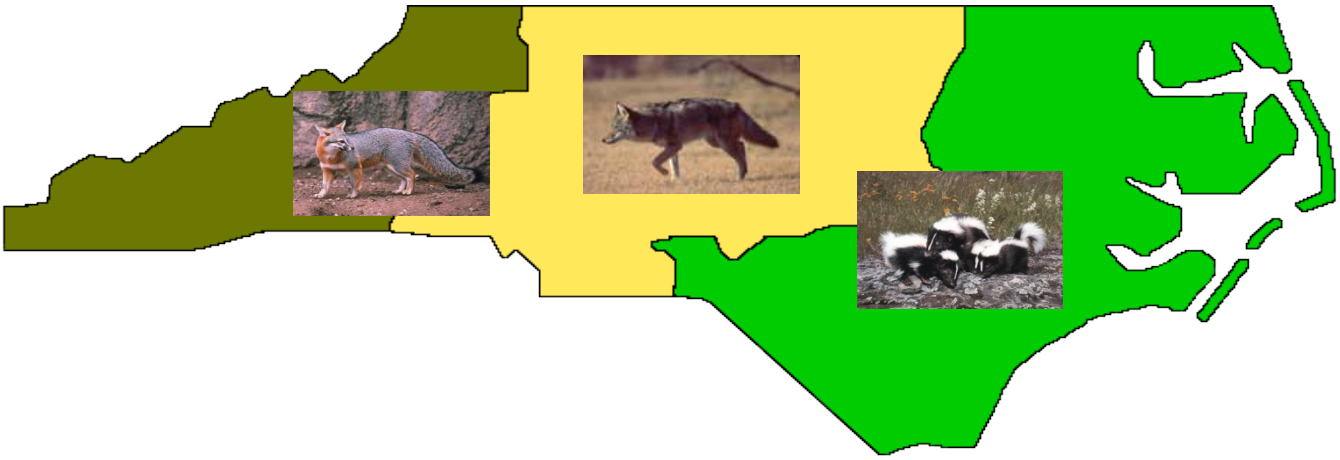
ENVIRONMENTAL ASSESSMENT

REDUCING MAMMAL DAMAGE

IN THE STATE OF NORTH CAROLINA



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ACRONYMS

AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BO	Biological Opinion
CAHA	Cape Hatteras National Seashore
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DEA	Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FPL	Feline Panleukopenia
FR	Federal Register
FY	Fiscal Year
MOU	Memorandum of Understanding
NASS	National Agricultural Statistic Service
NCDA	North Carolina Department of Agriculture
NCWRC	North Carolina Wildlife Resources Commission
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NWRC	National Wildlife Research Center
ORV	Oral Rabies Vaccination
PEP	Post - Exposure Prophylaxis
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
TNR	Trap, Neuter, Release Program
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of Interior
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 North Carolina continues to receive requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety, associated with bobcat (*Felis rufus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), river otter (*Lutra canadensis*), woodchuck (*Marmota monax*), American mink (*Mustela vison*), feral swine (*Sus scrofa*), feral cat (*Felis domesticus*), feral dog (*Canis familiaris*), gray squirrel (*Sciurus carolinensus*), Eastern cottontail (*Sylvilagus floridanus*), and black bear (*Ursus americanus*). Normally, individual wildlife damage management actions 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 purpose of this Environmental Assessment (EA) is to evaluate cumulatively the individual wildlife damage management activities conducted by WS to manage damage and threats to agricultural resources, property, natural resources, and threats to humans caused by those mammal species identified previously. This EA will assist in determining if the proposed cumulative management of mammal damage could have a significant impact on the environment for both humans and other organisms, analyze alternatives, coordinate efforts with other federal, state, and local agencies, inform the public, and to comply with the NEPA. This EA analyzes the potential effects of mammal damage management when requested, as coordinated between WS and the North Carolina Wildlife Resources Commission (NCWRC).

WS is 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 program activities; and 5) evaluate and determine if there are any potentially significant or cumulative adverse effects from the proposed program. The analyses contained in this EA are based on information derived from WS' Management Information System, published documents (see Appendix A), interagency consultations, public involvement, and the analyses in WS' programmatic Final Environmental Impact Statement (FEIS)[2] (USDA 1997) which will be incorporated into this document by reference.

This 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 that need while addressing the identified issues. Issues relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. The issues and alternatives associated with mammal damage management were initially developed by WS and after consultation with the NCWRC. The NCWRC has regulatory authority to manage populations of mammal species in the State. To assist with the identification of additional issues and alternatives to managing damage associated with

[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 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c).

[2]WS' has prepared a programmatic FEIS that further addresses WS' activities to manage damage associated with wildlife, including detailed discussion of program activities, risk assessment of methods, and discussion of issues (USDA 1997). Information from WS' programmatic FEIS has been incorporated by reference into this EA.

mammals in North Carolina this EA will be made available to the public for review and comment prior to the issuance of a Decision[3].

1.2 NEED FOR ACTION

Some species of wildlife have adapted to and thrive in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between humans and wildlife that lead to requests for assistance to reduce damage to resources and to reduce threats to human safety. WS' programmatic FEIS summarizes the relationship of wildlife values and wildlife damage in this way (USDA 1997):

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

Both sociological and biological carrying capacities must be applied to resolve wildlife damage problems. The wildlife acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations. Biological carrying capacity is the land or habitat's ability to support healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). These 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 persons directly and indirectly affected by the species and any associated damage. This damage threshold determines the wildlife acceptance capacity. While the habitat may have a biological carrying capacity to support higher populations of wildlife, in many cases the wildlife acceptance capacity is lower or has been met. Once the wildlife acceptance capacity is met or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and safety.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. Those species that cause damage have no intent to do harm. They utilize habitats (*e.g.*, reproduce, walk, forage) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or poses a threat to human safety, people seek assistance with resolving damage or reducing threats to human safety. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (*e.g.*, economic, social, aesthetics). Therefore, how damage is defined is often unique to the individual person and damage occurring to one individual may not be considered damage by another individual. However, the use of the term "*damage*" is consistently used to describe situations where the individual

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

person has determined the losses associated with wildlife is actual damage requiring assistance (*i.e.*, has reached an individual threshold). The term "*damage*" is most often defined as economic losses to resources or threats to human safety but could also include a loss in aesthetic value and other situations where the actions of wildlife are no longer tolerable to an individual person.

The need for action to manage damage and threats associated with mammals in North Carolina arises from requests for assistance[4] received by WS to reduce and prevent damage associated with mammals from occurring to four major categories: agricultural resources, natural resources, property, and threats to human safety. WS has identified those mammal species most likely to be responsible for causing damage to those four categories in the State based on previous requests for assistance. Table 1.1 lists WS' technical assistance projects involving mammal damage or threats of damage to those four major resource types in North Carolina from the federal fiscal year[5] (FY) 2006 through FY 2010. Technical assistance is provided by WS to those persons requesting assistance with resolving damage or the threat of damage by providing information and recommendations on mammal damage management activities that can be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 3 of this EA.

The technical assistance projects conducted by WS are representative of the damage and threats that are caused by mammals in North Carolina. As shown in Table 1.1, WS has conducted 172 technical assistance projects to address damage and threats associated with those mammal species identified in this EA from FY 2006 through FY 2010. The highest number of technical assistance projects conducted for any of the species addressed in this EA was 44 projects (annual average = 8.8/year) regarding damage or threats of damage by coyotes. Resources protected included predation on livestock and human health and safety.

WS also provides direct operational assistance when requested by those persons experiencing damage where WS is directly involved with managing damage by employing methods and techniques to alleviate damage. Direct operational assistance provided by WS will be further discussed in Chapter 3 of this EA. The number of requests for direct operational assistance received by WS is not reflected in the totals shown in Table 1.1.

Table 1.1 – Technical assistance projects conducted by WS from FY 2006 through FY 2010

Species	Projects	Species	Projects
Bobcat	1	**Woodchuck**	25
Coyote	44	**American Mink**	0
Gray Fox	13	**Feral Swine**	12
Red Fox	5	**Feral Cat**	5
Raccoon	27	**Feral Dog**	3
Virginia Opossum	9	**Gray Squirrel**	4
Striped Skunk	6	**Eastern Cottontail**	2
River Otter	4	**Black Bear**	12
		TOTAL	**172**

Table 1.2 lists those mammal species and the resource types that those mammal species can cause damage to in North Carolina. Many of the mammal species can cause damage to or pose threats to a variety of resources. Most requests for assistance received by WS are related to those mammal species causing

[4] WS only conducts mammal damage management after receiving a request for assistance. Before initiating mammal damage activities, a Memorandum of Understanding, cooperative service agreement, or other comparable document must be signed between WS and the cooperating entity which lists all the methods the property owner or manager will allow to be used on property they own and/or manage.

[5] The federal fiscal year begins on October 1 and ends on September 30 the following year.

damage to or posing threats to property and threats to human safety. For example, many of those mammal species listed in Table 1.2 can be found on airport properties where those species can pose a strike risk with aircraft. When those species move across runways and taxiways during operation of the airport, aircraft strikes can occur that can cause damage to the aircraft and threaten passenger safety if a catastrophic failure of the aircraft occurs from the strike.

Table 1.2 – The resource types damaged by mammal species in North Carolina

Species	Resource				Species	Resource			
	A	N	P	H		A	N	P	H
Bobcat	X	X			**Woodchuck**	X		X	X
Coyote	X	X	X	X	**American Mink**	X	X	X	X
Gray Fox	X	X	X	X	**Feral Swine**	X	X	X	X
Red Fox	X	X	X	X	**Feral Cat**	X	X	X	X
Raccoon	X	X	X	X	**Feral Dog**	X	X	X	X
Virginia Opossum	X	X	X	X	**Gray Squirrel**	X	X	X	X
Striped Skunk	X	X	X	X	**Eastern Cottontail**	X	X	X	X
River Otter	X	X			**Black Bear**	X		X	X

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

More specific information regarding mammal damage to those main categories are discussed in the following subsections of the EA:

Need for Mammal Damage Management to Reduce Risks to Human Health and Safety

Zoonoses (*i.e.*, wildlife diseases transmissible to people) are a major concern of cooperators when requesting assistance for managing threats from mammals. Disease transmission can not only occur from direct interactions between humans and mammals but from interactions with pets and livestock that have direct contact with mammals. Pets and livestock often encounter and interact with mammals which can increase the opportunity of transmission of disease to humans. Table 1.3 shows common diseases affecting humans that can be transmitted by mammals in addition to diseases which affect other animals, including domestic species. These include viral, bacterial, mycotic (fungal), protozoal, and rickettsial diseases.

People that request assistance with mammals frequently are concerned about potential disease risks, but are unaware of the types of diseases that can be transmitted by those animals. In those types of situations, assistance is requested because of a perceived risk to human health or safety associated with wild animals living in close association with humans, from animals roving in human-inhabited areas during daylight, or from animals showing no fear when humans are present. Although animals active during the day are not necessarily acting abnormally, especially in suburban environments, WS has received requests for assistance associated with resolving those types of risks to human safety.

In many circumstances when human health concerns are the primary reason for requesting WS' assistance there may have been no actual cases of transmission of disease to humans by mammals. Thus, it is the risk of disease transmission that is the primary reason for requesting and conducting wildlife damage management to lessen the threat of disease transmission. Situations in North Carolina where the threat of disease associated with wild or feral mammal populations include:

- Exposure of humans to threats of rabies posed by skunks denning and foraging in a residential community or from companion animals coming in contact with infected skunks

- Exposure of humans to threats of sarcoptic mange posed by fox denning and foraging in a residential community or from companion animals coming in contact with infected fox
- Threats of rabies and parasitic infections to humans from *Giardia* spp. resulting from high feral cat populations in a park, neighborhood, shopping center, or recreation area.

The most common disease concern expressed by individuals requesting assistance is the threat of rabies transmission to humans, pets, and companion animals. Rabies is an acute, fatal viral disease of mammals most often transmitted through the bite of a rabid animal that poses an indirect and direct threat to humans (USDA 2005*a*). Indirect threats to people occur from exposure from pets or livestock that have been infected from bites of a rabid animal. Direct threats can occur from handling infected wildlife or from aggressive animal behavior caused by rabies. The disease can be effectively prevented in humans when exposure is identified early and treated while domestic animals and pets can be vaccinated for rabies. However, the abundant and widely distributed reservoir among wild mammals complicates rabies control. The vast majority of rabies cases reported to the Centers for Disease Control and Prevention (CDC) each year occur in raccoons, skunks (primarily *M. mephitis*), and bats (Order Chiroptera) (CDC 2011).

