherever people live (Timm 1994, National Audubon Society 2000). They are primarily nocturnal, and usually become active about dusk, when they begin to forage for food and water. Some individuals may be active during daylight hours when rat populations are high. They have poor eyesight, relying more on hearing and the sense of smell, taste, and touch. They are considered color blind (Timm 1994).

Norway rats will eat nearly any type of food. When given a choice, they will select a nutritionally balanced diet, choosing fresh, wholesome items over stale or contaminated food. They prefer cereal grains, meats and fish, nuts, and some types of fruit. Food items in household garbage offer a balanced diet and satisfy their water requirements (Timm 1994). Rats often contaminate food they do not eat with droppings. They can also kill chickens and eat their eggs. They also eat wild plants, insects, and seeds (National Audubon Society 2000).

Norway rats breed throughout the year but often have peaks in spring and fall with reproductive activity declining during the heat of summer and often stopping completely in winter, depending upon habitat (National Audubon Society 2000). The average female rat has four to six litters per year with two to 22 young per litter (Timm 1994, National Audubon Society 2000). Twelve litters per year are possible (Burt and Gossenheider 1976, National Audubon Society 2000). Gestation is 21 to 26 days. Female rats may breed again within a day or two after a litter is born (Timm 1994).

The roof rat is similar in appearance to the Norway rat, but has a longer tail and a shorter nose (Whitaker, Jr. and Hamilton, Jr. 1998). While the roof rat is most abundant in coastal areas, in the eastern United States, it can be found inland to east Arkansas, west Kentucky, north Alabama and Georgia, and in North Carolina and Virginia (National Audubon Society 2000). Within its range, the roof rat is commonly found inhabiting buildings. When found with Norway rats in the same building, roof rats will generally

be found higher in the building, due to their ability to climb better than Norway rats. Roof rats generally nest and live in the walls of buildings (Whitaker, Jr. and Hamilton, Jr. 1998). Roof rats are capable of breeding when two to three months old. A female roof rat will typically have from four to six litters per year, and wean approximately 20 young (Whitaker, Jr. and Hamilton, Jr. 1998). The roof rat is omnivorous, but prefers to feed on grain and seeds if they are available. Considerable damage to stored grains in the form of consumption and contamination can occur from roof rats (National Audubon Society 2000). Because of their ability to climb, they often can do damage to nuts and fruits while still on the tree (Whitaker, Jr. and Hamilton, Jr. 1998).

The house mouse is a small grayish-brown mouse with a gray or buff belly and a scaly tail that is uniformly colored. It ranges in length from 81 to 86 mm (3 ¼ to 3 ½ inches) and weighs 11 to 22 g (1/3 to ½ oz). Although it is occasionally found in fields, it is primarily associated with buildings. The house mouse will eat anything edible and they are found throughout all of North America, wherever there are concentrations of people (National Audubon Society 2000). House mice are primarily nocturnal but can be found active during the day. House mice often build nests under floors and in the walls of buildings using fibrous material that may include paper, burlap, or fabric. They breed throughout the year with three to 11 young in every litter. They have a gestation period of 18 to 21 days and females can breed at six weeks of age (National Audubon Society 2000). House mice are capable of producing up to 13 litters each year and their populations can expand rapidly wherever food is abundant and shelter is adequate.

Requests for assistance are generally associated with gnawing of structures and vehicle hoses and belts, as well as damage threats to aviation. WS would primarily address requests for assistance by providing technical assistance. Between FY 2009 and FY 2013, WS lethally removed two Norway rats to alleviate damage or threats of damage.

Norway rats, roof rats, and house mice may be addressed by WS during wildlife hazard management, assessment, and monitoring at airports and airbases. Although those species do not cause direct hazards to aviation safety, they serve as prey attractants to raptors and mammalian predators that may pose serious threats to aircraft safety. Removal of those species by WS would occur primarily at airports by methods that may include trapping and the use of registered rodenticides (see Appendix B for a description of the rodenticides). Typically, any lethal removal would be associated with small mammal trapping surveys at airports/airbases or with operational activities to manage a localized prey base. WS could be requested to reduce densities of a localized prey base that was attracting avian or mammalian predators to an aircraft operations area. Removal could also occur to alleviate agricultural damage at feedlots or other agricultural facilities. When receiving requests for assistance associated with mice and rats, the WS program in Alabama would follow WS Directive 2.345.

The level of WS' involvement in those activities may vary considerably from year to year depending on the number of airports/airbases and agricultural facilities requesting assistance from WS. Determination of the number of rats and mice killed during damage management activities can be difficult when rodenticides were employed. This is because most rats and mice killed by those methods die underground or in structures. Although population estimates are not available, Norway rats, roof rats, and house mice are generally prolific breeders and are generally abundant throughout their range. Additionally, populations of those species fluctuate greatly over time. Due to the species' relatively high reproductive rates and because management activities would be restricted to specific local sites, WS' activities under the proposed action would have minimal impacts on overall populations of Norway rats, roof rats, and house mice in the State. WS' activities would be conducted pursuant to Executive Order 13112.

RACCOON POPULATION INFORMATION AND EFFECTS ANALYSIS

The raccoon is a stocky mammal about 61 to 91 cm (2 to 3 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*b*).

Raccoons are omnivorous and they will eat carrion, garbage, birds, mammals, insects, crayfish, mussels, other invertebrates, and a wide variety of grains, various fruits, and other plant materials. They also eat most foods prepared for human or animal consumption (Sanderson 1987). They occasionally kill poultry (Boggess 1994*b*).

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*b*, 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*b*), 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 one to three 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).

In Alabama, 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*b*).

Many people who request assistance are also concerned about health and safety issues associated with raccoons. Those risks could include disease transmission from raccoons to people, pets, or livestock. Disease threats could include, but would not be limited to, canine distemper, rabies, and the roundworm *Baylisascaris procyonis*, the eggs of which survive for extremely long periods in raccoon feces and soil. Ingestion of *B. procyonis* eggs can result in serious or fatal infections in other animals, as well as people (Davidson 2006; see Table 1.3).

Absolute raccoon population densities are difficult or impossible to determine because of the difficulty in knowing what percentage of the population had been counted or estimated with the additional difficulty of knowing how large an area the raccoons were 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 example, Twichell and Dill (1949) reported removing 100 raccoons from tree dens in a 41 hectares (101 acres) waterfowl refuge area, while Yeager and Rennels (1943) studied raccoons on 881 hectares (2,177 acres) in Illinois and reported trapping 35 to 40 raccoons in 1938-1939, 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 2002). Riley et al. (1998) summarized rural raccoon densities based on published literature that ranged from two to 650 per square mile in rural habitats, with an average of 10 to 80 raccoons per square mile.

Raccoons can be found throughout the State and are common in a variety of habitats, including rural, suburban, and urban areas. The ADCNR (2014) considers the raccoon to be a species of "*lowest*

conservation concern" in the State. However, the statewide population of raccoons is currently unknown. Therefore, the best available information will be used to estimate statewide population. If raccoons only inhabited the deciduous forest, mixed forest, shrub/scrub, and woody wetlands land cover classifications, raccoons could be found on approximately 65,000 km^2 or 25,097 mi^2 of the land area in Alabama (see Table 4.1). If only 50% of those land classifications supported raccoons, under a worst-case scenario, and using the average density reported by Riley et al. (1998) of 10 to 80 raccoons per square mile, the statewide population could range from 125,500 to 1 million raccoons. This would be a worst case scenario since raccoon populations are likely to inhabit a much larger portion of those land classifications, raccoons are frequently found at much higher densities, and no urban or suburban lands were included in these calculations where raccoon populations are likely to be at their highest. Similar to estimates derived for the other mammal species addressed in this EA, estimating that raccoons inhabit only 50% of certain land classifications in the State is intended to determine a minimum population estimate to compare the potential effects of WS' proposed removal of raccoons and to determine the magnitude of WS' proposed removal.

Raccoons are classified as a game and furbearing animal in Alabama with a regulated hunting and trapping season (ADCNR 2013). The ADCNR currently allows an unlimited number of raccoons to be harvested during the length of the hunting and trapping seasons on private lands. Hunters harvested 331,240 raccoons in the State from 2009 through 2013 (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an average annual harvest of 66,248 raccoons. The highest annual harvest occurred during the 2009 hunting season when an estimated 80,700 raccoons were harvested in the State (Liles 2009). During the 2013 hunting season, 37,955 raccoons were harvested in the State (Metzler 2013) and 2,569 raccoons were harvested by trappers (M. Sievering, ADCNR pers. comm. 2014). Based on the number of raccoons previously harvested by hunters in the State, the statewide population is likely higher than 125,500 raccoons especially given the ADCNR removed the daily harvest limit for raccoons for the 2013 hunting season (ADCNR 2013).

As with other furbearing species, raccoons can also be lethally removed to alleviate damage or threats of damage. The total number of raccoons lethally removed annually in the State to alleviate damage or threats of damage is currently unknown. WS continues to provide assistance in efforts to contain the spread of the raccoon variant of rabies in Alabama, which are part of the national rabies barrier program addressed under a separate environmental analysis (USDA 2009*a*). Other rabies monitoring or management activities may occur as part of this program. Activities involving raccoons conducted under the ORV program were addressed in a separate EA (USDA 2009*a*) but those activities will also be evaluated in this EA for cumulative impact analyses.

During all damage management activities conducted by WS from FY 2009 through FY 2013, WS lethally removed 1,179 raccoons in Alabama, which is an annual average removal of 236 raccoons. During FY 2013, WS removed 772 raccoons in Alabama, which represented the highest annual removal by WS from FY 2009 through FY 2013. Of those raccoons lethally removed by WS from FY 2009 through FY 2013, 46 raccoons were lethally removed unintentionally during other damage management activities, which is an average annual removal of nine raccoons. WS also live-captured and released 1,235 raccoons intentionally between FY 2009 and FY 2013, primarily during activities associated with the ORV program (USDA 2009*a*). In addition, nine raccoons were live-captured unintentionally during other damage management activities and released unharmed between FY 2009 and FY 2013. WS has also dispersed seven raccoons between FY 2009 and FY 2013 to alleviate damage or threats of damage.

Based on previous requests for assistance received by WS and in anticipation of additional efforts to manage raccoon damage, up to 500 raccoons could be lethally removed by WS annually under the proposed action. Using the population estimate ranging from 125,500 to 1 million raccoons, the removal of 500 raccoons under the proposed action would represent 0.1% to 0.4% of the estimated population. As

stated previously, the actual statewide population likely exceeds 1 million raccoons given the parameters used to estimate the population. Activities conducted to prevent the further spread of raccoon rabies in the State generally do not result in the lethal removal of raccoons. Raccoons are live-captured, sampled, and released on-site as part of the post-baiting protocols (USDA 2009*a*). However, if raccoons were visibly injured or exhibited signs of disease, those raccoons are often euthanized and processed for rabies testing. The number of raccoons lethally removed in the State during the post-baiting trapping varies, but is not likely to exceed 50 individuals annually. Therefore, the statewide cumulative removal of raccoons by WS in Alabama under all damage and disease management activities would not exceed 550 raccoons annually, which would represent 0.4% of the lowest population estimate of raccoons in the State. If WS removed 550 raccoons, the lethal removal would present 1.4% of the estimated statewide harvest of raccoons during the 2013 hunting and trapping season and would represent 0.8% of the average annual number of raccoons harvested during the hunting season from 2009 through 2013.

If the level of annual harvest during the 2013 hunting and trapping season were representative of future annual harvest, and if the annual removal by WS reached 550 raccoons, the cumulative removal of raccoons by hunter/trappers and WS would be 41,114 raccoons. The cumulative removal of 41,114 raccoons would represent 4.1% of a statewide population estimated at 1 million raccoons. Since the statewide population is likely higher than 1 million raccoons for those reasons discussed previously, cumulative removal is likely a much smaller percentage of the actual statewide population. Hunters harvested an estimated 80,700 raccoons in the State during the 2009 hunting season, which was the highest annual harvest of raccoons in the State by hunters between 2009 and 2013. If the harvest of 80,700 raccoons were representative of future harvest by hunters and if the number raccoons harvested by trappers during the 2013 trapping season were representative of further harvest by trappers, the cumulative removal of raccoons, including the removal of up to 550 raccoons by WS, would represent 8.4% of a statewide population estimated at 1 million raccoons.

Raccoon populations can remain relatively abundant if annual harvest levels are below 49% (Sanderson 1987). In addition, the statewide population is likely much higher than estimated in this analysis. As with many of the other mammals species harvested for fur in the State, the unlimited harvest levels allowed by the ADCNR provides an indication that overharvest of raccoons is not likely to occur during annual harvest seasons and from damage management activities. Although the statewide population of raccoons is unknown, the cumulative removal of raccoons would be of low magnitude when compared to the actual statewide population. In addition, the live-capture and subsequent release of raccoons would not likely result in adverse effects to the statewide population since those animals would be released unharmed (USDA 2009*a*).

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. This species is 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 to adults (Voigt 1987). Red fox occur throughout most of North America. They are found throughout most of the

United States with the exception of a few isolated areas. Prehistoric fossil records suggest that the red fox may not have inhabited much of the United States; however, they were plentiful in many parts of Canada. Voigt (1987) has suggested 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 this species in North America.

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 and occur 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. They rear young in a maternity den usually in sparse ground cover on a slight rise, with a good view of all approaches (National Audubon Society 2000). Fox commonly use enlarged dens of other animals, such as woodchuck or badger dens, as maternity dens. 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. It is also an efficient scavenger, and in parts of the world, garbage and carrion are extremely important to its diet (Voigt 1987). They 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).

Population densities are difficult to determine because of the secretive and elusive nature of fox. 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). Home ranges for red fox in the eastern United States are usually from 500 to 2,000 ha (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. In Great Britain, where food is abundant in many urban areas, densities as high as 30 fox per km^2 (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 km^2 (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.

Red fox can be found statewide in Alabama and are common in forested upland habitats that are interspersed with pastures and farmland (ADCNR 2014*b*). The ADCNR (2014*b*) considers red fox to be a species of "*lowest conservation concern*". Like other furbearing species in the State, the statewide population is currently unknown. In addition, density data for red fox in Alabama is not currently available. Given that red fox densities are highest in areas where woodlands are interspersed with farmlands, the cumulative area of these classifications (shrub/scrub, grasslands, pasture, cultivated crops) in Alabama is about 40,400 km^2 (15,600 mi^2) (see Table 4.1). If red fox only occupied 50% of those land classifications in the State and the density of red fox in the State was 2.6 red fox per square mile, the statewide population could be estimated at 20,300 red fox.

Similar to gray fox, red fox can be harvested during annual hunting and trapping seasons in the State. There is no limit to the number of fox that can be harvested daily and no possession limit during the length of the trapping season for red fox. However, one red fox can be harvested daily during the hunting season for red fox and one harvested fox can be in possession during the length of the season. The number of red fox harvested annually in the State is currently unknown. During the 2013 trapping season, an estimated 47 red fox were harvested in the State (M. Sievering, ADCNR pers. comm. 2014) and Metzler (2013) estimated that 787 fox (red fox and gray fox) were harvested by hunters during the 2013 hunting season. Between 2009 and 2013, hunters have harvested an estimated 11,280 fox (red fox and gray fox) in the State (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an average annual harvest of 2,256 fox.