Table 1.3 - Wildlife diseases in the eastern United States that pose potential health risks through transmission to humans (Beran 1994, Davidson and Nettles 1997)[†]

Disease	Causative Agent	Hosts[‡]	Human Exposure
Anthrax	*Bacillus antracis*	cats, dogs	inhalation, ingestion
Tetanus	*Clostridium tetani*	mammals	direct contact
Dermatophilosis	*Dermatophilus congolensis*	mammals	direct contact
Pasteurellaceae	*Haemophilus influenzae*	mammals	bite or scratch
Salmonellosis	*Salmonella* spp.	mammals	ingestion
Yersinosis	*Yersinia* spp.	cats	ingestion
Chlamydioses	*Chlamydophilia felis*	cats	inhalation, direct contact
Typhus	*Rickettsia prowazekii*	opossums	inhalation, ticks, fleas
Sarcoptic mange	*Sarcoptes scabiei*	red fox, coyotes, dogs	direct contact
Trichinosis	*Trichinella spiralis*	raccoons, fox	ingestion, direct contact
Rabies	Rhabidovirus	mammals	direct contact
Visceral larval	*Baylisascaris procyonis*	raccoons, skunks	ingestion, direct contact
Leptospirosis	*Leptospira interrogans*	mammals	ingestion, direct contact
Echinococcus	*Echinococcus multilocularis*	fox, coyotes	ingestion, direct contact
Toxoplasmosis	*Toxoplasma ondii*	cats, mammals	ingestion, direct contact
Spirometra	*Spirometra mansonoides*	bobcats, raccoons, fox	ingestion, direct contact
Giardiasis	*Giardia lamblia, G. Duodenalis*	coyotes, cats, dogs	ingestion, direct contact

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

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

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 the CDC now occur in wildlife (Krebs et al. 2000, CDC 2010). Before 1960, the majority of cases were reported in domestic animals. The principal rabies hosts today are wild carnivores and bats. The number of rabies-related human deaths in the United States has declined from more than 100 annually in the early 1900s to an average of one or two people per year in the 1990s. Modern day prophylaxis, which is the series of vaccine injections given to people who have

been potentially or actually exposed, has proven nearly 100% successful in preventing mortality when administered promptly (CDC 2010). 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 2010).

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 or enzootic (*i.e*., present in an area over time but with a low case frequency) in a region, the number of PEPs administered in that area increases. Although the cost varies, a course of rabies immune globulin and five doses of vaccine given over a 4-week period typically exceeds $1,000 (CDC 2010) and has been reported to be as high as $3,000 or more (Meltzer 1996). As epizootics spread in wildlife populations, the risk of "*mass*" human exposures requiring treatment of large numbers of people that contact individual rabid domestic animals infected by wild rabid animals increases. One case in Massachusetts involving contact with, or drinking milk from, a single rabid cow required PEPs for a total of 71 persons (CDC 2001). The total cost of this single incident exceeded $160,000 based on a median cost of $2,376 per PEP in Massachusetts. Likely the most expensive single mass exposure case on record in the United States occurred in 1994 when a kitten from a pet store in Concord, New Hampshire tested positive for rabies after a brief illness. As a result 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). Total costs for this specific incident, including investigation, laboratory testing, and rabies immunoglobulin and vaccines was more than $1.5 million (American Veterinary Medical Association (AVMA) 2004).

Raccoons have been associated with the spread of rabies in states throughout the eastern United States, including North Carolina (USDA 2005*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 North Carolina, Alabama, and South Carolina. It was unintentionally introduced into the Mid-Atlantic States, probably by translocation of infected animals (Krebs et al. 1998). The first cases appeared in West Virginia and Virginia in 1977 and 1978, respectively. Since then, raccoon rabies in the area expanded to form the most intensive rabies outbreak in the United States. The strain 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. If the barrier is breached by raccoon rabies, research suggests that raccoon populations are sufficient for rabies to spread westward along a front at a rate similar to or greater than the rate at which this rabies strain has spread in the eastern United States (Sanderson and Huber 1982, Glueck et al. 1988, Hasbrouck et al. 1992, Mosillo et al. 1999).

Raccoon rabies presents a human health threat through potential direct exposure to rabid raccoons, or indirectly through the exposure of pets that had 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 greater 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 strain of rabies may be found in the Midwest and California; however, skunks found throughout North America may be infected with different strains of rabies such as the raccoon strain. The distribution of rabies in skunks therefore extends from North Carolina 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 canine strain of rabies still persists in Alaska. Clinical signs of rabies in fox are often manifested as the "*furious*" form of rabies (Majumdar et al. 2005).

In an effort to halt the westward spread of the raccoon variant of the rabies virus and to limit the spread of the canine variant from Texas, WS began participating in the distribution of oral rabies vaccine (ORV) baits (fishmeal polymer containing Raboral V-RG® vaccine [Merial, Athens, North Carolina, USA]). Currently, WS participates in the distribution of ORV baits and the surveillance of wildlife rabies vectors in 26 states, including North Carolina. ORV baits were first distributed by WS in North Carolina during the fall of 2003. A total of 98,629 baits were distributed (69,317 by air and 29,312 by hand) across a 1,202 km^2 area which included portions of Catoosa, Chattooga, and Walker Counties, and all of Dade County, in the northwest corner of North Carolina. North Carolina expanded its baiting program in 2004 by 302 km^2 to include larger portions of Walker and Catoosa Counties. Since the inception of the program in the fall of 2003, a total of 385,644 ORV baits have been distributed in North Carolina. In FY 2010, as part of a surveillance of rabies vectors in North Carolina, WS collected a total of 324 samples from target wildlife species. Of the 324 samples, 57 were tested with only 10 samples testing positive to the southeast raccoon rabies variant. WS' participation in the ORV program is further addressed in a separate EA (USDA 2005*a*) but will be addressed in this EA to evaluate potential cumulative effects of activities proposed in this EA and the capturing and releasing of target animals during surveillance activities associated with the ORV program (USDA 2005*a*)[6].

The North Carolina Department of Human Resources, Public Health Division and the North Carolina Department of Agriculture (NCDA) have provided the state leadership for the baiting effort. WS provided wildlife management leadership and contributed considerable funding to prevent the spread of rabies. Baiting effort in North Carolina is part of the larger North Carolina-Alabama-Tennessee barrier zone (USDA 2005*a*).

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

Diseases and parasites affecting feral cats and dogs can have particularly serious implications to human health given the close association of those animals with humans and companion animals. The topic of feral animals and their impacts on native wildlife and human health elicits a strong response in numerous professional and societal groups with an interest in the topic. Feral cats and dogs are considered by most

[6]The supplemental EA addressing WS' participation in an ORV distribution and surveillance program contains the analyses for distribution of ORV baits and for surveillance activities conducted in North Carolina. The analyses contained in this EA do not reflect WS' actions for capturing and releasing target animals during surveillance activities associated with the ORV program since those actions are addressed in the referenced ORV EA.

professional wildlife groups to be a non-native species that can have detrimental impacts to the native ecosystems especially in the presence of a human altered landscape. However, a segment of society views feral animals to be an extension of companion animals that should be cared for and for which affection bonds are often develop especially when societal groups feed and care for individual feral animals. Of special concern are those cats and dogs considered companion animals that are not confined indoors at all times, but are allowed to range outside the home for extended periods of time. Those companion animals are likely to encounter and become exposed to a wide-range of zoonoses that are brought back into the home upon return where direct contact with humans increases the likelihood of disease transmission, especially if interactions occur between companion animals and feral animals of the same species. Feral animals that are considered companion animals are also likely to impact multiple people if disease transmission occurs since those animals are likely to come in direct contact with several members of families and friends before diagnosis of a disease occurs.

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

Most of the zoonoses known to infect cats and dogs that are infectious to humans are not life threatening if diagnosed and treated early. However, certain societal segments are at higher risks if exposed to zoonoses. Women who are pregnant, people receiving chemotherapy for immunologic diseases and organ transplants, and those persons with weakened immune systems are at increased risk of clinical disease if exposed to toxoplamosis (AVMA 2004). In 1994, five Florida children were hospitalized with encephalitis that was associated with cat scratch fever (AVMA 2004). The daycare center at the University of Hawaii in Manoa was closed for two weeks in 2002 because of concerns about potential transmission of murine typhus (*Rickettsia typhi*) and flea (*Ctenocephalides felis*) infestations afflicting 84 children and faculty. The fleas were from a feral cat colony that had grown from 100 cats to over 1,000 cats, 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 (*C. felis*) are the only known vectors for infecting house bound cats and humans with this bacterium. Humans are not infected via the flea, but pet cats often are infected by flea bites. Human infections that may result from exposure of this bacterium via stray cats include: cat scratch disease in immunocompetent patients, bacillary angiomatosis, hepatic peliosis in immunocompromised patients, endocarditis, bacteremia, osteolytic lesions, pulmonary nodules, neuroretinitis, and neurologic diseases (Heller et al. 1997). In areas where dog rabies has been eliminated, but rabies in wildlife has not, cats often are the most significant animal transmitting rabies to humans (Vaughn 1976, Eng and Fishbein 1990, Krebs et al. 1996).

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

This discussion on zoonoses is intended to briefly address the more common known zoonoses found in the United States for those species specifically addressed in this EA but is not intended to be an exhaustive discussion of all potential zoonoses. The transmission of diseases from wildlife to humans is

neither well documented nor well understood for most infectious zoonoses. Determining a vector for a human infected with a disease known to occur in wildlife populations is often complicated by the presence of the known agent across a broad range of naturally occurring sources. For example, a person with salmonella poisoning may have contracted salmonella bacterium from direct contact with an infected pet, but could have also contracted the bacterium from eating undercooked meat or from other sources.

However, wildlife and feral animals are known carriers of diseases infectious to people, which increases the risk of transmission directly through contact with infected wildlife or feral animals and through exposure from contact with livestock and pets that have been exposed to diseased wildlife or feral animals. Disease transmission to humans from wildlife is uncommon with few documented occurrences. However, the infrequency of such transmission does not diminish the concerns of those individuals requesting assistance that are fearful of exposure to a diseased animal since disease transmissions have been documented to occur. WS actively attempts to educate the public about the risks associated with disease transmission from wildlife to humans through technical assistance and by providing leaflets on the risks of exposure.

As stated previously, a common concern among those persons requesting assistance is the threat to human health and safety from disease transmission which has only been heightened from recent, widely publicized zoonoses events like the spread of rabies, West Nile Virus, and Avian Influenza. However, requests are also received for assistance from a perceived threat 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 urban areas often increases the survival rates and carrying capacity of wildlife species that are adaptable to those habitats. Often the only limiting factor of wildlife species in and around urban areas is the prevalence of diseases, which can be confounded by the overabundance of wildlife congregated into a small area that can be created by the unlimited amount of food, water, and shelter found within urban habitats.

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by humans toward many species of wildlife, especially around urban areas, 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 humans, or abnormal behavior. Though 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 have only heightened people's awareness of the threat of such encounters. Although attacks on people associated with those species addressed in the EA occurs rarely, requests for assistance to lessen the threat of possible attack do occur from people in North Carolina. Wildlife exhibiting threatening behavior or a loss of apprehensiveness to the presence of people can be a direct result and indication of an animal inflicted with a disease. So, requests for assistance are caused by both a desire to reduce the threat of disease transmission and from fear of aggressive behavior either from an animal that is less apprehensive of people or induced as a symptom of disease. A majority of the reports about loss of apprehensiveness is due to habituation, rather than disease (C. Olfenbuttel, NCWRC, pers. comm. 2011).

The primary request for assistance to reduce threats to human safety received by WS is to lessen the threat of diseases transmission from exposure to wildlife. Since 2002, the two wildlife species of most concern to the public based on requests for assistance are skunks and raccoons. Public concerns are due to the perceived notion that there is high prevalence of rabies in the populations of those two species, when in fact there is no data confirming whether the prevalence of rabies is actually high or low. Of the raccoons and skunks tested in North Carolina, approximately half test negative for rabies (C. Olfenbuttel, NCWRC, pers. comm. 2011). To a lesser extent there is a concern for threats caused by feral cats.

Need for Mammal Damage Management to Protect Agricultural Resources

Red fox, gray fox, coyotes, feral dogs, bobcats, and other mammals can cause losses or injury to crops (*e.g.*, corn), 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 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 nearly $98.5 million in economic losses. Coyotes were indicated as the primary predator of livestock with 53.1% of cattle and calf losses attributed to coyotes while feral dogs represented 9.9% of the cattle losses associated with animal predation. Producers spent nearly $188.5 million 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 North Carolina, the NASS (2011) reported a total of 1,400 cattle and 4,000 calves were killed in 2010 by animal predators. Animal predation represented 16.4% of all cattle and calf losses in the State during 2010, resulting in an economic loss in North Carolina of an estimated $2.4 million in 2010 (NASS 2011). Of those cattle reported as lost due to animal predation in the State, coyotes were identified by respondents as the cause of the loss for 26.1% of the adult cattle losses and 63.7% of the calf losses. North Carolina cattle producers reported using a number of non-lethal methods to reduce losses due to predators. Guard animals were the primary non-lethal method employed by livestock producers in the State during 2010 with 64% of respondents reporting the use of guard animals (NASS 2011). The use of exclusion fencing was reported by 26.2% of respondents in North Carolina (NASS 2011).

The NASS (2011) reported no losses to cattle from bobcat predation in North Carolina. However, cattle producers in the United States indicated mountain lions and bobcats[7] caused 8.6% of the cattle and calf losses attributed to animal predators in 2010 (NASS 2011). Bobcats are also known to predate on other livestock, such as chickens and domestic waterfowl.

[7]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.

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 abortion in ewes. 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, FPL is considered to be the most serious. Reif (1976) found that during the acute stages of FPL, fleas were vectors of this disease to other cats. FPL infection is cyclic in nature, being more prevalent from July to September.

River otters may prey on fish at aquaculture facilities and fish hatcheries in North Carolina. The magnitude of losses related to depredations by otter are unknown, but appear to be widespread and of considerable concern by managers of such facilities (R. Lefever, Blue Ridge Fish Hatchery, Inc. pers. comm. 2011).

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

Feral swine can cause damage to a variety of agricultural crops through direct consumption but also from trampling, rooting, and wallowing (Beach 1993). Damage and threats to livestock associated with feral swine occurs from predation on livestock and the risks associated with disease transfer from feral swine to domestic livestock. Feral swine can also cause damage to other agricultural resources. For example, feral swine can cause damage to pastures and land used for hay by rooting and wallowing, can cause damage to ponds and water sources for livestock, and can cause damage from the consumption of livestock feed. Feral swine feeding activities in agricultural crops can also lead to increased erosion from the removal of vegetation that leaves the soil bare along with the overturning of soil caused by rooting.

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

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

domestic livestock and feral swine have a common interface, such as at water sources and livestock feeding areas.

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

In addition to the potential for disease transmission, feral swine are also known to predate on livestock. Feral swine are known to kill calves, kids, lambs, and poultry (Stevens 1996). Predation occurs primarily on young livestock but feral hogs can also kill weakened or injured livestock. Feral swine predation on livestock occurs rarely and the WS program in North Carolina has not received requests for assistance with managing predation on livestock associated with feral swine. However, if feral swine populations continue to increase in the State, WS could be requested to address localized predation associated with feral swine.

Examples of requests for assistance to resolve or alleviate damage to agricultural resources that the WS program in North Carolina has responded to since FY 2006 include:

- Coyotes attacking and killing calves, lambs, chickens, and emus
- Raccoons digging up grass and sod while foraging for insects
- Gray squirrels feeding on strawberries, peaches, and pecans
- Gray fox killing chickens and domestic waterfowl
- Striped skunks killing chickens

Need to Resolve Damage Occurring to Natural Resources

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

Those mammals addressed in this EA can also cause damage to natural resources. Mammals causing damage are often locally overabundant at the damage site and threaten the welfare of a species population identified as a natural resource. An example of this would be predation of the eggs and nestlings of ground nesting birds of concern by mammalian predators, such as raccoons, opossum, feral cats, feral dogs, or fox.

Habitats used by shorebirds have been significantly altered in the United States, especially wetlands, shorelines, and grasslands. Many shorebird species face significant threats from habitat loss, human disturbance, and different forms of habitat degradation such as predation, pollution, and prey resources (Brown et al. 2001).

In North Carolina, the Cape Hatteras National Seashore (CAHA) is used as nesting habitat by three federally listed sea turtles, the loggerhead sea turtle (*Caretta caretta*), the green sea turtle (*Chelonia*

mydas), and the leatherback sea turtle (*Dermochelys coriacea*). Two other federally listed sea turtle species, the hawksbill sea turtle (*Eretmochelys imbricata*) and the Kemp's Ridley sea turtle (*Lepidochelys kempii*), occupy the surrounding waters. The seashore is also home to the federally listed piping plover (*Charadrius melodus*). In addition, the seashore provides nesting habitat for several species of state-listed colonial waterbirds, including the common tern (*Sterna hirundo*), least tern (*Sterna antillarum*), gull-billed tern (*Sterna nilotica*), and black skimmer (*Rynchops niger*). Solitary nesters, such as the American oystercatcher (*Haematopus palliatus*) and Wilson's plover (*Charadrius wilsonia*) also use the CAHA as a breeding ground. Furthermore, the red knot (*Calidris canutus*) uses the seashore as wintering habitat during spring and fall migrations.

Providing a variety of important habitats, the CAHA plays a vital role in the survival of many wildlife species. Whether for nesting, resting, or feeding, the seashore provides for a diverse assemblage of birds. Rich, varied habitats and locations along the Atlantic Flyway contribute to the attractiveness of the seashore to birds. In 1999, the American Bird Conservancy designated the CAHA as a Globally Important Bird Area in recognition of the value the seashore provides to bird migration, breeding, and wintering (American Bird Conservancy 2005).

From 2002 to 2008, the CAHA requested WS' assistance with managing predation risks to T&E species found along the seashore. Loggerhead sea turtles nesting along the seashore were experiencing a 60% nest loss, which was primarily attributed to predation by raccoons. Red fox and grey fox also pose a threat to sea turtle nests due to their ability to dig under screening material that has been used to deter raccoon damage to nests (B. Muiznieks, National Park Service, pers. comm. 2008).

Predation is a primary factor limiting reproductive success of the piping plover (Haig 1992). Predation of eggs, chicks, and/or adults include, but is not necessarily limited to, mink, red fox, opossum, domestic dogs, feral and domestic cats, crows, and gulls (Haig 1992), and birds-of-prey (Murphy et al. 2003). Predators in piping plover habitat can also lead to piping plovers abandoning territories within and between breeding seasons (Cohen 2005).

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. Cats kill common species such as Northern cardinals (*Cardinalis cardinalis*), blue jays (*Cyanocitta cristata*), and house wrens (*Troglodytes aedon*), as well as rare and endangered species such as piping plover, Florida scrub-jay (*Aphelocoma coerulescens*), and California least tern (*Sterna antillarum*) (American Bird Conservancy 2005). Some feral and free-ranging cats kill more than 100 animals each year. One well-fed cat that roamed a wildlife experiment station was recorded to have killed more than 1,600 animals (mostly small mammals) over 18 months (American Bird Conservancy 2005). Researchers at the University of Wisconsin coupled their four-year cat predation study with the data from other studies, and estimated that rural feral and free-ranging cats kill at least 7.8 million and perhaps as many as 217 million birds a year in Wisconsin. In some parts of the state, feral and free ranging cat densities reached 114 cats per square mile, outnumbering all similar-sized native predators (Coleman et al. 1997). Churcher and Lawton (1989) observed 77 well fed free-ranging cats in a Britain village for one year and estimated that 30% to 50% of the animals captured by cats were birds. Churcher and Lawton (1989) concluded the cats had significantly affected house sparrow populations within the village. Based on information acquired in their study, Churcher and Lawton (1989) estimated that more than 20 million birds are killed by cats in Britain each year with more than 70 million animals overall being taken by cats annually.

The diet of feral and free-ranging cats varies depending on availability, abundance, and geographic location. In a survey of New Zealand scientific literature, Fitzgerald (1990) concluded that prey selection of feral and free-ranging cats is dependent on availability. The author found that cats on the mainland of New Zealand fed most heavily on mammals; whereas, cats on islands fed almost exclusively on birds

(particularly seabirds). Feral and free-ranging cats are known to prey on birds as large as mallards (*Anas platyrhynchos*) (Figley and VanDruff 1982) and young brown pelicans (*Pelecanus occidentalis*) (Anderson et al. 1989) along with mammals as large as hares and rabbits. Many feral cat populations rely heavily on humans, either for handouts and/or refuse. Pearson (1971) found that cats were serious predators of California voles (*Microtus californicus*) and that the greatest pressure on voles occurred when vole numbers were lowest. Liberg (1984) found that cats in southern Sweden fed predominantly on native mammals. Prey use was based more on availability than abundance. Langham (1990) found that mammals made up 74% of diets of New Zealand farmland feral cats, while 24% were birds. Cats fed most heavily on the most abundant species and groups. A study on a southern Illinois farmstead concluded that well fed cats preferred microtine rodents; however, they also consumed birds (George 1974). Microtine rodents are particularly susceptible to over harvest by cats and other predators (Pearson 1964). Coman and Brunner (1972) found that small mammals were the primary food item for feral cats in Victoria, Australia. Prey selection was directly related to proximity of cats to human habitation. Pearson (1964) found rodents composed a large portion of a cat's diet. Some people view cat predation of rodents as beneficial, but native small mammals are important to maintaining biologically diverse ecosystems. Field mice and shrews are also important prey for birds such as great horned owls (*Bubo virginianus*) and red-tailed hawks (*Buteo jamaicensis*) (American Bird Conservancy 2005).

Reptiles are thought to provide an important food source to cats when birds and mammals are less abundant, and in some situations cats have been observed to prey on threatened species of reptiles. Domesticated cats have been identified as significant nest and/or hatchling predators of sea turtles. A study on the Aldabra Atoll, Seychelles found feral cats had a significant impact 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 rock iguanas (*Cyclura* spp.) on Pine Cay in the Caicos Islands of the West Indies (Iverson 1978).

Cats can negatively affect local wildlife populations, especially in habitat "*islands*" such as suburban and urban parks, wildlife refuges, and other areas surrounded by human development. The loss of bird species from islands is well documented and nest predation is an important cause of the decline of neotropical migrants (American Bird Conservancy 2005). A two year study was conducted by Hawkins et al. (1999) in two parks with grassland habitat. One park had no cats but more than 25 cats were being fed daily in the other park. There were almost twice as many birds seen in the park with no cats as in the park with cats. California thrasher (*Toxostoma redivivum*) and California quail (*Callipepla californica*), both ground-nesting birds, were seen during surveys in the no-cat area; whereas, they were never seen in the cat area. In addition, more than 85% of the native deer mice (*Peromyscus* spp.) and harvest mice (*Reithrodontomys megalotis*) trapped were in the no-cat area; whereas, 79% of the house mice (*Mus musculus*), 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).

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

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

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

Feral swine are not native to North America, and many native species have not evolved to deal with swine competition or predation. Feral swine are known to feed on many smaller animals (some threatened or endangered), disrupt ecosystems via rooting, and to feed on rare and endangered plants. Many experts in the fields of botany and herpetology have observed declines in some rare species of plants, reptiles, amphibians, and soil invertebrates (Singer et al. 1982) in areas inhabited by feral swine. It has been well documented that feral swine disturb large areas of vegetation and soils through rooting, and it is documented that swine inhabiting coastal, upland, and wetland ecosystems are uprooting, damaging, and feeding on rare native species of plants and animals (Means 1999). Swine can disrupt natural vegetative communities, eliminate rare plants and animals, alter species composition within a forest, including both canopy and low growing species (Lipscomb 1989, Frost 1993), increase water turbidity in streams and wetlands (reducing water quality and impacting native fish), and increase soil erosion and alter nutrient cycling (Singer et al. 1982, DeBenedetti 1986). Kaller and Kelso (2003) found that feral and free-ranging swine were linked to increased levels of fecal coliform and other potentially pathogenic bacteria in several watersheds in Louisiana. Additionally, some species of freshwater mussels and aquatic insects can be negatively impacted by feral swine (Kaller and Kelso 2006).

Need for Mammal Damage Management to Protect Property

Mammals cause damage to a variety of property types in North Carolina each year. Raccoons, skunks, and woodchucks can cause damage to property by digging under porches, buildings, homes, and many other places. Skunks often cause damage to lawns and turf while digging for grubs and insects. Aircraft striking mammals can also cause substantial damage requiring costly repairs and aircraft downtime.

Airports provide ideal conditions for many wildlife species due to the large grassy areas adjacent to brushy, forested habitat used as noise barriers. Access to most airport properties is restricted so mammals living within airport boundaries are not harvestable during hunting and trapping seasons and are 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). 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). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995).

Between 1990 and 2008, 1,912 aircraft strikes were reported involving terrestrial mammals (Dolbeer et al. 2009). The number of mammal strikes actually occurring is likely to be much greater, since an estimated 80% of civil wildlife strikes go unreported (Cleary et al. 2000). Civil and military aircraft have collided with a reported 33 species of mammals from 1990 through 2008, including raccoons, gray fox, red fox, cats, coyotes, opossums, and striped skunks (Dolbeer et al. 2009). Of the terrestrial mammals reported struck by aircraft, 34% were coyotes causing an estimated $2.8 million in damages (Dolbeer et al. 2009). Data also indicates that a much higher percentage of mammal strikes resulted in aircraft damage compared to bird strikes (Dolbeer et al. 2009). Costs of those collisions vary, but FAA data reveals that mammal strikes in the United States cost the civil aviation industry approximately 244,068 hours of down time and $38.8 million in direct monetary losses between 1990 and 2008 (Dolbeer et al. 2009).

About 59% of mammal strikes resulted in damage compared to 14% for birds (Dolbeer et al. 2009). In addition to damages caused by mammal strikes to aircraft, those incidents can pose serious threats to human safety. For example, damage to the landing gear during the landing roll and/or takeoff run can cause a loss of control of the aircraft, causing additional damage to the aircraft and increasing the threat to human safety. Nearly 64% of the reported mammal strikes from 1990 through 2008 occurred at night, with 89% occurring during the landing roll or the takeoff run (Dolbeer et al. 2009). Since 1994, aircraft have struck one fox, four coyotes, and one rabbit in North Carolina according to reports filed with the FAA (FAA 2011). The infrequency of mammal strikes does not lessen the need to prevent threats to human safety and the prevention of damage to property. Preventing damage and reducing threats to human safety is the goal of those cooperators requesting assistance at airports in North Carolina given that a potential strike can lead to the loss of human life and considerable damage to property.

In addition, many mammal species addressed pose minimal strike hazards at airports but their presence on airport property could act as attractants for other wildlife species that do pose higher risks of aircraft strikes. For example, a high density of cottontail rabbits on airport property could attract raptors to the airport as rabbits are a food source for many raptors species. Raptors often pose a high risk to aircraft due to their relative size and their soaring and hovering habits. Therefore, reducing rabbits densities at airports can reduce strike risks with raptors by reducing the availability of a food source.