Most requests for assistance received by WS involving red fox have been associated with disease threats, aircraft strike risks, and predation threats to T&E species. During direct operational assistance projects, WS lethally removed 11 red fox intentionally from FY 2009 through FY 2013, which is an average lethal removal of two red fox per year. WS also intentionally live-captured and released seven red fox during activities conducted from FY 2009 through FY 2013. In addition, one red fox was lethally removed unintentional during other damage management activities between FY 2009 and FY 2013.

Based on previous requests received by WS to reduce damage and in anticipation of additional efforts, WS could removal up to 75 red fox annually under the proposed action alternative to alleviate damage or threats of damage. Using a statewide population estimate of 20,300 red fox, the lethal removal of up to 75 red fox annually by WS would represent 0.4% of the estimated population. In addition, the removal of up to 75 red fox annually by WS would represent 3.3% of the average number of fox harvested during the hunting season, if all fox harvested were red fox. If all the fox harvested during the 2013 hunting season were red fox and the harvest during the 2013 trapping seasons was representative of harvest that could occur in the future, the cumulative removal by hunters, trappers, and WS, if WS' removal reached 75 fox, would represent 4.5% of a statewide population estimated at 20,300 red fox. Red fox could also be lethally removed unintentionally during other damage management activities conducted by WS; however, WS does not anticipate the cumulative lethal removal of red fox to exceed 75 fox annually.

Although exact population and density estimates for red fox in Alabama are not available, the unlimited harvest allowed by the ADCNR for the species during the trapping seasons indicates the species is not at risk of overharvesting. Since the statewide population of red fox is likely higher than 20,300 fox, WS' annual removal of red fox and the cumulative harvest would represent a lower percentage of the actual statewide population.

RIVER OTTER POPULATION INFORMATION AND EFFECTS ANALYSIS

Historically, river otter 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. Otter are found in both marine and freshwater environments, ranging from coastal to high elevation 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 otter 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). The current statewide otter population is currently unknown. Densities of river otter in linear waterways have been reported ranging from one otter per 0.7 miles in southeast Alaska (Woolington 1984) to one otter per 10.6 miles (Reid 1984) in northeastern Alberta. 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). The results of a Missouri study found one otter per 2.5 to 5.0 miles of linear waterways (Erickson et al. 1984).

The distribution and population status of river otters in the State is poorly known but otter are likely found statewide along rivers, creeks, and lakes that are lined with wooded habitat (ADCNR 2014*b*). The ADCNR (2014*b*) has classified the river otter as a species of "*low conservation concern*". The statewide population of river otters and otter densities in the State are unknown.

Wetland estimates in Alabama have ranged from 2,557,312 acres (see Table 4.1) to 2,651,000 acres (Hefner et al. 1994), including an estimated 77,000 miles of streams and rivers (Alabama Department of Environmental Management 2012). As was discussed previously, otter are closely associated with aquatic habitats where they forage and den along shorelines. Using 77,242 miles of streams in Alabama and the range of one otter per 2.5 to 5.0 miles of waterway would result in a statewide population estimate ranging from 15,400 otter to 30,900 otter. If only 50% of those streams supported river otter, the minimum statewide river otter population could be estimated to range from 7,700 to 15,450 river otter in Alabama. This would be considered a worst-case scenario since the otter population is likely to inhabit a much larger portion of the streams and rivers of Alabama. In addition, otter also inhabit other aquatic habitats besides rivers and streams; therefore, the actual population is likely to be higher.

River otters are classified as furbearers in Alabama with a regulated annual trapping season. During the trapping season, the ADCNR places no limits on the number of otter that trappers are allowed to harvest during the length of the season (ADCNR 2013). During the 2013 trapping season, an estimated 419 otter were harvested in the State (M. Sievering, ADCNR pers. comm. 2014).

WS responded to 14 requests for technical assistance associated with river otter damage from FY 2009 through FY 2013. Requests for assistance were addressed by providing technical assistance on methods available to address damage. Resources damaged by river otter primarily included predation to commercially grown catfish (aquaculture) and private ponds containing sport fish.

During all direct operational assistance projects conducted from FY 2009 through FY 2013, WS killed 123 river otters in Alabama, which is average of 25 river otters lethally removed each year. Of those otters removed by WS from FY 2009 through FY 2013, 92 otter were removed as unintentional non-targets during aquatic rodent damage management activities. The highest unintentional removal occurred during FY 2009 when 37 otters were lethally removed unintentionally during other damage management activities. Between FY 2009 and FY 2013, WS live-captured and released five river otters, with four of those otters captured unintentionally during other damage management activities. The unintentional removal of otter is discussed here to evaluate the cumulative removal of otter. Based on previous requests for assistance and anticipating additional efforts to address damage, WS could lethally remove intentionally up to 50 river otters annually in Alabama to resolve requests to manage damage to resources.

WS anticipates receiving requests primarily from aquaculture producers that were experiencing unacceptable predation of fish stock by river otters.

As was discussed previously, river otters are also likely to be lethally removed by WS as unintentional non-targets during other activities to alleviate wildlife damage. To evaluate the potential cumulative impacts on the river otter population from the activities proposed under this alternative, WS will evaluate cumulative removal using the highest annual non-target removal of otter that occurred during previous activities. As stated previously, the highest annual non-target removal by WS occurred during FY 2009 when 37 otter were killed unintentionally. Based upon the aforementioned population estimate, WS' lethal removal of up to 50 river otters annually under the proposed action would represent 0.7% of the otter population in Alabama estimated at 7,700 otters and 0.3% of a statewide population estimated at 15,450 otters. When WS' average annual unintentional removal is combined with the proposed removal evaluated in this EA, the cumulative removal by WS would represent 0.9% of a statewide population estimated at 7,700 otter and would represent 0.4% of a statewide population estimated at 15,450 otter. If the highest unintentional removal by WS of 37 otters was combined with the proposed intentional removal of up to 50 otters, WS' cumulative removal would represent 1.1% of a statewide population estimated at 7,700 otters and 0.6% of a statewide population estimated at 15,450 otters.

If WS' removal of otter reached 87 otter annually and if the number of otters harvested during the trapping season in 2013 was representative of future harvest, the cumulative lethal removal of otters would represent 6.6% of a statewide population estimated at 7,700 otters. However, the statewide population is likely to be higher than 7,700 otters; therefore, cumulative removal is likely to represent a smaller percentage of the actual population. The proposed intentional removal and the cumulative removal of otters in the State by WS and the harvest by trappers would be of low magnitude when compared to the actual statewide population estimates. The unlimited harvest allowed by the ADCNR also provides an indication that harvest and damage management activities are not sufficient to cause the overharvest of otters.

SOUTHERN FLYING SQUIRREL POPULATION INFORMATION AND EFFECTS ANALYSIS

The southern flying squirrel is the smallest of the tree squirrels and can be distinguished from other squirrel species by their loose fold of skin the extends from their front legs to their back legs. Although the common name implies this species of squirrel can fly, the southern flying squirrel uses the fold of skin that extends between their front legs and their back legs to parachute or glide (Schwartz and Schwartz 2001, ADCNR 2014*d*). The range of the flying squirrel extends across most of the eastern United States, except for portions of the northeastern United States and the southern tip of Florida (Schwartz and Schwartz 2001, ADCNR 2014*d*). They prefer mature hardwood forests but flying squirrels can be found in most forested habitats (Schwartz and Schwartz 2001, ADCNR 2014*d*). The typical diet of the flying squirrel consists of tree buds, nuts, fruits, berries, mushrooms, and seeds (Schwartz and Schwartz 2001, ADCNR 2014*d*). Flying squirrels are often considered the most carnivorous of the squirrel species, with flying squirrels feeding on birds, nestlings, eggs, carrion, and invertebrates, primarily in the summer when those food sources are most abundant (Schwartz and Schwartz 2001, ADCNR 2014*d*). Southern flying squirrels are active at night and are rarely seen during the day (Schwartz and Schwartz 2001, ADCNR 2014*d*).

In Alabama, southern flying squirrels can be found statewide and are considered most common in mature, broad-leaved forests, but they are also known to occur in coniferous-deciduous forests and urban areas (ADCNR 2014*d*). The ADCNR (2014*b*) considers the southern flying squirrel to be a species of "*lowest conservation concern*". The statewide population of flying squirrels is unknown but the ADCNR (2014) stated that southern flying squirrels "…*are stable or increasing across the southeast* [United States]".

In favorable habitat, Schwartz and Schwartz (2001) stated that densities of flying squirrels could reach one to five squirrels per acre. Deciduous forests cover approximately 31,800 km^2 (see Table 4.1) of the land area in Alabama or approximately 7.9 million acres. If flying squirrels only inhabited 50% of the land area consisting of deciduous forests, the statewide population could be estimated to range from 4 million to 19.8 million squirrels based on densities of one to five squirrels per acre.

Requests for assistance associated with damage that flying squirrels cause generally relates to squirrels that are entering into residential buildings or other structures. Damage can occur from squirrels gnawing through siding to enter buildings, from squirrels gnawing on electrical wires, from squirrels building nests in attics, and accumulations of urine and fecal matter inside buildings where squirrels frequent (Jackson 1994*a*). Between FY 2009 and FY 2013, the WS program in Alabama has conducted three technical assistance projects associated with flying squirrels where WS provided information on identifying damage and ways the requester could manage damage. During direct operational assistance projects conducted from FY 2009 through FY 2013, WS live captured and released seven flying squirrels to alleviate damage. No lethal removal of flying squirrels occurred by WS in the State from FY 2009 through FY 2013.

Based on previous requests for assistance and in anticipation of additional efforts to address damage caused by flying squirrels, WS could lethally remove up to 10 flying squirrels annually under the proposed action alternative. When receiving requests for assistance associated with flying squirrels, the WS program in Alabama would follow WS Directive 2.345. Removing 10 flying squirrels annually would represent a small percentage of the estimated statewide population of squirrels and would be of low magnitude when compared to the actual statewide population of flying squirrels.

STRIPED SKUNK POPULATION INFORMATION AND EFFECTS ANALYSIS

Although easily recognized by their black and white fur, striped skunks may be most readily recognized by the odiferous smell of their musk. They are common throughout the United States and Canada (Rosatte 1987). Striped skunk are primarily nocturnal and do not have a true hibernation period; however, during extremely cold weather they may become temporarily dormant. The striped skunk is an omnivore, feeding heavily on insects, such as grasshoppers, crickets, beetles, bees, and wasps (Chapman and Feldhamer 2003). The striped skunk's diet also includes small mammals, the eggs of ground-nesting birds, and amphibians. Striped skunks are typically not aggressive and attempt to flee when approached by people (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. It appears to be in relation to 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, except those densities 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 skunk per 10 acres (Rosatte 1987).

Striped skunks can be found statewide in Alabama and are generally considered common around open areas, forest edges, and in urban areas (ADCNR 2014*b*). The abundance of striped skunks in the State can vary with skunks having a high abundance in some regions and few skunks present in other areas

(ADCNR 2014*b*). In general, skunks are considered more common in the northern portion of the State (ADCNR 2014*b*). Skunks are considered a "*low conservation concern*" in the State (ADCNR 2014*b*).

Population estimates and density estimates for striped skunks in Alabama are currently not available. Striped skunks can be found in a variety of habitats across the State. Given that striped skunks inhabit all rural, upland cover types throughout Alabama, the cumulative area of these classifications in Alabama is about 121,400 km^2 (30 million acres) (see Table 4.1). If skunks only inhabit 50% of those land classifications in the State and densities occur at one skunk per 77 acres, the statewide population could be estimated at nearly 194,800 skunks. Similar to other furbearing species, skunks can be found throughout the State and the estimate is intended to evaluate the magnitude of removal proposed under the proposed action. The statewide population of skunks is likely higher than 194,800 skunks.

Skunks are considered a furbearing animal in Alabama with annual trapping seasons with 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. During the trapping season in 2013, an estimated 28 striped skunks were harvested in the State by trappers (M. Sievering, ADCNR pers. comm. 2014).

WS conducted 16 technical assistance projects associated with skunks in the State between FY 2009 and FY 2013. In addition, WS was requested to provide direct operational assistance associated with skunks. Most requests for technical assistance were addressed by providing information on methods the requester could employ to alleviate damage or threats without any direct involvement by WS. Requests were received regarding damage or threats of damage to property, residential buildings, non-residential buildings, pets, turf, flowers, and human safety. Damage and threats occurred primarily from the burrowing/digging behavior of skunks, the odor associated with skunks spraying, and rabies threats. Most requests for assistance received were associated with threats to human safety, primarily risks of disease transmission.

From FY 2009 through FY 2013, WS lethally removed 19 striped skunks during all damage management activities in the State, which is an average annual removal of four skunks. Based on previous requests for assistance received by WS and in anticipation of additional efforts to manage striped skunk damage in Alabama, up to 25 skunks could be lethally removed by WS annually under the proposed action, when requested. Using the lowest population estimate of 194,800 skunks, the removal of 25 skunks would represent 0.01% of the estimated statewide population. Striped skunks could also be lethally removed unintentionally during other damage management activities conducted by WS; however, WS does not anticipate the cumulative lethal removal of skunks to exceed 25 skunks annually. If WS' removal of skunks reached 25 skunks annually and if the number of skunks harvested during the trapping season in 2013 was representative of future harvest, the cumulative lethal removal of skunks would represent 0.03% of a statewide population estimated at 194,800 skunks. However, the statewide population is likely to be higher than 194,800 skunks; therefore, cumulative removal is likely to represent a smaller percentage of the actual population.

The unlimited number of skunks allowed by the ADCNR to be harvested during the annual trapping season provides an indication that skunk densities in the State are sufficient to maintain a sustained harvest level and adverse effects from harvest and damage management purposes are not likely to cause overharvest of the species leading to population declines.

VIRGINIA OPOSSUM POPULATION INFORMATION AND EFFECTS ANALYSIS

Opossums are the only marsupials (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). They are also found in parts of the southwestern United States, California, Oregon, and Washington (Jackson 1994*b*). It has been documented that human activities have aided in the range expansion of opossum (Gardner 1982). 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 broad range of pelage colors, but they 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, opossum 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 four to 20 hectares (10 to 50 acres), foraging throughout this area frequently (Jackson 1994*b*), 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 one to 17 young born in an embryonic state that 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 outside of the pouch 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 the five-year study, Seidensticker et al. (1987), also observed 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 Alabama in appropriate habitat. In Alabama, opossum can be found in deciduous forests, open woodlands, and farmland with a preference for marshes, swamps, and forested areas around rivers and streams (ADCNR 2014*b*). 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 removal proposed by WS to alleviate damage and threats of damage. Given that opossum densities are highest in forested areas, farmlands, and wetlands, the cumulative area of those classifications in Alabama is about 121,400 km^2 (46,900 mi^2) (see Table 4.1). If opossum were only found on 50% of those land classifications in the State and 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 236,900 opossum. Using the range of opossum densities found by Seidensticker et al. (1987) of 1.3 opossum per square mile to 20.2 opossum per square mile and only 50% of those land classification in the State being occupied by opossum, the statewide population would range from a low of 30,500 opossum to a high of nearly 473,700 opossum.