During FY 2011, WS responded to two requests for assistance associated with black bears at airports in the State. One request for assistance was received from airport authorities when a bear entered a building on airport property. Due to human safety concerns, WS was requested to euthanize the bear using a firearm. WS was also requested during FY 2011 to euthanize an injured bear at an airport after airport personnel shot the bear due to their concerns that the bear posed a risk to incoming and outgoing flights. After obtaining permission from the NCWRC, the injured bear was euthanized by WS. Multiple attempts were made to disperse the bears using non-lethal harassment techniques in both situations, but were unsuccessful.

Wildlife populations near or found confined within perimeter fences at airports can be a threat to human safety and cause damage to property when struck by aircraft. Those wildlife confined inside the airport perimeter fence would not be considered distinct populations nor separate from those populations found outside the perimeter fence. Wildlife found within the boundaries of perimeter fences originate from populations outside the fence. Those populations inside the fence do not exhibit nor have unique characteristics from those outside the fence and do not warrant consideration as a unique population under this analysis.

Feral swine can damage landscaping, golf courses, roads, drainage ditches and cause erosion by feeding in these areas. Feral swine dig or root in the ground with their nose in search of desired roots, grubs, earthworms, and other food sources. Feral swine can damage landscaping, golf courses, roads, drainage ditches and cause erosion by feeding in these areas. The rooting and digging activity of feral swine turns

sod and grass over which often leaves the area bare of vegetation and susceptible to erosion. Feral swine also pose a threat to property from being struck by motor vehicles and aircraft.

1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

Actions Analyzed

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

The methods available for use or recommendation under each of the alternatives evaluated are provided in Appendix B[8]. The alternatives and Appendix B also discuss how methods would be employed to manage damage and threats associated with mammals in the State. Therefore, the actions evaluated in this EA are the use of those methods available under the alternatives and the employment of those methods by WS to manage or prevent damage and threats associated with mammals from occurring when requested by the appropriate resource owner or manager and when permitted by the NCWRC, as required. The NCWRC has jurisdiction over the management of wildlife in the State and has specialized expertise in identifying and quantifying potential adverse effects to the human environment from mammal damage management activities. Damage management activities conducted by WS under the alternatives would only occur when permitted by the NCWRC through the issuance of appropriate permits, when applicable.

Federal, State, County, City, and Private Lands

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

Native American Lands and Tribes

The WS program in North Carolina would only conduct damage management activities when requested by a Native American Tribe and only after a Memorandum of Understanding (MOU) or cooperative service agreement has been signed between WS and the Tribe requesting assistance. Therefore, the Tribe would determine when WS' assistance is required and what activities would be allowed. Because Tribal officials would be responsible for requesting assistance from WS and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would be anticipated. Those methods available to alleviate damage associated with mammals on federal, state, county, municipal, and private properties under the alternatives analyzed in this EA would also be available for use to alleviate damage on Tribal properties when the use of those methods have been

[8]A complete list of chemical and non-chemical methods available for use under the identified alternatives, except the alternative with no damage management (Alternative 3), can be found in Appendix B. However, listing methods neither implies that all methods would be used by WS to resolve requests for assistance nor does the listing of methods imply that all methods would be used to resolve every request for assistance.

approved for use by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would include those activities that could be employed on Native American lands, when requested and agreed upon.

Period for which this EA is Valid

If the analyses in this EA indicates an Environmental Impact Statement (EIS) is not warranted, this EA would remain valid until WS determines that new needs for action, changed conditions, new issues, or new alternatives having different environmental impacts must be analyzed. At that time, this analysis and document would be reviewed and supplemented pursuant to the NEPA. Review of the EA would be conducted to ensure that the EA is sufficient. If the alternative analyzing no involvement in mammal damage activities by WS is selected, no additional analyses or monitoring of activities would occur based on the lack of involvement by WS. The monitoring of activities ensures the EA is complete and still appropriate to the scope of mammal damage management activities conducted by WS in North Carolina based on the alternative selected.

Site Specificity

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

This EA analyzes the potential impacts of mammal damage management and addresses activities on all private and public lands in North Carolina under MOU, cooperative service agreement, and in cooperation with the appropriate public land management agencies. It also addresses the potential impacts of mammal damage management on areas where additional agreements may be signed in the future. Because the program's goals and directives are to provide assistance when requested, within the constraints of available funding and workforce, it is conceivable that additional mammal damage management efforts could occur. Thus, this EA anticipates the potential expansion of activities based on additional requests for assistance and analyzes the impacts of such efforts as part of the program.

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

Chapter 2 of this EA identifies and discusses issues relating to mammal damage management in North Carolina. The standard WS Decision Model (Slate et al. 1992, USDA 1997) would be the site-specific procedure for individual actions conducted by WS in the State (see Chapter 3 for a description of the Decision Model and its application). Additional information on the Decision Model is available in WS' programmatic FEIS (USDA 1997). Damage management decisions made using the model would be in

accordance with WS' directives[9] and those standard operating procedures (SOPs) described in this EA as well as relevant laws and regulations.

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

Summary of Public Involvement

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

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

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

WS' Programmatic Final Environmental Impact Statement: WS has developed a programmatic FEIS that addresses the need for wildlife damage management in the United States (USDA 1997). The FEIS contains detailed discussions of potential impacts to the human environment from wildlife damage management methods used by WS. In addition, the FEIS contains a risk assessment of many of the methods available to alleviate wildlife damage. Pertinent information available in the FEIS has been incorporated by reference into this EA.

White-tailed Deer Damage Management Environmental Assessment: WS prepared an EA to evaluate potential impacts to the human environment from the implementation of a management program to address damage to agricultural resources, natural resources, property, and to reduce threats to human safety caused by white-tailed deer (*Odocoileus virginianus*) (USDA 2005*b*). 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 (USDA 2005*b*). After consideration of the analysis contained in the EA and review of public comments, a Decision and Finding of No Significant Impact (FONSI) for the EA was issued on November 4, 2005. The Decision and FONSI selected the proposed action alternative which implemented an integrated damage management program using multiple methods to adequately address the need to manage deer damage. Program activities involving deer damage management in the State conducted under the selected alternative were further evaluated and a new Decision and FONSI were signed on April 7, 2011. Although white-tailed deer are not specifically addressed in this EA, many of the methods available to alleviate deer damage can also be

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

used to alleviate damage associated with other mammal species. Therefore, this EA will evaluate the cumulative use of methods related to deer damage management and the methods available under the alternatives in this EA.

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

1.5 AUTHORITY AND COMPLIANCE

The authority of WS and other agencies as those authorities relate to conducting wildlife damage management activities are discussed by agency in Appendix D. Several laws and regulations pertaining to wildlife damage management activities, including activities conducted in the State are also discussed in Appendix D. Additional laws and regulations pertaining to wildlife damage management activities are addressed in WS' programmatic FEIS (USDA 1997).

1.6 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. As the authority for the management of mammal populations in the State, the NCWRC 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 NCWRC is responsible for managing wildlife in the State of North Carolina, including mammals. The NCWRC 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 NCWRC which ensure WS' actions are incorporated into population objectives established for mammal populations in the State.

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

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES

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

2.1 AFFECTED ENVIRONMENT

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

Upon receiving a request for assistance, mammal damage management could be conducted on private, federal, state, county, and municipal lands in North Carolina to protect agricultural and natural resources, property, and public health and safety. Areas where damage or threats of damage could occur include, but are not limited to state, county, municipal and federal natural resource areas, park lands, and historic sites; state and interstate highways and roads; railroads and their right-of-ways; property in or adjacent to subdivisions, businesses, and industrial parks; timberlands, croplands, and pastures; private and public property where burrowing mammals cause damage to structures, dikes, ditches, ponds, and levees; public and private properties in rural/urban/suburban areas where mammals cause damage to landscaping and natural resources, property, and are a threat to human safety through the spread of disease. The area would also include airports and military airbases where mammals are a threat to human safety and to property; areas where mammals negatively impact wildlife, including T&E species; and public property where mammals are negatively impacting historic structures, cultural landscapes, and natural resources.

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 its 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 would occur in the absence of the federal action by a non-federal entity. This concept is applicable to situations involving federal assistance to reduce damage associated with wildlife species.

Unprotected animal species, such as most non-wildlife species, are not protected under state or federal law. Most state-resident wildlife species are managed under state authority or law without any federal oversight or protection. In some states, 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 allowing them to be dispersed or taken by anyone at any time when they are committing damage. For mammal damage management in North Carolina, the NCWRC has the authority to manage and authorize the taking of wildlife for damage management purposes.

When a non-federal entity (*e.g.*, agricultural producers, municipalities, counties, private companies, individuals, or any other non-federal entity) takes a mammal damage management action, the action is not subject to compliance with the NEPA due to the lack of federal involvement in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed. Therefore, in those situations in which a non-federal entity has decided that a

management action directed towards mammals will occur and determined which methods will be used, WS' involvement in the action would not affect the environmental status quo since the action could be taken by another entity in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requestor would have conducted the action in the absence of WS' involvement in the action. Since the lethal take of mammals can occur either without a permit if those species are unregulated, during hunting and trapping seasons, or through the issuance of permits by the NCWRC and since most methods for resolving damage are available to both WS and to other entities, WS' decision-making ability is restricted to one of three alternatives. WS can either take the action using the specific methods as decided upon by the non-federal entity, can provide recommendations on available methods, or take no action at which point the non-federal entity could take the action anyway either without a permit, during the hunting or trapping season, or through the issuance of a permit by the NCWRC. 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.

In some situations, however, certain aspects of the human environment may actually benefit more from WS' involvement than from a decision not to assist. For example, if a cooperator believes WS has greater expertise to selectively remove a target species than a non-WS entity; WS' management activities may have less of an impact on target and non-target species than if the non-federal entity conducted the action alone. The concern arises from those persons experiencing damage using methods that have no prior experience with managing damage or threats associated with mammals. The lack of experience in mammal behavior and damage management methods could lead to the continuation of damage which could threaten human safety or could lead to the use of inappropriate methods in an attempt to resolve damage. WS' personnel are trained in the use of methods which increases the likelihood that damage management methods are employed appropriately with regards to effectiveness, humaneness, minimizes non-target take, and reduces threats to human safety from those methods. WS' mission is to provide leadership in resolving and preventing damage to resources and to reduce threats to human safety caused by wildlife, including mammals in North Carolina. Thus, in those situations, WS' involvement may actually be beneficial when compared to the environmental status quo in the absence of such involvement.

2.2 ISSUES ASSOCIATED WITH MAMMAL DAMAGE MANAGEMENT ACTIVITIES

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed action. Such issues must be considered in the NEPA decision-making process. Issues relating to the reduction of wildlife damage were raised during the scoping process for WS' programmatic FEIS (USDA 1997) and were considered in the preparation of this EA. Those issues are fully evaluated within WS' programmatic FEIS which analyzed specific data relevant to WS' programmatic activities at the time of preparation. Issues related to managing damage associated with mammals in North Carolina were developed by WS in consultation with the NCWRC. This EA will also be made available to the public for review and comment to identify additional issues.

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

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

A common issue when addressing damage caused by wildlife are the potential impacts of management actions on the populations of target species. Methods used to resolve damage or threats to human safety can involve altering the behavior of target species and may require the use of lethal and non-lethal methods, when appropriate.

Non-lethal methods can disperse or otherwise make an area unattractive to target species causing damage which reduces the presence of those species at the site and potentially the immediate area around the site where non-lethal methods are employed. Lethal methods would be employed to remove a mammal or those mammals responsible for causing damage or posing threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring. The number of target species removed from the population using lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individuals involved with the associated damage or threat, and the efficacy of methods employed.

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

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

Methods available under each of the alternatives to resolve damage and reduce threats to human safety would be employed targeting an individual of a mammal species or a group of individuals after applying the WS' Decision Model (Slate et al. 1992, USDA 1997) to identify possible techniques. The effects on the populations of target mammal populations in the State from implementation of the alternatives addressed in detail, including the proposed action, are analyzed in Chapter 4. Information on mammal populations and trends are often derived from several sources including the fur harvest reports, damage complaints, ground or aerial surveys, and published literature.

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

The issue of non-target species effects, including effects on T&E species arises from the use of those methods available under each of the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target wildlife.

Concerns have also been raised about the potential for adverse effects to occur to non-target wildlife from the use of chemical methods. Chemical methods considered for use to manage damage or threat includes immobilizing drugs, euthanizing drugs, fumigants, and repellents. Chemical methods being considered for use to manage damage and threats associated with mammals in North Carolina are further discussed in Appendix B.

The Endangered Species Act (ESA) states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. WS conducts Section 7 consultations with the United States Fish and Wildlife Service (USFWS) to ensure compliance with the ESA and to ensure that *"any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species…Each agency shall use the best scientific and commercial data available"* [Sec. 7(a)(2)].

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. WS has consulted with the USFWS on programmatic activities under Section 7 of the ESA concerning potential impacts of methods available for use by WS on T&E species. The USFWS issued a Biological Opinion (BO) on WS' programmatic activities in 1992 (USDA 1997). As part of the scoping process and to facilitate interagency cooperation, WS consulted with the USFWS under Section 7 during the development of this EA which is further discussed in Chapter 4.

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

An additional issue often raised is the potential risks associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. WS' employees would use and recommend only those methods under each of the alternatives which are legally available, selective for target species, and are effective at resolving the damage associated with wildlife under each of the alternatives. Still, some concerns exist regarding the safety of WS' methods despite their legality. As a result, WS will analyze the potential for proposed methods to pose a risk to members of the public or employees of WS. In addition to the potential risks to the public associated with WS' methods, risks to employees are also an issue. WS' employees are potentially exposed to damage management methods as well as subject to workplace accidents. Selection of methods, as part of an integrated approach, includes 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 chemical methods available would include immobilizing drugs, euthanasia drugs, fumigants, and repellents.

The issue of the potential for drugs used in animal capture, handling, and euthanasia to cause adverse health effects in humans that hunt and consume the species involved has been raised. Among the species addressed in the EA, this issue is expected to only be of concern for wildlife which are hunted and sometimes consumed by people as food. Chemicals posed for use under the relevant alternatives are regulated by the EPA through the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), by North Carolina laws, by the Drug Enforcement Administration (DEA), by the Food and Drug Administration (FDA), and by WS' Directives. WS' use of chemical methods and risk assessments are further discussed in WS' programmatic FEIS (USDA 1997).

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

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

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

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

Issue 4 - Effects on the Socio-cultural Elements and Economics of the Human Environment

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

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The public share a similar bond with animals and/or wildlife in general and in modern societies a large percentage of households have indoor or outdoor pets. However, some people may consider individual wild animals as "*pets*" or exhibit affection toward those animals, especially

people who enjoy viewing wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

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

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

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

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

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

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

According to the AVMA (1987), suffering is described as a *"…highly unpleasant emotional response usually associated with pain and distress."* However, suffering *"…can occur without pain…,"* and *"…pain can occur without suffering…"* Because suffering carries with it the implication of a time frame, a case could be made for *"…little or no suffering where death comes immediately…"* (California Department of Fish and Game 1991).

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

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

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

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

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

Another issue commonly identified is a concern that mammal 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: bobcats, coyotes, gray fox, red fox, raccoons, opossum, skunks, river otters, woodchucks, mink, feral swine, gray squirrels, Eastern cottontails, and black bears. The only mammal species addressed in this EA that do not have hunting and trapping seasons in the State are feral cats and feral dogs.

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

2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

Additional issues were also identified by WS and the NCWRC during the scoping process of this EA that were considered but will not receive detailed analyses for the reasons provided. The following issues were considered but will not be analyzed in detail:

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

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

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA is to determine if the 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 provides a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination is made through this EA the alternatives might have a significant impact on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, the WS program in North Carolina would continue to conducted mammal damage management in a very small area of the State where damage is occurring or likely to occur.

WS' Impact on Biodiversity

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

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of the NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss can be tolerated by cooperators until the damage reaches a threshold where 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 some cases, any loss in value of a resource caused by wildlife could be financially burdensome to some people. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations. For example, aircraft striking mammals can lead to property damage and can threaten passenger safety if a catastrophic failure of the aircraft occurs as a result of the strike. Therefore, addressing the threats of wildlife strikes prior to an actual strike occurring would be appropriate.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied the plaintiffs' motion for a preliminary injunction. In part, the court found that a forest supervisor needs only show that damage from wildlife is threatened, to establish a need for wildlife damage management (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 wildlife damage management actions.

Mammal Damage Management Should Not Occur at Taxpayer Expense

An issue identified through the development of WS' programmatic FEIS is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based (USDA 1997). Funding for mammal damage management activities is derived from federal appropriations and through cooperative funding. Activities conducted in the State for the management of damage and threats to human safety from mammals would be funded through cooperative service agreements with individual property owners or associations. A minimal federal appropriation is allotted for the maintenance of a WS program in North Carolina. The remainder of the WS program is entirely fee-based. Technical assistance is provided to requesters as part of the federally-funded activities, but all direct assistance in which WS' employees perform damage management activities is funded through cooperative agreements between the requester and WS. Therefore, in most cases, the cooperator requesting assistance from WS is providing the funding for those activities.

Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce damage and threats to human safety caused by mammals and that prove to be the most cost effective would receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to allow for those methods that are most effective at resolving damage or threats to be employed under similar circumstance where mammals are causing damage or pose a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. The cost effectiveness of methods and the effectiveness of methods are linked. The issue of cost effectiveness as it relates to the effectiveness of methods is discussed in the following issue.

Effectiveness of Mammal Damage Management Methods

The effectiveness of any damage management program could be defined in terms of losses or risks potentially reduced or prevented, how accurately practitioners' diagnosis the problem and the species responsible for the damage, and then how actions are implemented to correct or mitigate risks or damages. To determine that effectiveness, WS must be able to complete management actions expeditiously to minimize harm to non-target animals and the environment, while at the same time, using methods as humanely as possible within the limitations of current technology, funding, and workforce. The most effective approach to resolving any damage problem is to use an adaptive integrated approach which may call for the use of several management methods simultaneously or sequentially (USDA 1997, Courchamp et al. 2003).

The purpose behind integrated damage management is to implement methods in the most effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment[10]. 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 is to reduce damage, risks, and conflicts with wildlife as requested and not to necessarily reduce/eliminate populations. Localized population reduction could be short-term and new individuals may immigrate, be released at the site, or be born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels, however, does not mean individual management actions are unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on a species' population.

A common issue raised is that the use of lethal methods is ineffective because additional mammals are likely to return to the area which creates a financial incentive to continue the use of only lethal methods. This assumes mammals only return to an area where damage was occurring if lethal methods are used. However, the use of non-lethal methods is also often temporary which could result in mammals returning to an area where damage was occurring once those methods are no longer used. The common factor when employing any method is that mammals would return if suitable conditions continue to exist at the location where damage was occurring and mammal densities are sufficient to occupy all available habitats to the extent that damage occurs. Therefore, any reduction or prevention of damage from the use of methods addressed in Appendix B would be temporary if habitat conditions continue to exist that attract mammals to an area where damage occurs.

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

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

mammals is discussed in Appendix B. WS' objective is to respond to request 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 (Cooper and Keefe 1997). Short-term approaches focus on redistribution and dispersal of mammals to limit use of an area where damage or threats were occurring. Short-term redistribution approaches may include prohibiting feeding, the use of pyrotechnics, propane cannons, effigies, and other adverse noise, erecting access barriers such as fencing, and taste aversion chemicals (Cooper and Keefe 1997). Population reduction by limiting survival or reproduction, removing mammals, and habitat modification are considered long-term solutions to managing damage caused by wildlife (Cooper and Keefe 1997).

Redistribution methods are often 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 are often short-term solutions that move 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 until the desired results are achieved which can increase the costs associated with those activities. Long-term solutions to resolving mammal damage often require management of the population and identifying the characteristics which attract mammals to a particular location.

WS would employ the Decision Model described in Chapter 3 and further described in WS' programmatic FEIS (USDA 1997) which allows methods to be evaluated during implementation to determine effectiveness. Based on the evaluation of the damage situation, the most effective methods would be employed individually or in combination based on the prior evaluations of methods or combinations of methods in other damage management situations. Once employed, methods would be further evaluated for effectiveness based on a continuous evaluation of activities by WS. Therefore, the effectiveness of methods is 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 continual evaluation of methods and results.

Mammal Damage Should Be Managed By Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce mammal damage for property owners when deemed appropriate by the resource owner. Some property owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to initiate an agreement with a government agency. In particular, large industrial businesses and cities and towns may prefer to use WS because of security and safety issues.

Effects from the Use of Lead Ammunition in Firearms

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

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

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a mammal, if misses occur, or if the mammal carcass is 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 lead to contamination of water, either 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 where it was believed the lead contamination was due to runoff from the parking lot, and not from the shooting range areas. The study also indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of 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 Environmental Protection Agency (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 is reduced once the bullets and shot form crusty lead oxide deposits on their surfaces, which serves to naturally further reduce 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 hunting in general, lead contamination of water from such sources would be minimal to nonexistent. Since the take of mammals can occur during regulated hunting seasons, through the issuance of permits by the NCWRC, or can be lethally removed at any time to alleviate damage, WS' assistance with removing mammals would not be additive to the environmental status quo 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. The amount of lead deposited into the environment may be lowered by WS' involvement in mammal damage management activities due to efforts by WS to ensure projectiles do no pass through but are contained within the mammal carcass which limits the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy increases the likelihood that mammals are lethally removed humanely in situations that ensure accuracy and that misses occur infrequently which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing

through carcasses. In addition, WS' involvement ensures mammal carcasses lethally removed using firearms would be retrieved and disposed of properly to limit the availability of lead in the environment and ensures mammal carcass are removed from the environment to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that are deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from mammal carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination.

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 are substantive, are 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, USDA 1997) 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 wildlife damage management requests.

As discussed previously, one EA analyzing impacts for the entire State would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas and allows for a better cumulative impact analysis. If a determination is 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 which 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, USDA 1997). 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 North Carolina 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 Approach to Managing Mammal Damage (Proposed Action/No Action)

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by mammals in North Carolina. A major goal of the program would be to resolve and prevent mammal damage and to reduce threats to human safety. To

meet this goal, WS, in consultation the NCWRC, would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding is available, operational damage management assistance. 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 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/or direct operational assistance to a property owner or manager experiencing damage. The take of many of the mammal species addressed in this EA can only legally occur through the issuance of a permit by the NCWRC and only at levels specified in the permit, unless those mammal species are afforded no protection in which case no permit for take is required.

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

WS would work with those persons experiencing mammal damage in addressing those mammals responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as mammals begin to cause damage. Mammal damage that has been ongoing can be difficult to resolve using available methods since mammals are conditioned to an area and are familiar with a particular location. Subsequently, making that area unattractive through the use of available methods can be difficult to achieve once damage has been 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 is the implementing mechanism for a damage management program under the proposed action alternative that is 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 mostly environmentally conscious way available. When a request for direct operational assistance is received to resolve or prevent damage caused by mammals, WS conducts site visits to assess damage or threats, identifies the cause of the damage, and applies the Decision Model described by Slate et al. (1992) and in WS' programmatic FEIS (USDA 1997) to apply methods to resolve or prevent damage using those methods available. The use of the Decision model by WS' employees under the proposed action is further discussed below. In addition, preference is given to non-lethal methods when practical and effective (WS Directive 2.101).

Non-lethal methods available under this alternative include, but are not limited to: habitat/behavior modification, visual deterrents, live traps, translocation, exclusionary devices, frightening devices, immobilizing drugs, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS include: live-capture followed by euthanasia, euthanasia chemicals, body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, and shooting. However, listing methods neither implies that all methods would be used or recommended by WS to resolve requests for assistance nor does listing of

methods imply that all methods would be used to resolve every request for assistance. The most appropriate response would often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. For example, if an entity requesting assistance has already attempted to alleviate damage occurring using non-lethal methods, WS would not necessarily employ those same non-lethal methods since those methods have been proven to be ineffective.

Euthanasia of live-captured mammals would occur through the use of euthanasia drugs or carbon dioxide once live-captured using other methods. Euthanasia drugs are an acceptable form of euthanasia for free-ranging wildlife while carbon dioxide is a conditionally acceptable[11] method of euthanasia (AVMA 2007). On occasion, mammals could be euthanized by gunshot once live-captured which is a method of euthanasia considered appropriate by the AVMA for free-ranging wildlife (AVMA 2007).

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

Non-lethal methods can disperse or otherwise make an area unattractive to mammals causing damage; thereby, reducing the presence of mammals at the site and potentially the immediate area around the site where non-lethal methods are employed. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model, especially when the requesting entity has used non-lethal methods previously and found those methods to be inadequate to resolving the damage or threats of damage. Non-lethal methods are used to exclude, harass, and disperse target wildlife from areas where damage or threats are 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. For any management methods employed, the proper timing is essential in effectively dispersing those mammals causing damage. Employing methods soon after damage begins or soon after threats are identified increases the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods is 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 through the use of the WS Decision Model. In many situations, the cooperating entity has tried to employ non-lethal methods to resolve damage and has either been unsuccessful or the reduction in damage or threats has not reached a level that is tolerable by the requesting entity. In those situations, WS could employ other non-lethal methods, attempt to apply the same non-lethal methods, or employ lethal methods. In many situations, the implementation of non-lethal methods such as exclusion-type barriers would be the responsibility of the requester which means that, in those situations, WS only function would be to implement lethal methods, if determined to be appropriate using the WS Decision Model.

Lethal methods would be employed to resolve damage associated with those mammals identified by WS as responsible for causing damage or threats to human safety only after receiving a request for the use of those methods. The use of lethal methods would result in local population reductions in the area where damage or threats were occurring since mammals would be removed from the population. Lethal

[11]The AVMA (2007) defines conditional acceptable as "...[methods] *that by the nature of the technique or because of greater potential for operator error or safety hazards might not consistently produce humane death or are methods not well documented in the scientific literature".*

methods are often employed 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 would result in local reductions of mammals in the area where damage or threats were occurring. The number of mammals removed from the population using lethal methods under the proposed action would be dependent on the number of requests for assistance received, the number of mammals involved with the associated damage or threat, and the efficacy of methods employed. Under the proposed action, the lethal methods being considered are the use of shooting with firearms, the live-capture of mammals that are subsequently euthanized, body-gripping traps, fumigants, and the recommendation of hunting and/or trapping as a localized population management tool.