Opossum can be found in a variety of habitats, including urban areas, so opossum occupying only 50% of those land classifications in the State is unlikely since opossum 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 removal by WS to alleviate or prevent damage.

Opossum are considered a furbearing animal and a game animal in the State and can be harvested during annual hunting and trapping seasons (ADCNR 2013). During the development of the EA, opossum could be harvested during hunting and trapping seasons with no limit on the number that could be lethally removed during those seasons. During the 2013 trapping season, an estimated 1,053 opossum were harvested in the State (M. Sievering, ADCNR pers. comm. 2014) and Metzler (2013) estimated that 4,383 opossum were harvested by hunters during the 2013 hunting season. Between 2009 and 2013, hunters have harvested an estimated 57,068 opossum in the State (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013), which is an average annual harvest of 11,414 opossum. In addition, opossum could be lethally removed to alleviate damage by other entities; however, the number of opossum lethally removed in the State to alleviate damage is also unknown.

As part of all damage management activities conducted by WS in the State, 95 opossum have been lethally removed by WS from FY 2009 through FY 2013, which is an average annual removal of 19 opossum. Of those 95 opossums lethally removed by WS from FY 2009 through FY 2013, 75 were removed as unintentional non-targets during other damage management activities. In addition, WS has purposefully live-captured and released 45 opossum from FY 2009 through FY 2013 during all damage management activities with an additional 258 opossum live-captured unintentionally during all damage management activities and released unharmed. Opossum were primarily live-captured as non-targets during surveillance activities relating to the ORV program (USDA 2009*a*). Based on previous requests for assistance received by WS and in anticipation of additional efforts, WS could lethally remove up to 100 opossum annually in the State as part of efforts to reduce or eliminate damage under the proposed action alternative. Based on a statewide population ranging from 30,500 opossum to 473,700 opossum, the lethal removal of up to 100 opossum annually by WS under the proposed action alternative, would represent 0.02% to 0.3% of the estimated population. Opossum could also be lethally removed unintentionally during other damage management activities conducted by WS; however, WS does not anticipate the cumulative lethal removal of opossum to exceed 100 opossum annually.

If the number of opossum harvested during the 2013 hunting and trapping seasons were representative of harvest that could occur in the future, the cumulative removal by hunters, trappers, and WS, if WS' removal reached 100 opossum, would represent 17.9% of a statewide population estimated at 30,500 opossum. If the annual removal by WS of 100 opossum was combined with the average number of opossum harvested in the State by hunters from 2009 through 2013, the cumulative removal would represent37.8% of the a statewide population estimated at 30,500 opossum. However, the actual statewide population likely exceeds 30,500 opossum given the parameters used to derive the estimate.

Although the total number of opossum lethally removed in the State by other entities to alleviate damage is unknown, the cumulative removal of opossum, including the proposed removal of up to 100 opossum annually by WS, would be of a low magnitude when compared to the statewide population. The unlimited harvest allowed by the ADCNR during the harvest seasons provides an indication that population densities of opossum in the State are sufficient that overharvest is not likely to occur, including lethal removal to alleviate or prevent damage. In addition, the live-capture and subsequent release of opossum would not likely result in adverse effects to the statewide population since those animals would be released unharmed.

WHITE-TAILED DEER POPULATION INFORMATION AND EFFECTS ANALYSIS

White-tailed deer are small to medium-sized mammals with tan or reddish brown pelts above in summer and grayish brown in winter. The belly, throat, noseband, eye-ring, and inside of the ears are white and their tail is brown with white above, often with a dark stripe down the center and white below. Deer are known for raising their tail while alarmed and in flight, called "*flagging*", in which the tail appears as a large, bright flash of white. This communicates danger to other deer and helps young follow their

mothers in flight (National Audubon Society 2000). The range in size of white-tailed deer is extreme. White-tailed deer in the northern extremes of its range, where there is good habitat, will achieve weights of greater than 136 kg (300 lbs). By comparison, the tiny Florida Keys subspecies (*O.v. clavium*) commonly weighs less than 23 kg (50 lbs) (National Audubon Society 2000).

Male white-tailed deer are called bucks. They exhibit antlers, which are a pair of bony outgrowths of the frontal bone that normally are shed annually. The antlers begin growing in the early summer at which time they are covered with a skin that grows as the antlers do. The skin has short fine hairs called "*velvet*", containing a network of blood vessels, which nourish the growing bone beneath. By late summer, the antlers are fully developed, and the "*velvet*" is rubbed off against small saplings by the animal as the bone hardens. The antlers then serve as sexual ornaments and rival males may use them as weapons in courtship battles during the breeding season, which is called the "*rut*". After the mating season, the antlers decalcify and detach from the frontal bone within two to three days of each other, fall to the ground, and are often quickly found and gnawed on by various rodents for the calcium (National Audubon Society 2000). Antler size depends upon nutrition, age, and genetics (Craven and Hygnstrom 1994).

The white-tailed deer reproductive season varies according to geographic range. It may occur by the first two weeks in November in the north, but occurs as late as January or February in the south. Females, called "*does*", may have one to three young, or "*fawns*", after a gestation period of approximately 202 days (Craven and Hygnstrom 1994). A young doe bred for the first time will usually have only one fawn, older does two or three. The female remains near the fawns, returning to feed them only once or twice a day. Twin fawns are separated, which serves to protect them. Weaning occurs between 1 and 2 ½ months. Fawns stay with the mother until fall or winter, sometimes up to two years, but the doe generally drives off her young the previous year shortly before giving birth (National Audubon Society 2000).

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). White-tailed deer range throughout most of the United States, except the far southwest, and inhabit the southern half of the southern tier of Canadian provinces. This species inhabits farmlands, brushy areas, forests, suburbs, and gardens. Rural areas containing a matrix of forest and agricultural crops can contain the highest deer densities (Roseberry and Woolf 1998). Biologists and resource managers in Alabama 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). Additionally, white-tailed deer are ranked as one of the most hazardous species to aviation according to the percentage of strikes that caused damage from 1990 through 2012 (Dolbeer et al. 2013).

White-tailed deer are present in all Alabama counties, and occupy almost all land types that contain suitable habitat. The ADCNR (2014) has classified white-tailed deer as a species of "*lowest conservation concern*" in the State. The ADCNR (2014) stated the statewide deer population was 1.75 million deer in 2000, which is the most current population estimate. The authority for management of resident wildlife species, including deer, is the responsibility of the ADCNR. The ADCNR collects and compiles information on white-tailed deer population trends and harvest and uses this information to manage deer populations. The primary tool for the management of deer populations in Alabama is through adjusting the allowed lethal removal during the deer harvest season in the State. White-tailed deer are classified as a game animal in Alabama with annual hunting seasons. During the 2013 hunting season, Metzler (2014) reported that 266,725 deer were harvested in the State. Between 2009 and 2013, nearly 1,511,000 deer were harvested in the State by hunters (Liles 2009, Liles 2010, Liles 2011, Liles 2012, Metzler 2013),

which is an average annual harvest of nearly 302,200 deer. The number of deer the ADCNR allows to be harvested by individual hunters during the length of the hunting season varies. However, during the development of this EA, up to two female deer could be harvested daily during the antlerless deer season with a harvest limit of one antlered deer per day (three total during the length of the season) (ADCNR 2013).

Mortality can also occur from vehicle collisions, dogs, illegal take, tangling in fences, disease, and other causes (Crum 2003). Annual deer mortality in Alabama from other sources (*e.g.*, illegal take, disease, and predation) is currently unknown. An estimated 26,050 deer-vehicle collisions occurred in Alabama from July 1, 2011 through June 30, 2012 (State Farm Mutual Automobile Insurance 2012).

From FY 2009 through FY 2013, WS responded to 16 technical assistance requests associated with white-tailed deer in the State. In addition, WS responded to requests for direct operational assistance associated with deer in the State. As part of those direct operational assistance requests, WS lethally removed 106 white-tailed deer between FY 2009 and FY 2013 to alleviate damage or threats of damage in the State, which is an average lethal removal of 21 deer each year. WS also employed non-lethal methods to disperse one deer between FY 2009 and FY 2013. WS unintentionally removed one deer during other damage manage activities conducted between FY 2009 and FY 2013. In addition, WS live-captured three deer unintentionally during other damage management activities and released those deer unharmed.

After review of previous activities conducted by WS and in anticipation of additional efforts, WS could lethally remove up to 500 deer annually. In addition, WS may be requested by the ADCNR and/or the ADAI to assist with sampling and managing the spread of diseases found in free-ranging and/or captive deer populations. If a disease outbreak occurred, WS could be requested to remove white-tailed deer for sampling and/or to prevent further spread of diseases. However, WS' total annual removal would not exceed 500 deer annually under the proposed action. Deer could also be lethally removed unintentionally during other damage management activities conducted by WS; however, WS does not anticipate the cumulative lethal removal of deer to exceed 500 deer annually.

If requested, WS could also assist with sampling and removing deer from captive facilities where deer were confined inside a perimeter fence. The detection of a disease at a captive facility often raises concerns for the potential spread of diseases to free-ranging herds. The spread of diseases among deer inside those 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 ADCNR and/or the ADAI. As proposed in this alternative, in those cases where WS was requested to assist with the removal of a captive deer herd in Alabama, the removal would not exceed 500 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 estimates. However, since removal of deer by WS for disease surveillance or monitoring could occur in free-ranging or captive herds, the potential removal of up to 500 deer for disease surveillance and monitoring by WS would be considered as part of the impact analysis on the statewide free-ranging deer population.

During the2013 hunting season, 266,725 deer were harvested in Alabama during the annual hunting season (Metzler 2014). If WS' removal reached 500 deer during 2013, WS' removal would have represented 0.2% of the harvest. As stated previously, the deer population in Alabama has been estimated at 1.75 million deer (ADCNR 2014*e*). The total deer mortality in the State in 2013 could be estimated at nearly 293,000 deer, based on the number of deer hunter's harvested, WS' removal, and vehicle collision data. If the deer population estimate provided by the ADCNR included recruitment of deer born that

year, then the removal of deer from all known sources in 2013 would represent 16.7% of the deer population, if the deer population remained at least stable. If WS had removed 500 deer in 2013, the total mortality of deer would have represented 16.8% of the population. If WS had lethally removed 500 deer in 2013, WS' removal would have represented an increase of 0.1% when compared to the total mortality in 2013 if no removal by WS had occurred (*i.e.*, 16.7% without removal by WS compared to 16.8% if WS' removal had been 500 deer in 2013).

With oversight of the ADCNR, the magnitude of removal of deer by WS annually to resolve damage and threats would be low. The ADCNR has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, would be detrimental to the survival of the white-tailed deer population in the State of Alabama (M. Sievering, ADCNR, pers. comm. 2012).

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 Alabama. 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 Gonadotropin-releasing Hormone (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™ appear to be reversible if deer are not provided with a booster shot periodically, the reduction in a local population of deer from the use of GonaCon™ can 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 would likely be 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 were no longer vaccinated or provided booster shots and other conditions (*e.g.*, food, disease) were 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 contended 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 ADCNR. WS would annually report to the ADCNR and monitor removal to ensure WS' activities do not adversely affect deer. The permitting of all WS' removal by the ADCNR would ensure WS' removal would meet the objectives of the statewide deer population.

WOODCHUCK POPULATION INFORMATION AND EFFECTS ANALYSIS

The woodchuck, also known as the "*groundhog*", is a large rodent, often seen in pastures, meadows, and open fields throughout Alabama. They dig large burrows, generally eight to 12 inches at the opening, sometimes five feet deep and 30 feet long with more than one entrance, which opens to a spacious grass-filled chamber. Green vegetation, such as grass, clover, and alfalfa, forms its diet. At times, the woodchuck will feed heavily on corn and can cause extensive damage in a garden to other crops (National Audubon Society 2000). Woodchucks may also jeopardize the integrity of earthen dams, present hazards to livestock and farm equipment because of burrowing, gnawing electrical cables, and damaging hoses and other accessories on automobiles by gnawing (Bollengier 1994).

The breeding season for woodchucks is usually from March through April (Bollengier 1994). Female woodchucks usually produce from four to six young per year (Chapman and Feldhamer 2003). The offspring breed at one year of age and live four to five years. Mammal species with high mortality rates, such as rodents (*e.g.*, woodchucks) and lagomorphs (*e.g.*, rabbits), typically possess high reproductive rates, and produce large and frequent litters of young (Smith 1996). For example, if a pair of woodchucks and their offspring all survived to breed as soon as possible, with an average litter size of four with a 1:1 sex ratio; they could produce over 645 woodchucks through their lifetime. The range of woodchucks in the United States extends throughout the East, northern Idaho, northeastern North Dakota, southeastern Nebraska, eastern Kansas, northeastern Oklahoma, and south to Virginia and Alabama.

Both sexes are similar in appearance, but the male is slightly larger, weighing an average of five to 10 pounds (2.2 to 4.5 kg). The total length of the head and body averages 16 to 20 inches (40 to 51 cm). The tail is usually four to seven inches (10 to 18 cm) long. Like other rodents, woodchucks have white or yellowish-white, chisel-like incisor teeth. Their eyes, ears, and nose are located toward the top of the head, which allows them to remain concealed in their burrows while they check for danger over the rim or

edge. Although they are slow runners, woodchucks are alert and scurry quickly to their dens when they sense danger (Bollengier 1994).

Woodchucks seldom stray far from their home dens. Chapman and Feldhamer (2003) estimated that distances of daily travel ranged from 100 m in colonies occupying good habitat to 400 m in somewhat lacking habitat, which makes a home range of seven to 124 acres in size. Woodchuck colonies have not been extensively studied to determine the social structure of a typical colony. However, in order for the species to survive, a colony would have to be comprised of at minimum two adults and the young of that year, totaling at least six to eight individuals.

The range of the woodchuck is generally confined to the northern two-thirds of the State along forest edges, open fields, pastures near brush fencerows or other cover. The ADCNR has classified the woodchuck as a species of "*lowest conservation concern*" (ADCNR 2014*b*). Woodchucks are classified as a game animal in Alabama, with a continuously open statewide harvest season and no limits on the number of woodchucks that a person can harvest. As stated previously, woodchucks are typically associated with pastures, meadows and fields, open woodlands, and clearings (Chapman and Feldhamer 2003, ADCNR 2014*b*). The land cover categories most likely to encompass those habitats include pasture, shrub/scrub, and mixed forest, which cumulatively total approximately 39,674 km^2 (15,324 mi^2) in Alabama (see Table 4.1). If only 50% of those land classes supported woodchucks, under a worst-case scenario, with an estimate of a single woodchuck home range at 124 acres and assuming that only one woodchuck occupied a home range and no home ranges overlapped, the statewide woodchuck population could be estimated to be approximately 39,500 woodchucks. This would be a worst-case scenario since the woodchuck population likely inhabits a much larger portion of those land classifications, woodchuck colonies likely consist of six to eight individuals, and some portion of most other land cover categories can support woodchuck populations.