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

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing mammal damage. Those methods are intended to reduce damage occurring at the time those methods are employed but do not necessarily ensure mammals would not return once those methods are discontinued or at some other point in time. Long-term solutions to resolving mammal damage are often difficult to implement and can be costly. In some cases, long-term solutions involve exclusionary devices, such as fencing, or other practices which are not costly or difficult to implement such as closing and securing 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 is not likely to occur are often times required to achieve complete success in reducing damage and to avoid moving the problem from one area to another. Modifying a site to be less attractive to mammals would likely result in the dispersal of those mammals to other areas where damage could occur or could result in multiple occurrences of damage situations.

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

A complete list of chemical and non-chemical methods available for use under the identified alternatives 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. WS' programmatic FEIS contains additional discussion on adaptive management using an integrated approach to address damage to resources and threats to human safety (USDA 1997).

Technical Assistance Recommendations

Under the proposed action, WS would provide technical assistance to those persons requesting mammal damage management as part of an integrated approach to managing damage. Technical assistance would

occur as described in Alternative 2 of this EA. Technical assistance is also further discussed in WS' programmatic FEIS (USDA 1997). From FY 2006 through FY 2010, WS has conducted 172 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 includes damage management activities that are directly conducted by or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and there is a written MOU, cooperative service agreement, or other comparable document between WS and the entity requesting assistance. The initial investigation defines 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 are often required to effectively resolve problems, especially if chemicals are necessary or if the problems are complex.

Educational Efforts

Education is an important element of activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, 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 are presented at professional meetings and conferences so that other wildlife professionals and the public are 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 that are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate wildlife damage management techniques. NWRC biologists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

WS' Decision Making Procedures

WS' personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992). WS' programmatic FEIS also provides further discussion and examples of how the Decision Model is used to address damage and threats associated with wildlife (USDA 1997). WS' personnel are frequently contacted after requesters have tried or considered methods and found them to be impractical, too costly, or inadequate for effectively reducing damage. WS' personnel assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a damage management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model, most damage management efforts 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

The WS program in North Carolina 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 are available. Resource owners and others directly affected by mammal damage or conflicts in the State have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

Under a community-based decision-making process, WS would provide information, demonstration, and discussion on all available methods to the appropriate representatives of the community for which services were requested to ensure a community-based decision is made. By involving decision-makers in the process, damage management actions can be presented to allow for 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 mammals often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on mammal damage management activities. This process allows decisions on mammal damage management activities to be made based on local input.

Community Decision-Makers

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

Private Property Decision-Makers

In the case of private property owners, the decision-maker is the individual that owns or manages the affected property. The decision-maker has the discretion to involve others as to what occurs or does not occur on property they own or manage. Due to privacy issues, WS can not disclose cooperator

information to others. Therefore, in the case of an individual property owner or manager, the involvement of others and to what degree others are involved in the decision-making process is a decision made by that individual. Direct assistance could be provided by WS if requested, funding is provided, and the requested management was according to 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 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 managing damage and threats associated with mammals with technical assistance only. Technical assistance could provide those cooperators experiencing damage or threats associated with mammals with information, demonstrations, and recommendations on available and appropriate methods available. The implementation of methods and techniques to resolve or prevent damage would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that are of limited availability for use by private entities (*e.g.*, loaning of propane cannons). Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to managing damage; these strategies are 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 requestor 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); however, WS would not provide direct operational assistance under this alternative. Recommendation of methods and techniques by WS to resolve damage would be based on information provided by the individual seeking assistance. In some instances, wildlife-related information provided to the requestor by WS results in tolerance/acceptance of the situation. In other instances, damage management options are discussed and recommended. Only those methods legally available for use by the appropriate individual would be recommend or loaned by WS. Similar to Alternative 1, those methods described in Appendix B would be available to those persons experiencing damage or threats associated with mammals in the State except for immobilizing drugs and euthanasia drugs. Immobilizing drugs and euthanasia drugs would only be available to WS or appropriately licensed veterinarians.

The WS program in the State regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing mammal damage. Technical assistance includes collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator has attempted to resolve the problem. WS then provides information on appropriate methods that the cooperator may consider to resolve the damage themselves. Types of technical assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues. Between FY 2006 and FY 2010, WS has conducted 172 technical assistance projects that involved mammal damage to agricultural resources, property, natural resources, and threats to human safety.

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

Alternative 3 – No Mammal Damage Management Conducted by WS

This alternative would preclude any and 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 NCWRC, 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 can occur despite the lack of involvement by WS. The take of mammals could occur through the issuance of permits by the NCWRC, when required, and during the hunting or trapping seasons. All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of immobilizing drugs and euthanasia chemicals. Immobilizing drugs and euthanasia chemicals can only be used by WS or appropriately licensed veterinarians.

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

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

In addition to those alternative analyzed in detail, several alternatives were identified by WS and the NCWRC but 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 all 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 all non-lethal methods fails to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the request. This alternative would not prevent the use of lethal methods by those persons experiencing mammal damage.

Those persons experiencing damage often employ non-lethal methods to reduce damage or threats prior to contacting WS. Verification of the methods used would be the responsibility of WS. No standard exists to determine requester diligence in applying those methods, nor are there any standards to determine how many non-lethal applications are necessary before the initiation of lethal methods. Thus, only the

presence or absence of non-lethal methods can be evaluated. The proposed action (Alternative 1) is similar to a non-lethal before lethal alternative because the use of non-lethal methods is considered before lethal methods by WS (WS Directive 2.101). Adding a non-lethal before lethal alternative and the associated analysis would not add additional information to the analyses in the EA.

Use of Non-lethal Methods Only by WS

Under this alternative, WS would implement non-lethal methods only to resolve damage caused by mammals in the State. Only those methods discussed in Appendix B that are considered non-lethal would be employed by WS. No lethal take of mammals would occur by WS. The use of lethal methods could continue to be used under this alternative by those persons experiencing damage by mammals. Exclusionary devices can be effective in preventing access to resources in certain circumstances. Exclusion is most effective when applied to small areas to protect high value resources. However, exclusionary methods are neither feasible nor effective for protecting human safety, agriculture, or native wildlife species from mammals across large areas. The non-lethal methods used or recommended by WS under this alternative would be identical to those 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 NCWRC, other governmental agencies, local animal control agencies, or private businesses or organizations. Under this alternative, however, property owners/managers might be limited to using non-lethal methods only as they may have difficulty obtaining permits for lethal methods, especially in urban areas.

Property owners or managers could conduct management using any method that is 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 lack of WS' assistance with the full range of mammal damage management techniques may try methods not recommended by WS or use illegal methods (*e.g.*, poisons). In some cases, property owners or managers may misuse some methods or use some methods in excess of what is necessary which could then become hazardous and pose threats to the safety of humans and non-target species.

The proposed action, using an integrated damage management approach, incorporates the use of non-lethal methods when addressing requests for assistance. In those instances where non-lethal methods would effectively resolve damage from mammals those methods would be used or recommended under the proposed action. Since non-lethal methods would be available for use under the alternatives analyzed in detail, this alternative would not add to the analyses.

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 exclusionary fences can be effective at preventing wildlife from enter onto airport property. In those situations where damage could be alleviated using non-lethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Trap and Translocate Mammals Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. However, under North Carolina Administrative Code (NCAC), species in the Order Carnivora must be euthanized, if live-captured (15A NCAC 10B.0106). Mammal species addressed in this EA that are classified in the Order Carnivora include bobcat, coyote, gray fox, red fox, raccoon, striped skunk, river otter, mink, feral cat, feral dog, and the black bear. Under this alternative, requests for assistance received by WS associated with those species classified in the Order Carnivora would be referred to other state, federal, and/or private entities. WS would only address requests for assistance associated with opossum, woodchucks, feral swine, gray squirrels, and cottontails under this alternative and only live-capture methods would be employed. Those 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 NCWRC 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 NCWRC. Therefore, the translocation of mammals by WS would only occur as directed by the NCWRC. When requested by the NCWRC, WS could translocate mammals or recommend translocation under any of the alternatives analyzed in detail, except under the no involvement by WS alternative (Alternative 3); however, other entities could translocate mammals despite no involvement by WS.

The translocation of mammals to other areas following live-capture that have caused damage generally would not be effective or cost-effective. Translocation is generally ineffective because problem mammal species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in mammal damage problems at the new location. Also, hundreds of mammals would need to be captured and translocated to solve some damage problems; therefore, translocation would be unrealistic. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of the stress to the translocated animal, 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 NCWRC, this alternative was not considered in detail. Translocation of mammals could occur under any of the alternatives analyzed in detail, except Alternative 3. However, translocation of those mammals by other entities that are not classified in the Order Carnivora could occur under Alternative 3.

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

Under this alternative, the only method available to resolve requests for assistance 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 wildlife population management tool 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 either 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, no reproductive inhibitors are available for use to manage most mammal populations. Given the costs associated with live-capturing and performing sterilization procedures on mammals and the lack of availability of chemical reproductive inhibitors for the management of most mammal populations, this alternative was not evaluated in detail. If a reproductive inhibitor becomes available to manage a large number of mammal populations and has proven effective in reducing localized mammal populations, the use of the inhibitor could be evaluated under the proposed action as a method available that could be used in an integrated approach to managing damage. This EA would be reviewed and supplemented to the degree necessary to evaluate the use of the reproductive inhibitor as part of an integrated approach described under the proposed action. Currently, the only reproductive inhibitor that is registered with the EPA for a mammal species is Gonacon^{TM}, which is registered for use on white-tailed deer (*Odocoileus virginianus*).

Compensation for Mammal Damage

The compensation alternative would require WS to establish or seek 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. Analysis of this alternative in WS' programmatic FEIS indicated that a compensation only alternative had many drawbacks (USDA 1997). Compensation would: 1) require large expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation, 2) compensation most likely would be below full market value, 3) give little incentive to resource owners to limit damage through improved cultural or other practices and management strategies, and 4) not be practical for reducing threats to human health and safety.

Short Term Eradication and Long Term Population Suppression

An eradication alternative would direct all WS' program efforts toward total long term elimination of mammal populations on private, State, and federal government lands wherever a cooperative program was initiated in North Carolina. 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 as a result of using the WS' Decision Model. It is not realistic or practical to consider large-scale population suppression as the basis of the WS' program. Problems with the concept of suppression are similar to those described above for eradication. Typically,

WS' activities in North Carolina 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 North Carolina state agencies, such as the NCWRC, as well as most wildlife professionals for many years (Latham 1960, Hoagand 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 North Carolina. 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

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

Theoretically, TNR would work if all animals of one sex or both were sterilized. However, the probability of controlling invasive species in the wild with this technique is not currently reasonable, especially with the animals being self-sufficient and not relying on humans to survive. Additionally, some individuals within a population can be trap shy. Capturing or removing trap shy individuals often requires implementing other methods.

Of major concern are the potential for diseases and parasites transmission to humans either from direct contact during sterilization or the risk of exposure after the animal is released. Once live-captured, performing sterilization procedures during field operations on anesthetized feral cats would be difficult. Sanitary conditions are difficult to maintain when performing surgical procedures in field conditions. To perform operations under appropriate conditions, live-captured feral cats would need to be transported from the capture site to an appropriate facility which increases the threat from handling and transporting. A mobile facility could be used but would still require additional handling and transporting of the live-captured feral cats to the facility. Once the surgical procedure was completed, the feral cat 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). Feral cats subjected to TNR would continue to cause the same problems[12] 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, Stokopf 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).

[12] 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.

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). As a result of the continued threat to human safety created by TNR programs and the continued threat to T&E wildlife and native wildlife in general, this alternative will not be considered further.

3.3 STANDARD OPERATING PROCEDURES FOR MAMMAL DAMAGE MANAGEMENT

SOPs improve the safety, selectivity, and efficacy of wildlife damage management activities. The WS program in North Carolina uses many such SOPs which are discussed in detail in Chapter 5 of WS' programmatic FEIS (USDA 1997). Those SOPs would be incorporated into activities conducted by WS when addressing mammal damage and threats in the State.

Some key SOPs pertinent to the proposed action and alternatives include the following:

- The WS Decision Model, which is designed to identify effective wildlife damage management strategies and their 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 DEA, FDA, and WS' program directives and procedures.

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

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

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

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

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

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

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

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

- WS would employ methods and conduct activities for which the risk of hazards to public safety and hazard to the environment have been determined to be low according to a formal risk assessment (USDA 1997). Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazards to the public is even further reduced.

- The take of mammals would only occur when authorized by the NCWRC, 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 North Carolina, or even across major portions of North Carolina, would not be conducted.

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

3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

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

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

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

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

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

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

- Preference would be given to non-lethal methods, when practical and effective. If practical and effective non-lethal control methods were not available and if lethal control methods were available and appropriate for WS to implement or to recommend, WS may implement or recommend lethal methods.

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

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

- As appropriate, suppressed firearms would be used to minimize noise the noise associated with the discharge of a firearm.

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

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

- Live-traps would be checked frequently to ensure non-target species would be released in a timely manner to ensure survival.