WS continues to receive requests for assistance to manage damage associated with woodchucks in the State. Requests for assistance received by WS from FY 2009 through FY 2013 were primarily associated with woodchuck damage occurring to gardens, vegetables, turf and flowers, building foundations, and drainage and irrigation structures. As part of those requests for assistance, WS employed lethal methods to remove 23 woodchucks, which is an average of five woodchucks lethally removed by WS annually. The highest annual number removed occurred during FY 2011 when WS removed 13 woodchucks to alleviate damage. In addition, WS removed one woodchuck unintentionally during activities targeting other wildlife species between FY 2009 and FY 2013. WS has also live-captured and released 10 woodchucks unintentionally between FY 2009 and FY 2013.

WS anticipates continuing to receive requests for assistance to address woodchuck damage at any location in the State. Based on previous requests for assistance and in anticipation of additional efforts to manage damage, WS could lethally remove up to 20 woodchucks annually to alleviate damage. When receiving requests for assistance associated with woodchucks, the WS program in Alabama would follow WS Directive 2.345.

Gas cartridges could be employed to fumigate woodchuck burrows in areas where damage was occurring. Gas cartridges act as a fumigant by producing carbon monoxide gas when ignited. The cartridges contain sodium nitrate that when burnt, produces carbon monoxide gas. The cartridges would be placed inside active burrows at the entrance, the cartridge would be ignited, and the entrance to the burrow would be sealed with dirt, which allows the burrow to fill with carbon monoxide.

The number of entrances to burrow systems used by woodchucks varies. Twichell (1939) found the number of entrances to burrow systems used by woodchucks ranged from two to six entrances in Missouri with the average number being 2.8 entrances. Other studies note the number of entrances per

burrow system ranged from one to five entrances (Grizzell, Jr. 1955) to a high of 11 entrances per system (Merriam 1971). Merriam (1971) found the mean number of entrances per burrow system was 2.98 entrances. The use of burrow systems is usually restricted to a male and a reproductive female (Swihart 1992, Armitage 2003). The number of woodchucks lethally removed when using gas cartridges to fumigate burrows would be based on the mean number of entrances per burrow system of approximately three entrances (Twichel 1939, Merriam 1971) and each burrow system occupied by a male and a female (Swihart 1992, Armitage 2003). The removal of woodchucks could also occur using other methods, such as shooting, live traps, and body gripping traps. However, the number of woodchucks lethally removed using gas cartridges and the number removed by other methods would not be expected to exceed 20 woodchucks annually.

Damage management activities associated with woodchucks would target single animals or local populations of the species at sites where their presence was causing unacceptable damage to agriculture, human health or safety, natural resources, or property. Some local populations may be temporarily reduced because of damage management activities conducted under the proposed action alternative aimed at reducing damage at a local site. If WS' annual removal reached 20 woodchucks, the removal would represent 0.1% of a statewide population estimated at 39,500 woodchucks. However, WS' annual removal of woodchucks would likely represent a smaller percentage of the actual population given the population estimate derived represents a worst-case scenario. The unlimited removal and continuous open season for woodchucks provides an indication that densities are sufficient that overharvest is unlikely to occur.

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.

Under disease sampling strategies that could be implemented to detect or monitor diseases in the United States, WS' implementation of those sampling strategies would not adversely affect mammal populations in the State. Sampling strategies that could be employed involve sampling live-captured mammals that could be released on site after sampling occurs. The sampling (*e.g.*, drawing blood, tissue sample, fecal sample) and the subsequent release of live-captured mammals would not result in adverse effects since those mammals would be released unharmed on site. In addition, the sampling of mammals that were sick, dying, or harvested by hunters would not result in the additive lethal removal of mammals that would not have already occurred in the absence of disease sampling. Therefore, the sampling of mammals for diseases would not adversely affect the populations of any of the mammals addressed in this EA nor would sampling mammals result in any lethal removal 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 further action. However, those people requesting assistance would likely be those 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 removal mammals despite WS' lack of direct involvement in the management action. Therefore, under this alternative the number of mammals lethally removed annually would likely be similar to the other alternatives since removal could occur through the issuance of a permit by the ADCNR, removal of non-regulated mammal species could occur without the need for a permit from the ADCNR, and removal 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 ADCNR, 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 ADCNR, 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 removal, 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 (*e.g*., see White et al. 1989, USFWS 2001, United States Food and Drug Administration 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 removal of mammals by WS would occur under this alternative. Mammals could continue to be lethally removed to resolve damage and/or threats occurring through permits issued by the ADCNR, during the regulated hunting or trapping seasons, or in the case of non-regulated species, removal 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 removal levels similar to the proposed action.

Since mammals could still be removed 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 removal 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 of Mammal Damage Management Activities 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 people 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 to address damage caused by 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 were 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 effects 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 removal 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 affected if the area excluded was large enough. The use of auditory and visual dispersal methods 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 likely 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 would be intended to elicit fright responses in wildlife. When employing those methods to disperse or harass target species, any non-targets near methods when employed would also likely be dispersed from the area. Similarly, any exclusionary device constructed to prevent access by target species could also exclude access to some 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 likely elicit a similar response from both non-target and target species. Although non-lethal methods do not result in the lethal removal of non-targets, the use of non-lethal methods could restrict or prevent access of non-targets to beneficial resources. However, non-lethal methods would not be employed over large geographical areas and those methods would not be applied at such intensity levels 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, the use of non-lethal methods would not adversely affect populations of wildlife since those methods would often be temporary.

Other non-lethal methods available for use under this alternative would include live traps, nets, repellents, immobilizing drugs, and reproductive inhibitors. Live traps and nets restrain wildlife once captured; therefore, those methods would be considered live-capture methods. 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 2009, WS has not used repellents to reduce mammal damage in the State. However, WS may recommend or employ commercially available repellents when providing technical assistance and direct operational assistance. Only those repellents registered with the EPA pursuant to the FIFRA and registered with the ADAI 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, 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). 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.

WS could employ immobilizing drugs to handle and transport target mammal species. Immobilizing drugs would be applied directly to target animals through hand injection or by projectile (*e.g.*, dart gun). WS would make reasonable efforts to retrieve projectiles containing immobilizing drugs if misses occurred or if the projectile detached from target animals. Therefore, no direct effects to non-target animals would be likely since identification would occur prior to application. Animals anesthetized using immobilizing drugs recover once the drug has been fully metabolized. Therefore, non-targets that may consume animals that recover are unlikely to receive a dosage that would cause any impairment. When using immobilizing drugs to handle or transport target animals, WS would monitor anesthetized animals until that animal recovers sufficiently to leave the site.

Exposure of non-target wildlife to GonaCon™ could 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 removal 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 ADCNR or persons under their supervision under Alternative 2 and Alternative 3, 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. 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 the recommendation of harvest during hunting and/or trapping seasons, shooting, body-gripping traps, cable restraints, fumigants, rodenticides, euthanasia chemicals, and euthanasia after live-capture. 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 effects would be anticipated from use of this method. Similarly, the use of euthanasia methods would not result in non-target removal 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 removal 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, house mouse, and short-tailed shrew (*Blarina brevicauda*) (Hamilton 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, 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 removal from the use of fumigants would be limited.

Zinc phosphide is a toxicant used to kill rodents and lagomorphs. Zinc phosphide is two to 15 times more toxic to rodents than to carnivores (Hill and Carpenter 1982). Secondary risks appear to be minimal to predators and scavengers that scavenge carcasses of animals killed with zinc phosphide (Tietjen 1976, Hegdal and Gatz 1977, Hegdal et al. 1980, Hill and Carpenter 1982, Johnson and Fagerstone 1994). Risks would be minimal based since 90% of the zinc phosphide ingested by rodents is detoxified in the digestive tract (Hegdal et al. 1980) and 99% of the zinc phosphide residues occur in the digestive tracts, with none occurring in the muscle. In addition, the amount of zinc phosphide required to kill target rodents is not enough to kill most other predatory animals that consume tissue (Johnson and Fagerstone 1994).

In addition, zinc phosphide has a strong emetic action (*i.e.*, causes vomiting) and most non-target animals in research tests regurgitated bait or tissues contaminated with zinc phosphide without succumbing to the toxicant (Hegdal and Gatz 1977, Hegdal et al. 1980, Johnson and Fagerstone 1994). Furthermore, predators tend to eviscerate zinc phosphide-poisoned rodents before eating them or otherwise avoid the

digestive tract and generally do not eat the stomach and intestines (Hegdal et al. 1980, Johnson and Fagerstone 1994). Although zinc phosphide baits have a strong, pungent, phosphorous-like odor (garlic like), this characteristic seems to attract rodents, particularly rats, and apparently makes the bait unattractive to some other animals. Many birds appear capable of distinguishing treated from untreated baits and they prefer untreated grain when given a choice (Siegfried 1968, Johnson and Fagerstone 1994). Birds appear particularly susceptible to the emetic effects of zinc phosphide, which would tend to offer an extra degree of protection against bird species dying from the consumption of grain treated with zinc phosphide or, for scavenging bird species, from eating poisoned rodents. Use of rolled oats instead of whole grain also appears to reduce bird acceptance of bait. Uresk et al. (1988) reported on the effects of zinc phosphide on six non-target rodent populations. Uresk et al. (1988) determined that no differences were observed from pretreatment until after treatment in populations of eastern cottontail rabbits and white-tailed jackrabbits (*Lepus townsendii*). However, primary consumption of bait by non-target wildlife could occur and potentially cause mortality. Uresk et al. (1988) reported a 79% reduction in deer mouse populations in areas treated with zinc phosphide; however, the effect was not statistically significant because of high variability in densities and the reduction was not long-term (Deisch et al. 1990).

Ramey et al. (2000) reported that five weeks after treatment, no ring-necked pheasants (*Phasianus colchicus*) had been killed because of zinc phosphide baiting. In addition, Hegdal and Gatz (1977) determined that zinc phosphide did not affect non-target populations and more radio-tracked animals were killed by predators than died from zinc phosphide intoxication (Hegdal and Gatz 1977, Ramey et al. 2000). Tietjen (1976) observed horned larks (*Eremophila alpestris*) and mourning doves (*Zenaida macroura*) on zinc phosphide-treated prairie dog colonies, but observations after treatment did not locate any sick or dead birds, a finding similar to Apa et al. (1991). Uresk et al. (1988) reported that ground-feeding birds showed no difference in numbers between control and treated sites. Apa et al. (1991) further states that zinc phosphide was not consumed by horned larks because: 1) poisoned grain remaining for their consumption was low (*i.e.*, bait was accepted by prairie dogs before larks could consume it), 2) birds have an aversion to black-colored foods, and 3) birds have a negative sensory response to zinc phosphide.

Reduced impacts on birds associated with the use of zinc phosphide have also been reported by Tietjen and Matschke (1982). Deisch et al. (1989) reported on the effect zinc phosphide has on invertebrates. Deisch et al. (1989) determined that zinc phosphide bait reduced ant densities; however, spider mites, crickets, wolf spiders, ground beetles, darkling beetles, and dung beetles were not affected. Wolf spiders and ground beetles showed increases after one year on zinc phosphide treated areas (Deisch 1986). Generally, direct long-term impacts from rodenticide treatments were minimal for the population of insects that were sampled (Deisch et al. 1989). Long-term effects were not directly related to rodenticides, but more to habitat changes (Deisch 1986) as vegetative cover and prey diversity increased without prairie dogs grazing and clipping the vegetation (Deisch et al. 1989). In addition, zinc phosphide treated baits would be placed underground or used in bait stations. The application of baits below ground or in bait stations would limit the direct exposure risks by most non-target species.

Use of zinc phosphide on various types of fruit, vegetable, or cereal baits (*e.g.*, apples, carrots, sweet potatoes, oats, barley) has proven to be effective at suppressing target wildlife populations. All chemicals that could be used by WS would be registered under the FIFRA and administered by the EPA and the ADAI. Specific bait applications would be designed to minimize non-target hazards (Evans 1970). WS' personnel that use chemical methods would be certified as pesticide applicators by the ADAI and would be required to adhere to all certification requirements set forth in the FIFRA and the Alabama pesticide control laws and regulations. No chemicals would be used on federal or private lands without authorization from the land management agency or property owner/manager.

Anticoagulant rodent baits with warfarin, brodifacoum, bromadiolone, or diphacinone as active ingredients could be used in bait stations to target small rodents. WS could utilize locking bait stations to restrict access of non-target species to rodenticides, such as anticoagulants. The use and proper placement of bait stations would minimize the likelihood that the bait would be consumed by non-target species. There may be secondary hazards from anticoagulant baits. Those risks are reduced somewhat by the fact that the predator scavenger species would usually need exposure to multiple carcasses over a period of days. Areas where anticoagulants could be used would be monitored and carcasses picked up and disposed of in accordance with label directions.

An issue that has arisen is the potential for low-level flights to disturb wildlife, including T&E species. Aerial operations could be an important method of damage management in Alabama when used to address damage or threats associated with feral swine and/or coyotes in remote areas where access was limited due to terrain and habitat. Aerial operations involving shooting would only occur in those areas where a work initiation document allowing the use of aircraft had been signed between WS and the cooperating landowner or manager. Aircraft could also be used for aerial surveys of wildlife or radio telemetry. Aerial operations would typically be conducted with aircraft between the months of December and April when the foliage has fallen; however, aircraft could be used at any time of year. The amount of time spent conducting aerial operations would vary depending on the survey area, severity of damage, the size of the area where damage or threats were occurring, and the weather, as low-level aerial activities would be restricted to visual flight rules and would be impractical in high winds or at times when animals were not easily visible.

Aircraft play an important role in the management of various wildlife species for many agencies. Resource management agencies rely on low flying aircraft to monitor the status of many animal populations, including large mammals (Lancia et al. 2000), birds of prey (Fuller and Mosher 1987), waterfowl (Bellrose 1976), and colonial waterbirds (Speich 1986). Low-level flights also occur when aircraft are used to track animal movements by radio telemetry (Gilmer et al. 1981, Samuel and Fuller 1994).

A number of studies have looked at responses of various wildlife species to aircraft overflights. The National Park Service (1995) reviewed the effects of aircraft overflights on wildlife and suggested that adverse effects could occur to certain species. Some species will frequently or at least occasionally show an adverse response to even minor overflights. In general though, it appears that the more serious potential adverse effects occur when overflights are chronic (*i.e.*, they occur daily or more often over long periods). Chronic exposures generally involve areas near commercial airports and military flight training facilities. Aerial operations conducted by WS rarely occur in the same areas on a daily basis, and little time is actually spent flying over those particular areas.

The effects on wildlife from military-type aircraft have been studied extensively (Air National Guard 1997), and were found to have no expected adverse effects on wildlife. Examples of species or species groups that have been studied with regard to the issue of aircraft-generated disturbance are as follows:

***Waterbirds and Waterfowl*:** Low-level overflights of two to three minutes in duration by a fixed-wing airplane and a helicopter produced no "*drastic*" disturbance of tree-nesting colonial waterbirds, and, in 90% of the observations, the individual birds either showed no reaction or merely looked up (Kushlan 1979). Belanger and Bedard (1989, 1990) observed responses of greater snow geese (*Chen caerulescens atlantica*) to man-induced disturbance on a sanctuary area and estimated the energetic cost of such disturbance. Belanger and Bedard (1989, 1990) observed that disturbance rates exceeding two per hour reduced goose use of the sanctuary by 50% the following day. They also observed that about 40% of the disturbances caused interruptions in feeding that would require an estimated 32% increase in nighttime feeding to compensate for the energy lost. They concluded that overflights of sanctuary areas should be

strictly regulated to avoid adverse effects. Conomy et al. (1998) quantified behavioral responses of wintering American black ducks (*Anas rubripes*), American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level military aircraft and found that only a small percentage (2%) of the birds reacted to the disturbance. They concluded that such disturbance was not adversely affecting the "*time-activity budgets*" of the species. Low-level aerial operations conducted by WS would not be conducted over federal, state, or other governmental agency property without the concurrence of the managing entity. Those flights, if requested, would be conducted to reduce threats and damages occurring to natural resources and should not result in impacts to bird species. Thus, there is little to no potential for any adverse effects on waterbirds and waterfowl.

***Raptors*:** The Air National Guard analyzed and summarized the effects of overflight studies conducted by numerous federal and state government agencies and private organizations (Air National Guard 1997). Those studies determined that military aircraft noise initially startled raptors, but negative responses were brief and did not have an observed effect on productivity (see Ellis 1981, Fraser et al. 1985, Lamp 1989, United States Forest Service 1992 as cited in Air National Guard 1997). A study conducted on the impacts of overflights to bald eagles (*Haliaeetus leucocephalus*) suggested that the eagles were not sensitive to this type of disturbance (Fraser et al. 1985). During the study, observations were made of more than 850 overflights of active eagle nests. Only two eagles rose out of either their incubation or brooding postures. This study also showed that perched adults were flushed only 10% of the time during aircraft overflights. Evidence also suggested that golden eagles (*Aquila chrysaetos*) were not highly sensitive to noise or other aircraft disturbances (Ellis 1981, Holthuijzen et al. 1990). Finally, one other study found that eagles were particularly resistant to being flushed from their nests (see Awbrey and Bowles 1990 as cited in Air National Guard 1997). Therefore, there is considerable evidence that eagles would not be adversely affected by overflights during aerial operations.

Mexican spotted owls (*Strix occidentalis lucida*) (Delaney et al. 1999) did not flush when chain saws and helicopters were greater than 110 yards away; however, owls flushed to these disturbances at closer distances and were more prone to flush from chain saws than helicopters. Owls returned to their pre-disturbance behavior 10 to 15 minutes following the event and researchers observed no differences in nest or nestling success (Delaney et al. 1999), which indicates that aircraft flights did not result in adverse effects on owl reproduction or survival.

Andersen et al. (1989) conducted low-level helicopter overflights directly at 35 red-tailed hawk (*Buteo jamaicensis*) nests and concluded their observations supported the hypothesis that red-tailed hawks habituate to low level flights during the nesting period since results showed similar nesting success between hawks subjected to overflights and those that were not. White and Thurow (1985) did not evaluate the effects of aircraft overflights, but found that ferruginous hawks (*B. regalis*) were sensitive to certain types of ground-based human disturbance to the point that reproductive success may be adversely affected. However, military jets that flew low over the study area during training exercises did not appear to bother the hawks, nor did the hawks become alarmed when the researchers flew within 100 feet in a small fixed-wing aircraft (White and Thurow 1985). White and Sherrod (1973) suggested that disturbance of raptors by aerial surveys with helicopters may be less than that caused by approaching nests on foot. Ellis (1981) reported that five species of hawks, two falcons (*Falco* spp.), and golden eagles (*Aquila chrysaetos*) were "*incredibly tolerant*" of overflights by military fighter jets, and observed that, although birds frequently exhibited alarm, negative responses were brief and the overflights never limited productivity.

Grubb et al. (2010) evaluated golden eagle response to civilian and military (Apache AH-64) helicopter flights in northern Utah. Study results indicated that golden eagles were not adversely affected when exposed to flights ranging from 100 to 800 meters along, towards, and from behind occupied cliff nests.

Eagle courtship, nesting, and fledging were not adversely affected, indicating that no special management restrictions were required in the study location.

The above studies indicate raptors were relatively unaffected by aircraft overflights, including those by military aircraft that produce much higher noise levels. Therefore, aerial operations would have little or no potential to affect raptors adversely.

***Passerines*:** Reproductive losses have been reported in one study of small territorial passerines ("*perching*" birds that included sparrows, blackbirds) after exposure to low altitude overflights (see Manci et al. 1988 as cited in Air National Guard 1997), but natural mortality rates of both adults and young are high and variable for most species. The research review indicated passerine birds cannot be driven any great distance from a favored food source by a non-specific disturbance, such as military aircraft noise, which indicated quieter noise would have even less effect. Passerines avoid intermittent or unpredictable sources of disturbance more than predictable ones, but return rapidly to feed or roost once the disturbance ceases (Gladwin et al. 1988, United States Forest Service 1992). Those studies and reviews indicated there is little or no potential for aerial operations to cause adverse effects on passerine bird species.

***Pronghorn (antelope) and Mule Deer*:** Krausman et al. (2004) found that Sonoran pronghorn (*Antilocapra americana sonoriensis*) were not adversely affected by military fighter jet training flights and other military activity on an area of frequent and intensive military flight training operations. Krausman et al. (1986) reported that only three of 70 observed responses of mule deer (*Odocoileus hemionus*) to small fixed-wing aircraft overflights at 150 to 500 feet above ground level resulted in the deer changing habitats. The authors believed that the deer might have been accustomed to overflights because the study area was near an interstate highway that was followed frequently by aircraft. Krausman et al. (2004) also reported that pronghorn and mule deer do not hear noise from military aircraft as well as people, which potentially indicates why they appeared not to be disturbed as much as previously thought.

***Mountain Sheep*:** Krausman and Hervert (1983) reported that, of 32 observations of the response of mountain sheep to low-level flights by small fixed-wing aircraft, 60% resulted in no disturbance, 81% in no or "*slight*" disturbance, and 19% in "*great*" disturbance. Krausman and Hervert (1983) concluded that flights less than 150 feet above ground level could cause mountain sheep to leave an area. When Weisenberger et al. (1996) evaluated the effects of simulated low altitude jet aircraft noise on desert mule deer (*Odocoileus hemionus crooki*) and mountain sheep (*Ovis canadensis mexicana*), they found that heart rates of the ungulates increased according to the dB levels, with lower noise levels prompting lesser increases. When they were elevated, heart rates rapidly returned to pre-disturbance levels suggesting that the animals did not perceive the noise as a threat. Responses to the simulated noise levels were found to decrease with increased exposure.

***Bison*:** Fancy (1982) reported that only two of 59 bison (*Bison bison*) groups showed any visible reaction to small fixed-winged aircraft flying at 200 to 500 feet above ground level. The study suggests that bison were relatively tolerant of aircraft overflights.

***Domestic Animals and Small Mammals*:** A number of studies with laboratory animals (*e.g.*, rodents [Borg 1979]) and domestic animals (*e.g.*, sheep [Ames and Arehart 1972]) have shown that these animals can become habituated to noise. Long-term lab studies of small mammals exposed intermittently to high levels of noise demonstrate no changes in longevity. The physiological "*fight or flight*" response, while marked, does not appear to have any long-term health consequences on small mammals (Air National Guard 1997). Small mammals habituate, although with difficulty, to sound levels greater than 100 dbA (United States Forest Service 1992).

Although many of those wildlife species discussed above are not present in Alabama, the information was provided to demonstrate the relative tolerance most wildlife species have of overflights, even those that involve noise at high decibels, such as from military aircraft. In general, the greatest potential for impacts to occur would be expected to exist when overflights were frequent, such as hourly and over many days that could represent "*chronic*" exposure. Chronic exposure situations generally involve areas near commercial airports and military flight training facilities. Even then, many wildlife species often become habituated to overflights, which would naturally minimize any potential adverse effects where such flights occur on a regular basis. Therefore, aircraft used by WS should have far less potential to cause any disturbance to wildlife than military aircraft because the military aircraft produce much louder noise and would be flown over certain training areas many more times per year, and yet were found to have no expected adverse effects on wildlife (Air National Guard 1997).

The fact that WS would only conduct aerial hunting on a very small percentage of the land area of the State indicates that most wildlife would not even be exposed to aerial overflights in the State. Further lessening the potential for any adverse effects is that such flights occur infrequently throughout the year.

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 removal of unintended species. The unintentional removal 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 cable restraints and in some situations, with live-capture methods, such as foothold traps and cage traps.

Table 4.3 shows the number of non-targets lethal removed unintentionally during activities conducted by WS from FY 2009 through FY 2013. To ensure a cumulative evaluation occurs, Table 4.3 includes non-targets lethally removed unintentionally during activities associated with managing damage caused by aquatic rodents (USDA 2002) and the ORV program (USDA 2009*a*) that overlap with non-targets lethally removed during activities targeting those mammal species addressed in this EA. Most of those non-targets shown in Table 4.3 were lethally removed unintentional during activities targeting aquatic rodents (USDA 2002). For example, most of the river otter lethally removed unintentionally by WS between FY 2009 and FY 2013 were associated with activities being conducted to alleviate damage caused by beaver. However, those species included in Table 4.3 could also be lethally removed unintentionally during activities conducted under the proposed action alternative described in this EA since many of same methods would be available for use to alleviate damage or threats of damage.

Table 4.3 – WS' lethal removal of non-targets by method in Alabama, FY 2009 – FY 2013†

Species	Method of Lethal Removal				Total
	Body Grip	Cage Trap‡	Foothold	Neck Snare	
Eastern Cottontail	1	0	0	0	**1**
Nine-banded Armadillo	5	0	0	0	**5**
Raccoon	25	0	18	3	**46**
Red Fox	1	0	0	0	**1**
River Otter	88	0	2	2	**92**
Virginia Opossum	1	71	2	0	**75**
White-tailed Deer	0	0	1	0	**1**
Woodchuck	1	0	0	0	**1**

†Includes non-targets lethally removed unintentionally during activities associated with managing damage caused by aquatic rodents (USDA 2002) and the ORV program (USDA 2009*a*) that overlap with non-targets lethally removed during activities targeting those mammal species addressed in this EA

‡Animals were dispatched with firearms to minimize safety concerns of personnel with the release of animals

The lethal removal of non-targets could result in declines in the number of individuals in a population; however, as was discussed previously, the lethal removal of non-targets by WS during damage management activities would be of low magnitude when compared to the actual statewide population of those species. The previous non-targets lethally removed unintentionally by WS are representative of non-targets that could be lethally removed by WS under the proposed action alternative. Although additional species of non-targets could be lethally removed by WS, the removal of individuals from any species would not be likely to increase substantively above the number of non-targets removed annually by WS during previous damage management activities.

In addition, those species lethally removed or live-captured previously are considered target species in this EA and the level of removal analyzed for each of those species under Issue 1 included the unintentional removal that could occur by WS or the unintentional removal was evaluated as part of the cumulative analysis. Therefore, the lethal removal of those species was evaluated cumulatively under Issue 1, including removal that could occur when a species was considered a target or non-target. WS would continue to monitor activities, including non-target removal, to ensure the annual removal of non-targets does not result in adverse effects to a species' population. Those species lethally removed as non-targets previously by WS can be harvested in the State during annual harvest seasons or are considered unregulated and lethal removal could occur at any time.

Table 4.4 shows those non-targets live-captured and released unharmed by WS from FY 2009 through FY 2013. Similar to Table 4.3, Table 4.4 includes non-targets live-captured unintentionally and released during activities associated with managing damage caused by aquatic rodents (USDA 2002) and the ORV program (USDA 2009*a*) that overlap with non-targets lethally removed during activities targeting those mammal species addressed in this EA. For example, many of the feral cats and opossum live-captured in cage traps from FY 2009 through FY 2013 were associated with activities being conducted under the ORV program (USDA 2009*a*). However, those species could also be live-captured and released during activities conducted under the proposed action alternative addressed in this EA.

Table 4.4 – Non-targets live-captured and released by WS in Alabama, FY 2009 – FY 2013†

Species	Method of Live-Capture				Total
	Body Grip‡	Cage Trap	Foothold‡	Snare‡	
Eastern Cottontail	0	1	0	0	**1**
Feral Cat	0	89	0	0	**89**
Feral Dog	0	2	0	0	**2**
Gray Fox	0	1	0	0	**1**
Gray Squirrel	0	1	0	0	**1**
Mink	0	1	0	0	**1**
Raccoon	2	3	4	0	**9**
River Otter	0	1	0	3	**4**
Virginia Opossum	1	257	0	0	**258**
White-tailed Deer	0	3	0	0	**3**

†Includes non-targets lethally removed unintentionally during activities associated with managing damage caused by aquatic rodents (USDA 2002) and the ORV program (USDA 2009*a*) that overlap with non-targets lethally removed during activities targeting those mammal species addressed in this EA

‡Animals captured in body grip traps, foothold traps, or neck snares by the tail or other extremity would be released if they are unharmed and can be released safely.

As shown in Table 4.4, most non-targets captured by WS during damage management activities are live-captured and subsequently released unharmed. Non-targets released have been primarily live-captured during activities targeting raccoons as part of the ORV program (USDA 2009*a*) addressed in Chapter 1 in which WS employs cage traps to live-capture raccoons for sampling. The ORV program and the post-bait

trapping program are further described in the EA addressing those activities (USDA 2009*a*). The capture and limited lethal removal that could occur as part of the ORV program and trapping activities are further addressed in the ORV program EA (USDA 2009*a*). In addition, non-targets could be lethally removed or live-captured unintentionally during damage management activities targeting aquatic rodents (USDA 2002).

WS would monitor the removal of non-target species to ensure program activities or methodologies used in mammal damage management would not adversely affect non-targets. 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 ADCNR any non-target removal to ensure removal by WS was considered as part of management objectives established for those species by the ADCNR. The potential for adverse effects to occur with non-targets would be similar to the other alternatives and would be considered minimal to non-existent based on previous non-target removal.

As discussed previously, the use of non-lethal methods to address damage or threats would generally be regarded as having no 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 would be 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.

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 removal 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 effects on T&E species are described in Chapter 3 of this EA.

Federally Listed Species **-** The current list of species designated as threatened or endangered in Alabama as determined by the USFWS and the National Marine Fisheries Service was 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 (D. Everson, USFWS pers. comm. 2013).

State Listed Species **–** The current list of State listed species designated as endangered or threatened by the ADCNR was reviewed during the development of the EA (Alabama Natural Heritage Program 2012). 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 ADCNR has concurred with WS' determination for State listed species (C. Sykes, ADCNR pers. comm. 2013).

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 persons 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 but would be based on the knowledge and experience of the person to identify the target species correctly.

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 removal when compared to the non-target removal 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 conducted no further action, the potential to remove 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 removal 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 people requesting assistance, lethal methods could be employed by those people experiencing damage. Those persons requesting assistance would likely be those persons that would use lethal methods since a damage threshold had been met for that individual requester that triggered seeking 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 removal 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 (*e.g.*, see White et al. 1989, USFWS 2001, United States Food and Drug Administration 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 removal of wildlife species.

The ability to reduce negative effects 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 removal.

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 lethally removed under permits issued by the ADCNR, removal would continue to occur during the regulated harvest seasons, and some mammal species could continue to be removed 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 other federal, state, and private entities. Although some risks could 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 effects 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 Mammal Damage Management Activities 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, work initiation document, 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 to identify any risks to human safety associated with the use of those methods. Cooperators would be made aware by signing a MOU, work initiation document, or other similar document, which would assist WS and the cooperating entity with identifying any risks to human safety associated with methods at a particular location.