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

- WS has consulted with the USFWS and the NCWRC 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 are determined to have no significant impact on the environment and an EIS is not required, to ensure those activities do not negatively impact non-target species.

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

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

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

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

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

- WS would adhere to all established withdrawal times for mammals when using immobilizing drugs for the capture of mammals that are agreed upon by WS, the NCWRC, and veterinarian authorities. Although unlikely, in the event that WS is requested to immobilize mammals either during a period of time when harvest of those mammal species is occurring or during a period of time where the withdrawal period could overlap with the start of a harvest season, WS would euthanize the animal.

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

Issue 4 - Effects on the Socio-cultural Elements and Economics of the Human Environment

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

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

- Preference is 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 problem mammals.

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

- WS' use of euthanasia methods would follow those recommended by WS' directives (WS Directive 2.505) and the AVMA (AVMA 2007).

- 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 NCWRC.

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

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

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2. 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 as a result 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 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 and the NCWRC.

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

A common issue is whether damage management actions would adversely affect the populations of target mammal species, especially when lethal methods are employed. WS maintains ongoing contact with the NCWRC to ensure activities are within management objectives for those species. The NCWRC monitors the estimated take of mammals from all sources and factors in survival rates from predation, disease, and other mortality data. As discussed previously, the analysis for magnitude of impact from lethal take can be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest trend data. Information on mammal populations and trends are often derived from several sources including the published literature and harvest data.

As was discussed previously, methods available to address mammal damage or threats of damage in the State that would be available for use or recommendation under Alternative 1 (technical and operational assistance) and Alternative 2 (technical assistance only) are either lethal methods or non-lethal methods. Under Alternative 2, WS would recommend lethal and non-lethal methods as part of an integrated approach to resolving requests for assistance. Alternative 1 addresses requests for assistance received by WS through technical and operational assistance where an integrated approach to methods would be employed and/or recommended. Non-lethal methods include, but are not limited to: habitat/behavior modification, pyrotechnics, visual deterrents, live traps, translocation, cable restraints, exclusionary devices, frightening devices, nets, immobilizing drugs, and chemical repellents (see Appendix B for a complete list and description of potential methods). Lethal methods considered by WS to address mammal damage include: live-capture followed by euthanasia, shooting, body-gripping traps, fumigants, cable restraints, and the recommendation of hunting and/or trapping, where appropriate. Euthanasia would occur through the use of euthanasia drugs or carbon dioxide once mammals are live-captured using other methods. In addition, gunshot could be employed to euthanize live-captured wildlife. No assistance would be provided by WS under Alternative 3 but many of those methods available to address mammal damage would continue to be available for use by other entities under Alternative 3.

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 are employed. Non-lethal methods would be given priority when addressing

requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed 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 has already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods since their use has already been proven ineffective in adequately resolving the damage or threat.

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

The continued use of non-lethal methods often leads to the habituation of mammals to those methods which can decrease the effectiveness of those methods. For any management methods employed, the proper timing is essential in effectively dispersing those mammals causing damage. Employing methods soon after damage begins or soon after threats are identified increases the likelihood that those damage management activities would achieve success in addressing damage. Therefore, coordination and timing of methods is necessary to be effective in achieving expedient resolution of mammal damage.

Lethal methods would be employed or recommended to resolve damage associated with those mammals identified by WS as responsible for causing damage or threats to human safety only 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 are often employed 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 would result in local reductions of mammals in the area where damage or threats were occurring. The number of mammals removed from the population using lethal methods 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.

Most lethal methods are intended to reduce the number of mammals present at a location since a reduction in the number of mammals at a location leads to a reduction in damage which is applicable whether using lethal or non-lethal methods. The intent of non-lethal methods is to harass, exclude, or otherwise make an area unattractive to mammals which disperse those mammals to other areas which can lead to a reduction in damage at the location where those mammals were dispersed. The intent of using lethal methods is similar to the objective trying to be achieved when using non-lethal methods which is to reduce the number of mammals in the area where damage is occurring which can lead to a reduction in the damage occurring at that location.

Although the use of firearms can reduce the number of mammals using a location (similar to dispersing mammals), the use of a firearm is most often used to supplement and reinforce the noise associated with non-lethal methods. The capture of mammals using live-traps and subsequently euthanizing those mammals is employed to reduce the number of mammals using a particular area where damage is occurring. Similarly, the recommendation that mammals be harvested during the regulated hunting and/or trapping season for those species in the State is intended to manage those populations in an area where damage is occurring.

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

Most lethal and non-lethal methods currently available provide only short-term benefits when addressing mammal damage. Those methods are intended to reduce damage occurring at the time those methods are employed but do not necessarily ensure mammals would not return once those methods are discontinued or the following year when mammals return to an area. Long-term solutions to resolving mammal damage are often 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 is not likely to occur are often times required to achieve complete success in reducing damage and 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 and trapping seasons and the allowed take during those seasons is the responsibility of the NCWRC. 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 with hunting and/or trapping season in the State would be occurring in addition to any take that could occur by WS under the alternatives or recommended by WS. Table 4.1 shows the annual estimated harvest levels of several of the mammal species addressed in this EA by year between the 2005 harvest season and the 2010 season.

Table 4.1 – North Carolina Furbearer Harvest for the 2005 to 2010 Seasons

SPECIES	Harvest Season						TOTAL
	2005	2006	2007	2008	2009	2010	
Bobcat	678	690	791	1,045	993	803	**5,000**
Coyote	593	567	847	1,434	1,747	2,091	**7,279**
Gray Fox	2,770	2,392	3,020	5,560	4,212	3,313	**21,267**
Red Fox	631	613	695	1,180	838	769	**4,726**
Raccoon	6,156	5,281	5,967	6,712	7,307	5,442	**36,865**
Mink	327	432	328	331	193	193	**1,804**
Opossum	3,457	4,101	4,317	6,393	4,481	3,841	**26,590**
River Otter	3,104	3,675	1,751	1,457	1,341	1,322	**12,650**
Striped Skunk	226	172	186	641	354	324	**1,903**

*Estimated based on data from licensed fur dealer reports and mail survey information

Harvest information from 2005 through 2010 for those species that are addressed in this assessment but are not included in Table 4.1 is not currently available. In addition, the total number of individuals from

each species that are lethally removed by other entities to alleviate damage or threats of damage is currently not available.

As discussed previously, the analysis for magnitude of impact from lethal take can be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest trend data. 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 Approach to Managing Mammal Damage (Proposed Action/No Action)

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

American Mink Population Information and Effects Analysis

The mink is member of the weasel family and is 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 underfur 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 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 make their dens in muskrat houses, bank burrows, holes, crevices, logjams, or abandoned beaver lodges. They are active mainly at night and are active year-round except for brief intervals during periods of low temperature or heavy snow (Boggess 1994*a*). They may, however, adjust hunting times to prey availability (National Audubon Society 2000).

Population densities for mink vary spatially according to habitat and may be influenced temporally by weather, trapping, and intraspecific aggression. Generally, populations are most dense in those states and provinces with abundant, stable aquatic habitat. In general, population densities typically range from 0.025 to 0.247 mink per acre (McVey et al. 1993). According to harvest statistics, Louisiana populations are most dense in swamps, followed by marshes and drained bottomlands (Linscombe et al. 1982). In Montana, Mitchell (1961) estimated that 280 mink inhabited a 33-km^2 (12.8 mi^2) area, resulting in a density of one mink per 11.8 ha (29.2 acres). However, the following year, Mitchell (1961) estimated that there were only 109 mink in the area, a density of one mink per 30.3 ha (74.7 acres). Marshall (1936) estimated densities from mink tracks in snow in Michigan, reporting 0.6 females in 1 km^2 (1.5/mi^2) of riverbank and a 1:1 sex ratio following heavy trapping. Errington (1943) counted one to five mink families occupying a 180-ha (450 acres) marsh in Iowa from 1933 to 1938. In 1939, Errington (1943) found no families in the same marsh. Errington (1943) suggested that over-trapping was responsible for the low numbers, which continued after 1938. Errington (1943) also suggested that intraspecific aggression was responsible for the upper limit of mink inhabiting the marsh.

McCabe (1949) estimated that there were 24 mink on a 445-ha (1,100 acres) refuge in Wisconsin during 1944, a density of 1 mink per 18.8 ha (46.3 acres). McCabe (1949) estimated that during the next four years (1945 to 1948) the population ranged from seven to 10 individuals. The estimates derived by McCabe (1949) were inversely related to duration and depth of snow cover, but were poorly related to food supply (rabbits [*Sylvilagus* spp.] and mice [*Peromyscus* spp.]). McCabe (1949) suggested that excessive poaching and heavy trapping on the borders of the refuge caused lower mink numbers following 1944. Gerell (1971) worked in two study areas in Sweden. In a 10,000-ha (25,000 acres) area, Gerell (1971) estimated that there were 11 and 16 summer residents during two years, one mink per 909 ha (2,245 acres) in year 1 and one mink per 625 ha (1,545 acres) in year 2. In the second area, Gerell (1971), which included 10 km (6 miles) of riverbank, estimated three and six summer residents in two years. In interior British Columbia, Ritcey and Edwards (1956) caught 11, six, and five mink on 1.9 km (1.2 miles) of stream during three years. Densities calculated by Ritcey and Edwards (1956) were similar to the estimate of 1.5 to 3 mink per km (2.5 to 5 mink per mile) of shoreline reported by Hatler (1976) for a coastal area of Vancouver Island. Mitchell (1961) reported that a turnover of the population occurred during a 3-year period, and Gerell (1971) concurred (Novak et al. 1987).

Mink are considered common throughout North Carolina in areas with aquatic habitats. Mink are classified as furbearers in North Carolina, with a regulated trapping season with unlimited take allowed during the length of the season (NCWRC 2011). The annual statewide fur harvest of mink in North Carolina has ranged between 193 and 432 individuals with a total of 1,804 mink reported harvested from the 2005 to 2010 trapping seasons (see Table 4.1). Between the 2005 and 2010 harvest season, trappers have harvested an average of 301 mink per year in the State. The number of mink lethally taken by entities other than WS in the State to alleviate damage or threats of damage is unknown. Between FY 2005 and FY 2010, WS has lethally removed a total of 28 mink with the highest level of take occurring in FY 2008 when 27 mink were lethally removed by WS to alleviate predation occurring to T&E bird species. Based upon previous requests for WS' assistance, as many as 20 mink each year could be killed by WS to address such damage or threats of damage in the State.

The statewide population of mink is currently unavailable. Therefore, a population estimate will be derived to provide an indication of the magnitude of take proposed by WS to alleviate damage and threats of damage. The State of North Carolina covers 53,820 square miles with 48,618 square miles being land area and 5,202 square miles of water (United States Census Bureau 2011). In addition, there are approximately 242,691 miles of streams in the State with an estimated 123,772 miles of perennial streams (American Rivers 2011). As was discussed previously, mink are closely associated with aquatic habitats where they forage and den along shorelines of rivers, streams, lakes, and ponds. If mink were only found along 50% of the perennial stream miles of the State and using a mean density of 0.1 mink per mile, the population would be estimated at nearly 6,200 mink. Mink can be found in a variety of aquatic habitats, including wetlands and lakes, so mink occupying just perennial streams of the State is unlikely since mink can be found almost statewide. However, mink occupying only 50% of the perennial stream was used to provide a minimum population estimate to determine the magnitude of the proposed take by WS to alleviate or prevent damage and the cumulative take from the harvest seasons.

If WS' take of mink to alleviate damage reached 20 individuals annually and the mink population remains at least stable, the take of 20 mink by WS would represent 0.3% of a mink population estimated at 6,200 mink. Approximately 301 mink have been harvested in the State annually during the trapping season for mink from 2005 through 2010 with a range of harvest from 193 mink to 432 mink. Using the average number of mink taken per year in the State during the annual harvest season, the cumulative take would total 321 mink if 20 mink were lethally removed by WS. The cumulative take of 321 mink would represent 5.2% of a population estimated at 6,200 mink with the cumulative take ranging from 2.6% to 7.3% of the estimated population based on previous harvest levels. As stated before, the actual statewide

population of mink is likely higher than 6,200 mink; therefore, the cumulative take would likely be an even smaller percentage of the statewide population. Although the actual statewide population of mink is unknown, the unlimited take allowed by the NCWRC during the annual trapping season provides an indication that the species is not likely to decline from overharvest, including take that occurs from damage management activities. The NCWRC has determined that there is no evidence to suggest that human-mediated mortality resulting from regulated fur harvest and damage management, including removal by WS, would be detrimental to the survival of the mink populations in the state of North Carolina (C. Olfenbuttel, NCWRC, pers. comm. 2011).

Bobcat Population Information and Effects Analysis

The bobcat, also called "*wildcat*," is a medium-sized member of the North American cat family, and may be mistaken for a large bob-tailed domestic cat by some people. This species is actually two to three times larger than most domestic cats and appears more muscular and fuller in body. Bobcats are capable of hunting and killing prey that range from the size of a mouse to that of a deer. Rabbits, tree squirrels, ground squirrels, 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. Bobcats are opportunistic predators, and may feed on livestock and domestic animals such as poultry, sheep, goats, house cats, small dogs, exotic birds and game animals, and rarely, calves (Virchow and Hogeland 1994). McCord and Cardoza (1982) reported the cottontail rabbit to be the principal prey of bobcats throughout their range.