Under the proposed action, WS could use or recommend those methods discussed in Appendix B singularly or in combination 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. Those non-lethal methods that could be used as part of an integrated approach to managing damage that would be available for use by WS as part of direct operational assistance, would be similar to those risks associated with the use of those methods under the other alternatives.

Lethal methods available under the proposed action would include the use of euthanasia chemicals, body-gripping traps, cable restraints, the recommendation of harvest during hunting and/or trapping seasons, fumigants, rodenticides, and shooting. 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 those methods available, the 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 would 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 could be controlled and monitored, the risks to human safety from the use of methods would likely be less. If damage management activities occurred at public parks or near other public use areas, then risks of the public encountering damage management methods and the corresponding risk to human safety would increase. Activities would generally be conducted when human activity was minimal (*e.g.*, early mornings, at night) or in areas where human activities was 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 would only be 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 could 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 would occur by trained personnel after target species were observed in the capture area of the net. Lasers also pose minimal risks to the public since application would occur directly to target species by trained personnel, which would limit 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 the use of firearms were issues identified. To help ensure the safe use of firearms and to increase awareness of

those risks, WS' employees who use firearms during official duties would be 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. 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 security of firearms would also occur pursuant to WS Directive 2.615.

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 could include immobilizing drugs, euthanasia chemicals, reproductive inhibitors, fumigants, rodenticides, 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 would likely occur on site with close monitoring of the animal to ensure proper care of the animal. Immobilizing drugs would be reversible with a full recovery of sedated animals occurring. Drugs used in capturing and handling wildlife that would be available include ketamine, a mixture of ketamine/xylazine, and Telazol. A list and description of immobilizing drugs available for use under the identified alternatives can be found in Appendix B.

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. SOPs that would be part of the activities conducted include:

- All immobilizing 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. This practice would avoid release of animals that may be consumed by hunters and/or trappers 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 immobilizing drugs would be released well before hunting/trapping seasons, which would give the drug time to metabolize completely out of the animals' systems before they might be harvested and consumed by people. In some instances, animals collected for control purposes would be euthanized when they were 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.

Meeting the requirements of the AMDUCA should prevent any adverse effects to human health with regard to this issue.

Euthanizing chemicals would be administered under similar circumstances to immobilizing drugs. Euthanizing chemicals would be administered to animals live-captured using other methods. Euthanasia chemicals would include sodium pentobarbital, potassium chloride, and Beuthanasia-D. Euthanized animals would be disposed of in accordance with WS Directive 2.515; therefore, would not be available for harvest and consumption. Euthanasia of target animals would occur in the absence of the public to minimize risks, whenever possible.

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 likely 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.

The recommendation of various rodenticides or the use of those rodenticides registered for use to manage rodents in the State could occur under the proposed action as part of an integrated approach to managing damage. Those rodenticides that would be available for use by WS or could be recommended by WS under this alternative would also likely be available under any of the alternatives. Therefore, risks to human safety from the recommendation of rodenticides or the direct use of rodenticides would be similar across all the alternatives. WS' involvement, either through recommending the use of rodenticides or their direct use, would ensure that label requirements of these rodenticides would be 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 rodenticides could be lessened through WS' participation.

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 ADAI 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. During the development of this EA, GonaCon™ was not registered for use in Alabama; therefore, GonaCon™ would not be available for use within the State. However, this product could be registered for use in Alabama and could be administered by ADCNR 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 had 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.

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 would likely be places where hunting was prohibited or restricted (*e.g.*, in public parks); therefore, the consumption of deer would be 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 harvest 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 season that are established by the ADCNR 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 ADCNR 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.

CONSEQUENCES OF AERIAL WILDLIFE OPERATIONS ACCIDENTS

Aerial wildlife operations, like any other flying, may result in an accident. WS' pilots and crewmembers would be trained and experienced to recognize the circumstances that lead to accidents. The national WS Aviation Program has increased its emphasis on safety, including funding for additional training, the establishment of a WS Flight Training Center and annual recurring training for all pilots. Still, accidents may occur and the environmental consequences should be evaluated.

***Major Ground or Wild/Forest Fires*:** Although fires could result from aircraft-related accidents, no such fires have occurred from aircraft incidents previously involving government aircraft and low-level flights.

Fuel Spills and Environmental Hazard from Aviation Accidents: A representative of the National Transportation Safety Board has stated previously that aviation fuel is extremely volatile and will evaporate within a few hours or less to the point that even its odor cannot be detected (USDA 2005). The fuel capacity for aircraft used by WS varies. For fixed-winged aircraft, a 52-gallon capacity would generally be the maximum, while 91 gallons would generally be the maximum fuel capacity for helicopters. In some cases, little or none of the fuel would be spilled if an accident occurs. Thus, there should be little environmental hazard from unignited fuel spills.

Oil and Other Fluid Spills: With the size of aircraft used by WS, the quantities of oil (*e.g.*, 6 to 8 quarts maximum for reciprocating (piston) engines and 3 to 5 quarts for turbine engines) capable of being spilled in any accident would be small with minimal chance of causing environmental damage. Aircraft used by WS would be single engine models, so the greatest amount of oil that could be spilled in one accident would be about 8 quarts.

When exposed to oxygen, petroleum products biodegrade through volatilization and bacterial action (EPA 2000). Thus, small quantity oil spills on surface soils can be expected to biodegrade readily. Even in subsurface contamination situations involving underground storage facilities that would generally be expected to involve larger quantities than would ever be involved in a small aircraft accident, the EPA guidelines provide for "*natural attenuation*" or volatilization and biodegradation in some situations to mitigate environmental hazards (EPA 2000). Thus, even where oil spills in small aircraft accidents were not cleaned up, the oil does not persist in the environment or persists in such small quantities that no adverse effects would be expected. In addition, WS' accidents generally would occur in remote areas away from human habitation and drinking water supplies. Thus, the risk to drinking water appears to be exceedingly low to nonexistent.

For these reasons, the risk of ground fires or fuel/oil pollution from aviation accidents could be considered low. In addition, based on the history and experience of the program in aircraft accidents, it appears the risk of significant environmental damage from such accidents is exceedingly low.

No adverse effects to human safety have occurred from WS' use of methods to alleviate mammal damage in the State from FY 2009 through FY 2013. 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. Based on the use patterns of methods available to address damage caused by mammals, this alternative would comply with Executive Order 12898 and Executive Order 13045.

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

Under this alternative, WS would be restricted to making recommendations on the use of methods and the demonstration of methods to resolve damage. WS would only provide technical assistance to those people 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, could 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, those methods could be used with a high degree of safety.

Under a technical assistance only alternative, the use of immobilizing drugs, euthanasia chemicals, and GonaCon™ would not be available to the public. However, personnel with the ADCNR or their designated agents could use GonaCon™ under this alternative, if registered. 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 ADCNR. If cannon nets were recommended, persons employing nets would be present at the site during application to ensure the safety of the public and operators. Although some fire and explosion 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 recommended in areas where public activity was high, which would further reduce the risks to the public. Nets would be recommended for use 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 effects on target species. Repellents that require ingestion are intended to discourage foraging on vulnerable resources and to disperse mammals from areas where the repellents were 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, as well as others, as the product was applied due to the potential for drift. 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 recommended use of chemical methods that were considered lethal would also be available under this alternative. Lethal chemicals available would consist primarily of those Ready-To-Use toxicants targeting rodents that were available at local hardware stores for use in managing old world rodents. Those toxicants would require no special certification to use and they would generally be considered safe when their use occurred in accordance with label directions. Additional lethal chemicals would be available through WS' recommendation to contact private sector wildlife control operators that have received ADAI certification for use of restricted-use pesticides. While those chemicals may not be available to individual landowners, using a private sector wildlife control operator, similar chemical use, and mammal damage control could be achieved.

The recommendation by WS that mammals be harvested during the regulated hunting and/or trapping season, which would be established by the ADCNR 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 ADCNR 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 removal 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. The recommendation of methods by WS to people requesting assistance and the pattern of use recommended by WS would comply with Executive Order 12898 and Executive Order 13045.

Alternative 3 – No Mammal Damage Management Conducted by WS

Under the no involvement 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 damages associated with mammals from conducting damage management activities in the absence of WS' assistance. The direct burden of implementing permitted methods would be placed on those people experiencing damage or would require those people 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, most rodenticides, and repellents would continue to be available to those persons with the appropriate pesticide applicators license. 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 were not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, would pose minimal risks to human safety.

Issue 4 - Effects of Mammal Damage Management Activities on the Aesthetic Value 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 was 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. In most cases, the mammals removed by WS could be removed by the person experiencing damage or removed by other entities if no assistance was provided by WS.

All activities would be conducted where a request for assistance was received and only after the cooperator and WS had signed a MOU, work initiation document, or similar document. Some aesthetic value would be gained by the removal of some mammal species 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 that could be removed by WS under this alternative could be removed by other entities, WS' involvement in removing those mammals would not likely be additive to the number of mammals that could be removed in the absence of WS' involvement. Other entities could remove mammals when the ADCNR authorizes the removal, without the need for a permit if the species was unregulated, or during the regulated hunting or trapping seasons.

WS' removal of mammals from FY 2009 through FY 2013 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 lethally removed 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 removed by the property owner or manager if WS were not involved in the action. Removal by the property owner or manager could occur under a permit, during the regulated hunting and trapping seasons, or if the mammals were unregulated, removal could occur without the need for a permit. Given the limited removal proposed by WS under this alternative when compared to the known sources of mortality of mammals and the population estimates 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 removed under this alternative by those entities experiencing mammal damage or threats, which could result in localized reductions in the presence of mammals at the location where damage was occurring. The presence of mammals where damage was occurring could 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 threshold for that particular person. Therefore, in the case of mammal damage, the social acceptance level of those mammals causing damage 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 could be employed by the requestor that could 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. In addition, those persons could contact other entities to provide direct assistance with dispersing or removing those mammals causing damage.

The potential 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 or if no further action was taken by the requester. If those persons experiencing damage abandoned the use of those methods or conducted no further actions, 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 people 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 removed under this alternative in the State. Lethal removal could continue to occur when permitted by the ADCNR through the issuance of permits, removal could occur during the regulated harvest season, and in the case of non-regulated species, removal could occur any time without the need for a permit.

Since mammals would continue to be lethally removed 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 removed since WS' has no authority to regulate removal or the harassment of mammals in the State. The ADCNR, with management authority over mammals could continue to adjust all removal levels based on population objectives for those mammal species in the State. Therefore, the number of mammals lethally removed annually through hunting and under permits would be regulated and adjusted by the ADCNR.

Those people experiencing damage or threats could continue to use those methods they feel appropriate to resolve mammal damage or threats, including lethal removal or could seek the direct assistance of other entities. Therefore, WS' involvement in managing damage would not be additive to the mammals that could be dispersed or removed. 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 that would be available include resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), translocation, exclusion devices,

frightening devices, reproductive inhibitors, cage traps, foothold traps, nets, immobilizing drugs, 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 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*", since the animal would be alive and generally unharmed. Yet, without proper care, live-captured wildlife in a cage trap could 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 would be 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 in a 24-hour period to ensure mammals captured were addressed in a timely manner and to prevent injury. Although stress could occur from being restrained, timely attention to live-captured wildlife would alleviate suffering. Stress would likely be temporary.

Under the proposed action, lethal methods could also be employed to alleviate or prevent mammal damage and threats, when requested. Lethal methods would include shooting, body-gripping traps, cable restraints, fumigants, rodenticides, euthanasia chemicals, and the recommendation of removal during hunting and/or trapping seasons. 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).

The euthanasia methods being considered for use under the proposed action for live-captured mammals are carbon dioxide, carbon monoxide, gunshot, and barbiturates or potassium chloride in conjunction with general anesthesia. Those methods are considered acceptable methods by the AVMA for euthanasia and the use of those methods would meet the definition of euthanasia (AVMA 2013). The use of carbon dioxide, carbon monoxide, barbiturates and potassium chloride for euthanasia would occur after the animal had been live-captured and would occur away from public view. Although the AVMA guideline also lists gunshot as a conditionally acceptable method of euthanasia for free-ranging wildlife, there is greater potential the method may not consistently produce a humane death (AVMA 2013). WS' personnel that employ firearms to address mammal damage or threats to human safety would be trained in the proper placement of shots to ensure a timely and quick death.

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 were 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. As state previously, research suggests that some methods, such as restraint in foothold traps or changes in the blood chemistry of trapped animals, indicate "*stress*" (Kreeger et al. 1988). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991, Sharp and Saunders 2008, Sharp and Saunders 2011).

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 people experiencing damage associated with mammals would be reproductive inhibitors, immobilizing drugs, and euthanasia chemicals. Therefore, the issue of humaneness 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 similarity would be 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 potential for 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 Alabama. Those people 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 ADCNR. Those species addressed in this EA that have established hunting and/or trapping seasons include woodchuck, gray squirrel, fox squirrel, cottontail rabbit, raccoon, river otter, mink, striped skunk, coyote, gray fox, red fox, bobcat, opossum, feral swine, and white-tailed deer. For many mammal species considered harvestable during a hunting and/or trapping season, the estimated number of mammals harvested during the season could be reported by the ADCNR in published reports.

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

The magnitude of lethal removal addressed in the proposed action would be low when compared to the mortality of those species from all known sources. When WS' proposed removal 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 ADCNR, the number of mammals that WS could remove annually would not limit the ability of those persons interested to harvest those mammal species during the regulated season. All removal by WS would be reported to the ADCNR annually to ensure removal by WS was incorporated into population management objectives established for mammal populations. Based on the limited removal proposed by WS and the oversight by the ADCNR, WS' removal 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 ADCNR or when considered a non-regulated species, could be removed at any time using legally available methods. Lethal removal could also occur 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 animals that people are authorized to remove and the allowed harvest levels during the regulated hunting/trapping seasons would be determined by the ADCNR. 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 ADCNR determines the number of mammals that may be lethally removed 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 ADCNR would continue to regulate populations through adjustments of the allowed removal 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 the 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 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 ADCNR, activities of each agency and the removal 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 Mammal Damage Management Activities on Target Mammal Populations

The issue of the effects on target mammal species arises from the use of non-lethal and lethal methods to address the need for reducing damage and threats. As part of an integrated methods approach to managing damage and threats, WS could apply both lethal and non-lethal methods when requested by those persons experiencing damage.

Non-lethal methods could 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. WS' employees would give non-lethal methods priority when addressing requests for assistance (see WS Directive 2.101). However, WS would not necessarily employ non-lethal methods 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 attempted to disperse mammals using non-lethal harassment methods, WS would not necessarily employ those methods again during direct operational assistance since those methods had already been proven to be ineffective in that particular situation. WS and other entities could use non-lethal methods 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 WS or another entity employed those methods. However, mammals responsible for causing damage or threats would likely disperse to other areas with minimal impacts occurring to those species' populations. WS would not employ non-lethal methods over large geographical areas or apply those methods 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. WS and most people generally regard non-lethal methods as having minimal impacts on overall populations of wildlife since individuals of those species would be unharmed. Therefore, the use of non-lethal methods would not have cumulative effects on mammal populations in the State.

WS' employees could employ lethal methods to resolve damage associated with those target mammal species identified by WS as responsible for causing damage or threats to human safety. However, lethal removal by WS would only occur after receiving a request for such assistance and only after the ADCNR authorized WS to use lethal methods, when required. Therefore, the use of lethal methods could result in local reductions in the number of target animals in the area where damage or threats were occurring since WS would remove those target individuals from the population. WS would often employ lethal methods to reinforce non-lethal methods and to remove mammals that have been identified as causing damage or posing a threat to human safety. The use of lethal methods could therefore result in local reductions of mammals in the area where damage or threats were occurring. The number of mammals removed from a species' 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.

WS would maintain ongoing contact with the ADCNR to ensure activities were within management objectives for those species. WS would submit annual activity reports to the ADCNR. The ADCNR would have the opportunity to monitor the total removal of mammals from all sources and could factor in survival rates from predation, disease, and other mortality data.

WS would monitor removal by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of removal was below the level that would cause undesired adverse effects to the viability of native species populations. This EA analyzed the potential cumulative impacts on the populations of target mammal species from the implementation of the proposed action alternative in Section 4.1.

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 private damage management activities
- Human induced mortality through regulated harvest
- 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 the damage occurring, including other affected elements and the dynamics of the damaging species, to determine appropriate strategies to minimize effects on environmental elements. The Model allows WS to implement damage management actions and to subsequently monitor those actions to adjust/cease 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 effects on target species.

With management authority over mammal populations in the State, the ADCNR could adjust removal levels, including the removal of WS, to ensure population objectives for mammals were achieved. Consultation and reporting of removal by WS would ensure the ADCNR had the opportunity to consider any activities WS conducts.

WS' removal of mammals in Alabama from FY 2009 through FY 2013 was of a low magnitude when compared to the total known removal of those species and the populations of those species. The ADCNR could consider all known removal when determining population objectives for mammals and could adjust the number of mammals that could be lethally removed during the regulated harvest season and the number of mammals removed for damage management purposes to achieve the population objectives. Any removal of regulated mammal species by WS would occur at the discretion of the ADCNR. Any mammal population declines or increases would be the collective objective for mammal populations established by the ADCNR through the regulation of lethal removal. Therefore, the cumulative removal of mammals annually or over time by WS would occur at the desire of the ADCNR 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 activities based on the following considerations:

Historical outcomes of WS' damage management activities on wildlife

WS would conduct damage management activities associated with mammals 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 resource agencies to ensure damage management activities would not adversely affect mammal populations and that WS' activities were considered as part of management goals established by those agencies. Historically, WS' activities to manage damage caused by mammals in Alabama 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. Alteration of activities would be defined through SOPs, and implementation would be insured through monitoring, in accordance with the WS' Decision Model (see WS Directive 2.201; Slate et al. 1992).

Issue 2 - Effects of Mammal Damage Management Activities 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 removal (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 removal, cumulative impacts on non-target species from the use of exclusionary methods or repellents would not occur but would likely disperse those individuals to other areas. Exclusionary methods and repellents can require constant maintenance 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, denning, 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 removal (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 removal (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 removal of non-target wildlife was 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, rodenticides, fumigants, immobilizing drugs, and euthanasia chemicals, which are described in Appendix B. Except for repellents that would be applied directly to the affected resource and reproductive inhibitors that would be applied directly to target animals, those chemical methods available for use would be employed using baits that were highly attractive to target species, used in known burrow/den sites, and/or used in areas where exposure to non-targets would be minimal. The use of those methods often requires an acclimation period and monitoring of potential bait sites for non-target activity. All chemicals would be used according to product labels, which would 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 Alabama 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 Alabama when used according to label requirements.

When using rodenticides, as required by WS' SOPs and applicable pesticide labels, all potential bait sites would be pre-baited and monitored for non-target use as outlined in the pre-treatment observations section of the label. If non-targets were observed feeding on the pre-bait, the areas would be abandoned and no baiting would occur at those locations. Once sites were baited, sites would be monitored to further observe for non-target feeding activity. If non-targets were observed feeding on bait, those sites would be abandoned. WS would retrieve all dead target species to the extent possible following treatment to minimize any secondary hazards associated with or perceived to be associated with scavengers feeding on target species carcasses. When using rodenticides, appropriate bait stations would be utilized and inspected as required by the applicable label.

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 have a high level of selectivity and could be employed using SOPs to ensure minimal impacts to non-target species. Those species lethally removed as unintentional non-targets were included in analysis as target species in this EA. The cumulative removal of those species, including target and non-target removal were evaluated in Chapter 4 of this EA. The unintentional removal of wildlife would likely be limited and would not reach 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 lethally removed to reach a magnitude where declines in those species' populations would occur. Therefore, removal under the proposed action of non-targets would not cumulatively affect non-target species. WS' has reviewed the T&E species listed by the ADCNR, the USFWS, and the

National Marine Fisheries Service, 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 Mammal Damage Management Activities 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 effects 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. When possible, 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, work initiation document, or other comparable document between WS and the cooperating entity. SOPs would also ensure the safety of the public from those methods used to capture or removal 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 registered with the ADAI. 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 were applied according to label requirements, no effects to human safety would be expected. Similarly, fumigants and rodenticides must also be registered for use with the EPA and the ADAI. Given the use patterns of repellents, rodenticides, and fumigants, no cumulative effects would occur to human safety.

WS has received no reports or documented any effects to human safety from WS' mammal damage management activities conducted from FY 2009 through FY 2013. No cumulative 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 of Mammal Damage Management Activities on the Aesthetic Value 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 would be established and enforced by the ADCNR by regulating harvest during the statewide hunting and trapping seasons after consideration of other known mortality factors. Therefore, WS would have no direct impact on the status of mammal populations since removal by WS occurs at the discretion of the ADCNR. Since those persons seeking assistance could remove mammals from areas where damage was occurring when permitted by the ADCNR, 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 people. Mortality is high among wildlife populations and specific individuals among a species may experience death early in life. Mortality in wildlife population is a natural occurrence and people 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 people 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 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 at least once a day in accordance with Alabama laws and regulations 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 removed by this method.

WS would employ methods as humanely as possible by applying SOPs 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 to ensure SOPs were adequate 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 removal for damage management purposes from FY 2009 through FY 2013 was low when compared to the total removal of mammals and when compared to the estimated statewide populations of those species. Since all removal of mammals is regulated by the ADCNR, removal by WS that could occur annually and cumulatively would occur pursuant to mammal population objectives established in the State. WS' removal of mammals (combined removal) annually to alleviate damage would be a minor component to the known removal that occurs annually during the harvest seasons for most mammal species.

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 ADCNR. Those species addressed in this EA that have established harvest seasons include woodchuck, gray squirrel, fox squirrel, cottontail rabbit, raccoon, river otter, mink, striped skunk, coyote, gray fox, red fox, bobcat, opossum, feral swine, and white-tailed deer.

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

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APPENDIX A
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APPENDIX B

METHODS AVAILABLE FOR RESOLVING OR PREVENTING MAMMAL DAMAGE IN ALABAMA

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 Alabama 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 Alabama. 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, work initiation document, 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 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 to prevent the entry of mammals into buildings through existing holes or gaps. Riprap can also be used on dams and levees to deter woodchucks and other burrowing rodents. 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*b*, 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 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 or chipmunks 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, 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 Alabama 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 people. 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 Alabama due to the risk of disease transmission. High population densities of some animals 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 ADCNR.

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

Drop nets are nylon or cloth nets that would be 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 would be baited and once feeding occurs under the net, the net would be released. Drop nets require constant supervision by personnel to drop the net when target individuals were present and when animals were 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 were 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 do occur from the use of nets. Injuries to deer occurred when using drop nets with the rate of injury being correlated with the number of deer captured during a single application of the net (Haulton et al. 2001). Nets are not generally available to the public.

Cannon nets use nylon or cloth nets to capture wildlife that have been 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 animals are feeding 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 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 could 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 animals during a single application. Similar to drop nets, injury rates for cannons nets appear to be correlated with the number of animals captured during a single application of the net (Haulton et al. 2001). Non-targets incidentally captured can be released on site unharmed. Cannon nets would generally not be available for use by the public and would not be available for use by the public under Alternative 2 and Alternative 3 except by the ADCNR or other natural resource agencies. A permit may be required from theADCNR to use cannon nets.

Foothold Traps can be effectively used to capture a variety of mammals. Foothold traps can be placed beside, or in some situations, 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 selectivity of foothold traps. 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. Foothold traps would generally be available for use by the public and other state or federal agencies.

Some restrictions on trap types and jaw spread occur in Alabama. The most recent regulations printed in the trapping guide state that all steel foothold traps for land sets must have an outside measurement of six inches or less. In addition, foothold traps cannot have teeth or serrated edges along the inside jaws. Traps must have a tag affixed bearing the name, address, and license number of the owner (Division of Wildlife and Freshwater Fisheries 2014).

Cable Restraints are typically made of wire or cable, and can be set to capture an animal by the neck, body, or 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. Steel cable snares are also prohibited on land, except that powered foot snares less than 5.5 inches are legal.

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. In general, cable restraints would be available to all entities to alleviate damage.

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 swine 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, which allows for the possibility of capturing multiple swine. Cage traps would be available to all entities to alleviate damage.

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; and 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 people 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. 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. Body-grip traps cannot exceed five inches in spread when utilized on land. Body-grip traps would be available for use by all entities.

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 would be 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 lethal removal. 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.

Denning is the practice of locating coyote or fox dens and killing the young, adults or both to stop an ongoing predation problem or prevent future depredation of livestock. Coyote and red fox depredations on livestock often increase in the spring and early summer due to the increased food requirements associated with feeding and rearing litters of pups. Removal of pups will often stop depredations even if the adults are not taken (Till 1992). Pups are typically euthanized in the den using a registered gas fumigant cartridge or by digging out the den and euthanizing the pups with sodium pentobarbital (see discussion of gas cartridges and sodium pentobarbital under *Chemical Wildlife Damage Management Methods*).

Hunting/Trapping: WS sometimes recommends that resource owners 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.

Aerial Shooting or aerial hunting (*i.e*., shooting from an aircraft) is a commonly used damage management method for coyotes and feral swine. Aerial shooting can be especially effective in removing offending coyotes that have become "*bait-shy*" to trap sets or are not susceptible to calling and shooting. Aerial shooting is one of the preferred damage management methods for reducing feral swine damage as well, in that local swine populations can quickly be removed when weather and habitat conditions are favorable. Aerial hunting is mostly species-selective (there is a slight potential for misidentification) and can be used for immediate control to reduce livestock and natural resource losses if weather, terrain, and cover conditions are favorable. WS has also used aerial hunting for disease surveillance (*e.g*., taking deer samples for chronic wasting disease and searching for carcasses in areas where an anthrax outbreak has occurred). Fixed-wing aircraft are most frequently used in flat and gently rolling terrain whereas helicopters with better maneuverability have greater utility and are safer over rugged terrain and timbered areas.

In broken timber or deciduous cover, aerial hunting is more effective in winter when snow cover improves visibility and leaves have fallen. The WS program aircraft-use policy helps ensure that aerial hunting is conducted in a safe and environmentally sound manner, in accordance with federal and state laws. Pilots and aircraft must be certified under established WS program procedures and only properly trained WS' employees are approved as gunners. Ground crews are often used with aerial operations for safety reasons. Ground crews can also assist with locating and recovering target animals, as necessary.

Aircraft overflights have created concerns about disturbing wildlife. The National Park Service (1995) reviewed studies on the effects of aircraft overflights on wildlife. Their report revealed that a number of studies documented responses by certain wildlife species that could suggest adverse impacts may occur. Few, if any studies, have proven that aircraft overflights cause significant

adverse impacts to wildlife populations, although the report stated it is possible to draw the conclusion that affects to populations could occur. It appears that some species will frequently, or at least occasionally, show adverse responses to even minor overflight occurrences. In general, it appears that the more serious potential impacts occur when overflights are frequent, such as hourly, and over long periods of time, which represents chronic exposure. Chronic exposure situations generally occur in areas near commercial airports and military flight training facilities. The use of firearms from aircraft would occur in remote areas where tree cover and vegetation allows for visibility of target animals from the air. WS spends relatively little time over any one area.

WS has used fixed-wing aircraft and helicopters for aerial hunting in areas inhabited by wildlife for years. WS conducts aerial activities on areas only under signed agreement and concentrates efforts during certain times of the year and to specific areas. WS' Predator Damage Management Environmental Assessments (*e.g.*, USDA 2005) that have looked at the issue of aerial hunting overflights on wildlife have found that WS has annually flown less than 10 min./mi.^{2} on properties under agreements. WS flies very little over any one property under agreement in any given year. As a result, no known problems to date have occurred with WS' aerial hunting overflights on wildlife, nor are they anticipated in the future.

Aerial Surveying is a commonly used tool for evaluating and monitoring damage and establishing population estimates and locations of various species of wildlife. WS uses aerial surveying throughout the United States to monitor damages and/or populations of coyotes, fox, wolves, feral swine, feral goats, feral dogs, bobcats, mountain lions, white-tailed deer, pronghorn antelope, elk, big-horn sheep, and wild horses but any wildlife species big enough to see from a moving aircraft could be surveyed using this method. As with aerial shooting, the WS program aircraft-use policy helps ensure that aerial surveys are conducted in a safe and environmentally sound manner, in accordance with Federal and State laws. Pilots and aircraft must also be certified under established WS program procedures and policies.

Aerial Telemetry is used in research projects studying the movements of various wildlife species. Biologists will frequently place radio-transmitting collars on selected individuals of a species and then monitor their movements over a specified period. Whenever possible, the biologist attempts to locate the research subject using a hand-held antennae and radio receiver, however, occasionally animals will make large movements that prevent biologists from locating the animal from the ground. In these situations, WS can utilize either fixed wing aircraft or helicopters and elevation to conduct aerial telemetry and locate the specific animal wherever it has moved to. As with any aerial operations, the WS program aircraft-use policy helps ensure that aerial surveys would be conducted in a safe and environmentally sound manner, in accordance with federal and state laws.

Chemical Wildlife Damage Management Methods

All pesticides used by WS would be registered under the FIFRA and administered by the EPA and the ADAI. All WS personnel in Alabama who apply restricted-use pesticides would be certified pesticide applicators by the ADAI and have specific training by WS for pesticide application. The EPA and the ADAI 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 the United States Food and Drug Administration and/or the United States Drug Enforcement Agency.

Chemicals would not be 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.

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 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 a 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).

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calm 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 is a more powerful anesthetic and usually used for larger animals. Telazol is a combination of equal parts of tiletamine hydrochloride and zolazepam hydrochloride (a tranquilizer). The product is generally supplied sterile in vials, each containing 500 mg of active drug, and when dissolved in sterile water has a pH of 2.2 to 2.8. Telazol produces a state of unconsciousness in which protective reflexes, such as coughing and swallowing, are maintained during anesthesia. Schobert (1987) listed the dosage rates for many wild and exotic animals. Before using Telazol, the size, age, temperament, and health of the animal are considered. Following a deep intramuscular injection of Telazol, onset of anesthetic effect usually occurs within 5 to 12 minutes. Muscle relaxation is optimum for about the first 20 to 25 minutes after the administration, and then diminishes. Recovery varies with the age and physical condition of the animal and the dose of Telazol administered, but usually requires several hours.

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. Barbiturates are a recommended euthanasia drug for free-ranging wildlife (AVMA 2013). Sodium pentobarbital would only be administered after deer have been live-captured and properly immobilized to allow for direct injection. There are United Stated Drug Enforcement Agency 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 United Stated Drug Enforcement Agency 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 (2013). Animals that have been euthanized with this chemical experience cardiac arrest followed by death, and 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 United Stated Drug Enforcement Agency 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 United Stated Drug Enforcement Agency 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.

Zinc phosphide is an inorganic compound used to control rats, mice, voles, ground squirrels, prairie dogs, nutria, muskrats, feral rabbits, and gophers. Zinc phosphide is a heavy, finely ground gray-black powder that is partially insoluble in water and alcohol. When exposed to moisture, it decomposes slowly and releases phosphine gas (PH_3). When zinc phosphide treated bait encounters acids in the stomach, phosphate (PH_3) gas is released, which may account in a large part for observed toxicity. Animals that ingest lethal amounts of bait usually succumb overnight with terminal symptoms of convulsions, paralysis, coma, and death from asphyxia. If death is prolonged for several days, intoxication that occurs is similar to intoxication with yellow phosphorous, in which the liver is heavily damaged. Prolonged exposure to phosphine can produce chronic phosphorous poisoning.

Although zinc phosphide baits have a strong, pungent, phosphorous-like odor (garlic like), this characteristic seems to attract rodents, particularly rats, and apparently makes the bait unattractive to some other animals. For many uses of zinc phosphide formulated on grain or grain-based baits, pre-baiting is recommended or necessary for achieving good bait acceptance. Primary toxicity risks to non-target species from the direct consumption of treated bait can be minimized by using bait stations to prevent access by non-target species such as birds.

Because zinc phosphide is not stored in muscle or other tissues of poisoned animals, there is no secondary poisoning with this rodenticide. The bait however, remains toxic up to several days in the gut of the dead rodent. Other animals can be poisoned if they eat enough of the gut content of rodents recently killed with zinc phosphide.

Aluminum phosphide is an inorganic phosphide used to control insects and rodents in a variety of settings. It is mainly used as an indoor fumigant at crop transport, storage or processing facilities (or in shipholds, railcars) for both food and non-food crops. It may also be used as an outdoor fumigant for burrowing rodent and mole control, or in baits for rodent control in crops. Aluminum phosphide is available in pellet and tablet form, and is available in porous blister packs, sachets, or as dusts. As in the case of Phostoxin, it may be formulated as 55% active ingredient along with ammonium carbamate and inert ingredients.

Aluminum phosphide causes acute toxicity with the main routes of exposure occurring through ingestion and inhalation. Dermal absorbtion is not known to occur. The reported rodent oral LD_{50} is 11.5 mg/kg for Phostoxin. Aluminum phosphide ingested orally reacts with water and stomach acids to produce phosphine gas, which may account in a large part for the observed toxicity. Phosphine generated in the gastrointestinal tract is readily absorbed in to the bloodstream, and it is readily absorbed through the lung epithelium.

In chronic toxicity studies, rats fed chow fumigated with aluminum phosphide that averaged 0.51 ppm phosphine residues (approximately 0.43 mg/kg/day) showed no differences from the control animals with respect to blood or urine chemistry and no observable differences in tissue structure. It was reported that workers had probably encountered similar exposures on an intermittent basis (in some cases over as long as a 20-year period) and had yet to show signs of toxicity, which suggests that chronic effects may be minor or have a very long latency period. Inhalation studies were conducted on the effects of phosphine gas on male and female rats exposed at levels of 0.5, 1.5, and 4.5 mg/meters cubed for six hours per day over a 13-week period. Higher exposure groups (7.5 and 15 mg/meters cubed) were added following preliminary acute test results.

Results indicated that 15 mg/m^3 were lethal to 4 out of 10 female rats following 3 days of exposure. Significant treatment-related effects on body weight and decreased food consumption were seen across all treatment groups and sexes, but were reversible. Decreases in red-blood cell counts, hemoglobin, hematocrit, and increased platelet counts were seen in male rats of the 4.5 mg/m^3 group. Dose-related changes in blood urea nitrogen and other clinical parameters were also seen across exposure groups. Post-mortem examination of test animals revealed microscopic lesions in the outer cortex of the kidneys of rats exposed to 15 mg/m^3, but not at lower exposure levels. All of those effects were apparently reversible following a four-week recovery period.

Aluminum phosphide would be used by WS in Alabama primarily as a fumigant for small field rodents and moles. Products would be used in accordance with label restrictions in a manner defined by application guidelines on the label. Use in Alabama is infrequent and amounts used would be very small.

Anticoagulant rodent baits with warfarin, brodifacoum, bromadiolone, or diphacinone as active ingredients could be used in bait stations to target small rodents. WS would utilize locking bait stations to restrict access of non-target species to rodenticides such as anticoagulants. The use and proper placement of bait stations would minimize the likelihood that the bait would be consumed by non-target species. There may be secondary hazards from anticoagulant baits. Those risks would be reduced somewhat by the fact that the predator scavenger species would usually need exposure to multiple carcasses over a period of days. Areas where anticoagulants are used would be monitored and carcasses picked up and disposed of in accordance with label directions.

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.

Gas cartridges (EPA Reg. No. 56228-21, EPA Reg. No. 56228-2) are registered by WS with the ADAI 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 they 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).

APPENDIX C

FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

Notes:

- This report shows the listed species associated in some way with Alabama.
- 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	Acornshell, southern (*Epioblasma othcaloogensis*)
T	Bankclimber, purple (mussel) (*Elliptoideus sloatianus*)
E	Bat, gray Entire (*Myotis grisescens*)
E	Bat, Indiana Entire (*Myotis sodalis*)
E	Bean, Choctaw (*Villosa choctawensis*)
E	Bean, Cumberland (pearlymussel) (*Villosa trabalis*)
E	Blossom, turgid (pearlymussel)(*Epioblasma turgidula*)
E	Blossom, yellow (pearlymussel)(*Epioblasma florentina florentina*)
E	Campeloma, slender (*Campeloma decampi*)
E	Cavefish, Alabama (*Speoplatyrhinus poulsoni*)
T	Chub, spotfin (*Erimonax monachus*)
E	Clubshell, ovate (*Pleurobema perovatum*)
E	Clubshell, southern (*Pleurobema decisum*)
E	Combshell, Cumberlandian (*Epioblasma brevidens*)
E	Combshell, southern (*Epioblasma penita*)
E	Combshell, upland (*Epioblasma metastriata*)
E	Darter, boulder (*Etheostoma wapiti*)
T	Darter, goldline (*Percina aurolineata*)
E	Darter, rush (*Etheostoma phytophilum*)
T	Darter, slackwater(*Etheostoma boschungi*)
T	Darter, snail (*Percina tanasi*)
E	Darter, vermilion (*Etheostoma chermocki*)
E	Darter, watercress (*Etheostoma nuchale*)
E	Ebonyshell, round (*Fusconaia rotulata*)
T	Elimia, lacy (snail) (*Elimia crenatella*)
E	Fanshell (*Cyprogenia stegaria*)
T	Heelsplitter, Alabama (=inflated) (*Potamilus inflatus*)
E	Hornsnail, rough Entire (*Pleurocera foremani*)
E	Kidneyshell, southern (*Ptychobranchus jonesi*)

Animal species listed in this state and that occur in this state	
Status	**Species**
E	Kidneyshell, triangular (*Ptychobranchus greenii*)
E	Lampmussel, Alabama (*Lampsilis virescens*)
E	Lilliput, pale (pearlymussel) (*Toxolasma cylindrellus*)
E	Lioplax, cylindrical (snail) (*Lioplax cyclostomaformis*)
E	Manatee, West Indian (*Trichechus manatus*)
T	Moccasinshell, Alabama (*Medionidus acutissimus*)
E	Moccasinshell, Coosa (*Medionidus parvulus*)
E	Moccasinshell, Gulf (*Medionidus penicillatus*)
E	Monkeyface, Cumberland (pearlymussel) (*Quadrula intermedia*)
E	Mouse, Alabama beach (*Peromyscus polionotus ammobates*)
E	Mouse, Perdido Key beach (*Peromyscus polionotus trissyllepsis*)
T	Mucket, orangenacre (*Lampsilis perovalis*)
E	Mucket, pink (pearlymussel) (*Lampsilis abrupta*)
E	Mussel, oyster (*Epioblasma capsaeformis*)
E	Mussel, sheepnose (*Plethobasus cyphyus*)
E	Mussel, snuffbox (*Epioblasma triquetra*)
E	Pearlshell, Alabama (*Margaritifera marrianae*)
E	Pearlymussel, cracking (*Hemistena lata*)
E	Pearlymussel, dromedary (*Dromus dromas*)
E	Pearlymussel, littlewing (*Pegias fabula*)
E	Pearlymussel, Slabside (*Pleuronaia dolabelloides*)
E	Pebblesnail, flat (*Lepyrium showalteri*)
E	Pigtoe, dark (*Pleurobema furvum*)
E	Pigtoe, finerayed (*Fusconaia cuneolus*)
E	Pigtoe, flat (*Pleurobema marshalli*)
T	Pigtoe, fuzzy (*Pleurobema strodeanum*)
E	Pigtoe, Georgia (*Pleurobema hanleyianum*)
E	Pigtoe, heavy (*Pleurobema taitianum*)
T	Pigtoe, narrow (*Fusconaia escambia*)
E	Pigtoe, oval (*Pleurobema pyriforme*)
E	Pigtoe, rough (*Pleurobema plenum*)
E	Pigtoe, shiny (*Fusconaia cor*)
E	Pigtoe, southern (*Pleurobema georgianum*)
T	Pigtoe, tapered (*Fusconaia burkei*)
E	Pimpleback, orangefoot (pearlymussel) (*Plethobasus cooperianus*)
T	Plover, piping (*Charadrius melodus*)
T	Pocketbook, finelined (*Lampsilis altilis*)
E	Pocketbook, shinyrayed (*Lampsilis subangulata*)

Animal species listed in this state and that occur in this state	
Status	**Species**
E	Purple Cat's paw (pearlymussel) (*Epioblasma obliquata obliquata*)
T	Rabbitsfoot (*Quadrula cylindrica cylindrica*)
E	Ring pink (mussel) (*Obovaria retusa*)
E	Riversnail, Anthony's (*Athearnia anthonyi*)
E	Rocksnail, interrupted (=Georgia) (*Leptoxis foremani*)
T	Rocksnail, painted (*Leptoxis taeniata*)
E	Rocksnail, plicate (*Leptoxis plicata*)
T	Rocksnail, round (*Leptoxis ampla*)
T	Salamander, Red Hills (*Phaeognathus hubrichti*)
T	sandshell, Southern (*Hamiota australis*)
T	Sculpin, pygmy (*Cottus paulus (=pygmaeus)*)
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	Shiner, blue (*Cyprinella caerulea*)
E	Shiner, Cahaba (*Notropis cahabae*)
E	Shiner, palezone (*Notropis albizonatus*)
E	Shrimp, Alabama cave (*Palaemonias alabamae*)
T	Slabshell, Chipola (*Elliptio chipolaensis*)
E	Snail, armored (*Pyrgulopsis (=Marstonia) pachyta*)
T	Snail, tulotoma (*Tulotoma magnifica*)
T	Snake, eastern indigo (*Drymarchon corais couperi*)
E	Spectaclecase (mussel) (*Cumberlandia monodonta*)
E	Stirrupshell (*Quadrula stapes*)
E	Stork, wood (*Mycteria americana*)
E	Sturgeon, Alabama (*Scaphirhynchus suttkusi*)
T	Sturgeon, gulf (*Acipenser oxyrinchus desotoi*)
T	Sunfish, spring pygmy (*Elassoma alabamae*)
T	Tortoise, gopher (*Gopherus polyphemus*)
E	Turtle, Alabama red-belly (*Pseudemys alabamensis*)
T	Turtle, flattened musk (*Sternotherus depressus*)
E	Wartyback, white (pearlymussel) (*Plethobasus cicatricosus*)
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**

Animal species listed in this state that do not occur in this state	
Status	**Species**
E	Beetle, American burying (*Nicrophorus americanus*)
E	Blossom, tubercled (pearlymussel) (*Epioblasma torulosa torulosa*)
E	Clubshell (*Pleurobema clava*)
E	Clubshell, black (*Pleurobema curtum*)
E	Darter, amber (*Percina antesella*)
E	Dragonfly, Hine's emerald (*Somatochlora hineana*)
E	Frog, dusky gopher (*Rana sevosa*)
E	Kidneyshell, fluted (*Ptychobranchus subtentum*)
E	Mapleleaf, winged (*Quadrula fragosa*)
E	Mussel, scaleshell (*Leptodea leptodon*)
E	Panther, Florida (*Puma (=Felis) concolor coryi*)
E	Pearlymussel, birdwing (*Lemiox rimosus*)
E	Riffleshell, tan (*Epioblasma florentina walkeri (=E. walkeri)*)
E	Warbler (=wood), Bachman's (*Vermivora bachmanii*)
E	Wolf, gray (*Canis lupus*)

Animal listed species occurring in this state that are not listed in this state	
Status	**Species**
E	Butterfly, Mitchell's satyr (*Neonympha mitchellii mitchellii*)
E	Sawfish, smalltooth (*Pristis pectinata*)
T	Sea turtle, loggerhead (*Caretta caretta*)

Summary of Plant listings

Plant species listed in this state and that occur in this state	
Status	**Species**
T	Amphianthus, little (*Amphianthus pusillus*)
T	Bladderpod, lyrate (*Lesquerella lyrata*)
T	Button, Mohr's Barbara (*Marshallia mohrii*)
E	Chaffseed, American (*Schwalbea americana*)
T	Fern, Alabama streak-sorus (*Thelypteris pilosa var. alabamensis*)
T	Fern, American hart's-tongue (*Asplenium scolopendrium var. americanum*)
E	Grass, Tennessee yellow-eyed (*Xyris tennesseensis*)
E	Harperella (*Ptilimnium nodosum*)
E	Leather flower, Alabama (*Clematis socialis*)
E	Leather flower, Morefield's (*Clematis morefieldii*)
E	Pinkroot, gentian (*Spigelia gentianoides*)
E	Pitcher-plant, Alabama canebrake (*Sarracenia rubra ssp. alabamensis*)
E	Pitcher-plant, green (*Sarracenia oreophila*)
E	Pondberry (*Lindera melissifolia*)

Plant species listed in this state and that occur in this state	
Status	**Species**
T	Potato-bean, Price's (*Apios priceana*)
E	Prairie-clover, leafy (*Dalea foliosa*)
E	Trillium, relict (*Trillium reliquum*)
T	Water-plantain, Kral's (*Sagittaria secundifolia*)

Plant listed species occurring in this state that are not listed in this state	
Status	**Species**
E	Quillwort, Louisiana (*Isoetes louisianensis*)