Bobcats reach densities of about 1 per 0.7 km^2 (one 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 (one per ½ mi^2) in coastal plains to about one cat per 10.7 km^2 (one per 4 mi^2) in portions of the Appalachian foothills. Mid-Atlantic and Midwestern states usually have scarce populations of bobcats (Virchow and Hogeland 1994). Populations are stable in many northern states and increasing 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 are common in suitable habitat and found statewide in the State. Population estimates for bobcats in North Carolina are not currently available. Population trend estimates provided by the NCWRC indicate a stable population in North Carolina with local populations showing cyclic increases and decreases every few years (C. Olfenbuttel, NCWRC, pers. comm. 2011). Since population estimates are not available for bobcats, the best available data will be used to estimate a population size to analyze impacts.

Bobcats are classified as game and furbearers in North Carolina, with a regulated hunting and trapping season allowing unlimited take to occur during the harvest season (NCWRC 2011). The number of bobcat pelts tagged by hunters and trappers in North Carolina has averaged nearly 833 bobcats per year between the 2005 and 2010 hunting and trapping seasons, with the highest level of harvest occurring in 2008 when 1,045 bobcats were harvested in the State. As mandated through the Convention on International Trade in Endangered Species, the NCWRC requires that all bobcat pelts to be sold must be tagged. However, bobcats can be found statewide in North Carolina where suitable habitat occurs and are not considered an endangered species.

Habitat preferred by bobcats is quite diverse in North Carolina ranging from upland forests to coastal wetlands. If only 50% of the land area of North Carolina represents suitable bobcat habitat and using density estimates for the Appalachian foothills of 1 bobcat per 4 mi^2, a statewide population could be estimated to be approximately 6,100 bobcats. However, this estimate could be considered low given that where quality habitat and prey are available densities tend to be much higher. A recent study where bobcats were reintroduced to an island off the coast of Georgia, bobcat densities stabilized at one bobcat per 1.2 mi^2 (Diefenbach et al. 2006). A total bobcat population could be estimated at 40,500 cats using a density of one bobcat per 1.2 mi^2. Under a worst case scenario, if only 50% of the land area in North Carolina was suitable for bobcat populations, a population could be estimated at 20,250 bobcats using densities found by Diefenbach et al. (2006).

Between FY 2005 and FY 2010, WS has removed a total of seven bobcats in the State as part of damage management activities, with the highest level of take occurring in FY 2010 when six bobcats were lethally removed. Based upon an anticipated increase in bobcat damage management activities in the future, it is possible that WS could kill 10 bobcats per year during damage management activities. Based on population densities of 1 bobcat per 4 mi^2, if 10 bobcats were removed by WS and the population remains at least stable, the take would represent less than 0.2% of the estimated population of 6,100 bobcats. The cumulative take that could occur by WS and the average harvest of bobcats estimated at 833 cats, would represent 13.8% of a population estimated at 6,100 bobcats. The highest level of take occurred in 2008 when 1,045 bobcats were harvested in the State. When the highest level of bobcat take during the harvest season is combined with the proposed annual take by WS of 10 bobcats, the cumulative take would represent 17.3% of a population estimated at 6,100 bobcats. The statewide population is likely higher than 6,100 bobcats and the unlimited take allowed by the NCWRC indicates the species is not likely to be overharvested. The take of bobcats by WS would only occur when permitted by the NCWRC and only at levels permitted.

Coyote Population Information and Effects Analysis

Coyotes are a familiar mammal to most people. Their coloration is blended, primarily gray mixed with a reddish tint. The belly and throat are a paler color than the rest of the body (Beckoff 1982). Coyotes have long, rusty or yellowish legs with dark vertical lines on the lower foreleg. They are similar in appearance to gray and red wolves (National Audubon Society 2000). Color varies greatly from nearly black to red or nearly white in some individuals and local populations. Most have dark or black guard hairs over their back and tail (Green et al. 1994). Coyotes sometimes breed with domestic dogs producing hybrids called "*coydogs*" (National Audubon Society 2000). The size of coyotes averages from about 20 to 40 lbs (9 to 18 kg) (Novak et al. 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 from 1900 to 1920. Now, all eastern states and Canadian provinces have at least a small population of coyotes (Voigt and Berg 1987). Currently, coyotes inhabit all 100 counties of North Carolina. Coyotes were initially introduced during the 1980s in Beaufort County, North Carolina by fox hunters training their dogs (Hill et al. 1987). At the same time, coyotes appeared in western North Carolina by natural migration from bordering states (Hill et al. 1987).

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

Coyotes breed between January and March and are able to breed 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, but causes large annual variation in total number of coyotes breeding. In a study in Texas, the percentage of females having litters varied from 48 to 81% (Knowlton 1972). Pups are born after a gestation period of 60 to 63 days, with litter sizes varying primarily with prey availability. Gier (1968) reported average litter sizes of 4.8 to 5.1 in years with low rodent numbers, but litters of 5.8 to 6.2 during years with high rodent numbers. Litter sizes of 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. Data from scent-station indices suggest that density increases from north to south. Coyote densities as high as 2 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.

Actual population estimates for coyotes in North Carolina are not currently available. Coyotes are common throughout North Carolina and inhabit a variety of habitats. The NCWRC has indicated the coyote population in the state is generally stable with local populations showing increases and decrease every few years (C. Olfenbuttel, NCWRC, pers. comm. 2011). Coyotes are classified as a wild animal in North Carolina and there are no limits on the number that can be taken. Coyotes can be lethally removed using hunting methods throughout the year and can be trapped during annual trapping seasons in the State (NCWRC 2011). Between the 2005 and 2010 harvest season, a total of 7,279 coyotes were harvested in the State, which is an average of 1,214 coyotes harvested annually in the State. The highest level of take occurred in 2010 when 2,091 coyotes were harvested. The number of coyotes harvested in the State between 2006 and 2010 has increased every year. In 2005, a total of 593 coyotes were harvested compared to 2,091 coyotes harvested in 2010, which is an increase of over 42% annually. Coyotes are also known to be taken to alleviate damage and threats of damage; however, the number of coyotes lethally taken annually to alleviate damage or threats of damage is currently unknown.

Between FY 2005 and FY 2010, WS has lethally removed a total of 75 coyotes in the State to alleviate damage or threats, which is an average of 13 coyotes per year. The highest level of take by WS occurred during FY 2010 when 38 coyotes were removed when requested to alleviate damage. Based on the number of requests for assistance received previously and based on the number of coyotes addressed as part of those requests for assistance, WS could take up to 100 coyotes total annually to alleviate damage or threats.

Because determinations of absolute coyote densities are frequently unknown (Knowlton 1972), many researchers have estimated coyote populations using various methods (Clark, 1972, Knowlton 1972, Camenzind 1978, USDI 1979, Pyrah 1984). The cost to accurately determine absolute coyote densities over large areas is prohibitive (Connolly 1992) and would not appear to be warranted given the coyote's overall relative abundance. The presence of unusual food concentrations and the assistance provided to a

breeding pair by non-breeding coyotes at the den can influence coyote densities and complicate efforts to estimate abundance (Danner and Smith 1980). Coyote densities are lowest in late winter prior to whelping, highest immediately after whelping, followed by a continued decline to the next whelping season (Parker 1995).

Predator abundance indices suggest that densities of coyotes in North America increase from north to south (Knowlton and Stoddart 1985, Parker 1995). Coyote densities range from 0.2 per mi^2 when populations are low (pre-whelping) to 3.6 coyotes per mi^2 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 may approach a high of five to six coyotes per mi^2 under extremely favorable conditions with densities of 0.5 to 1.0 per mi^2 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 provided in WS' programmatic FEIS 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, USDA 1997). 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) can result in rapid occupancy of vacant territories, which helps to explain why coyotes have thrived in spite of intensive damage management activities (Connolly 1978).

No population estimates were available for coyotes in North Carolina. If coyotes only occupy 50% of the land area of the State and the density of coyotes ranged from 0.5 coyotes per mi^2 to 1.0 coyotes per mi^2, the statewide population could be estimated to range from nearly 12,200 coyotes to a high of nearly 24,400 coyotes. Using a statewide coyote population ranging from 12,200 to 24,400 coyotes, take of up to 100 coyotes annually would represent from 0.4% to 0.8% of the estimated population. Although exact population estimates for coyotes in North Carolina are not available, unlimited take limits allowed by the NCWRC for the species indicates the species is not at risk of overharvesting. The highest reported take of coyotes in the State occurred in 2010 when 2,091 coyotes were reported harvested. Take of up to 100 coyotes by WS would have represented 4.8% of the highest total reported harvest of coyotes. When evaluated cumulative, the take of 100 coyotes by WS when combined with the highest harvest level reported of 2,091 coyotes would represent 18.0% of a coyote population estimated at 12,200 coyotes. Therefore, WS' take of coyotes under the proposed action and cumulatively would be of low magnitude when compared to the actual statewide coyote population and the number of coyotes harvested annually.

Gray Fox Population Information and Effects Analysis

The gray fox is common in many parts of the United States where deciduous woodlands provide habitat; yet, the secretive grey fox is seldom observed in the wild. The gray fox is somewhat smaller in stature than the red fox, having shorter legs and extremities. Gray fox exhibit striking pelage which has grizzled upper parts resulting from individual guard hairs being banded with white, gray, and black. A

predominance of black-tipped hairs in the middle of the back forms a dark longitudinal stripe that extends into a conspicuous black mane of coarse hair at the top of the black-tipped tail. Portions of the neck, sides, and limbs are cinnamon-colored. The ventral areas of a gray fox are buff colored. White shows on the ears, throat, chest, belly, and back legs, and the black, white, and reddish facial markings provide distinctive accents (Fritzell 1987).

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

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

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

Accurate estimates of carnivore populations are rare and those for gray fox populations are no exception. Published estimates of gray fox density vary from 1.2 to 2.1 per 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 (Follman 1973). Although exceptions exist, eastern gray fox generally have larger home ranges than western animals (Fritzell 1987). For instance, 16 adult fox were tracked for more than one month in Alabama (Nicholson 1982) and Missouri (Haroldson and Fritzell 1984) and it was determined that they all had home ranges larger than 200 ha (500 acres), and many exceeded 500 ha (1,235 acres).

Gray fox feed on a wide variety of plant and animal matter and are considered to be more omnivorous than other North American canids (Fritzell 1987). Although active primarily at twilight and at night, the gray fox is sometimes seen foraging by day in brush, thick foliage, or timber. The only American canid with true climbing ability, gray fox occasionally forage in trees and often takes refuge in them, especially leaning or thickly branched trees. The gray fox feeds heavily on cottontail rabbits, mice, voles, other small mammals, birds, insect, and plant material, including corn, apples, persimmons, nuts, cherries, grapes, pokeweed fruit, grass, and blackberries. Grasshoppers and crickets are often a very important part of the diet in late summer and autumn (National Audubon Society 2000).

Gray fox are considered a game animal in the State with restrictions on where fox can be harvested, restrictions on what methods can be used, and in some cases, with daily and possession limits in place.

The harvest of fox during hunting and trapping seasons is based on numerous "*local laws*" which can apply only to one county, to several counties, or could vary within a county (NCWRC 2011). In addition, some counties prohibit the harvest of fox (NCWRC 2011).

Between the 2005 and 2010 harvest seasons, a total of 21,267 gray fox have been reported harvested in the State which is an average of 3,545 gray fox harvested per year. The highest harvest level occurred during the 2008 harvest season when 5,560 gray fox were reported harvested in the State. The number of gray fox lethally removed to alleviate damage by other entities is currently unknown. In addition to take during the hunting and trapping season, WS also removed gray fox to alleviate damage and threats of damage in the State. From FY 2005 through FY 2010, WS has lethally removed a total of 84 gray fox in the State with the highest annual take level occurring in FY 2005 when 26 gray fox were lethally removed by WS.

WS' total take of gray fox from FY 2005 through FY 2010 represented 0.4% of the total take of gray fox that occurred during the harvest seasons from 2005 through 2010. Based on the number of gray fox lethally removed by WS previously and in anticipation of receiving additional requests to lethally remove gray fox, WS anticipates that up to 50 gray fox could be lethally removed annually by WS in the State to alleviate damage and threats of damage.

Gray fox can be found throughout North Carolina. The NCWRC indicates gray fox populations are stable with local populations showing cyclic trends on a local scale (C. Olfenbuttel, NCWRC, pers. comm. 2007). If gray fox only occupy 50% of the land area of North Carolina and the density of gray fox in the State is 3.1 gray fox per square mile, the statewide population could be estimated at nearly 75,400 gray fox. Gray fox can be found in a variety of habitats, including urban areas, so gray fox occupying only 50% of the land area of the State is unlikely since fox can be found statewide. However, similar to the other furbearing species, gray fox occupying only 50% of the land area was used to provide a minimum population estimate to determine the magnitude of the proposed take by WS to alleviate or prevent damage.

Using the lowest population estimate of 75,400 fox, the take of 50 gray fox by WS would represent 0.1% of the population. Like other mammal species addressed in this EA, the permitting of take to alleviate damage by the NCWRC provides an indication that gray fox populations maintain sufficient densities within the State to sustain the annual harvest and that overharvest is unlikely.

Red Fox Population Information and Effects Analysis

The red fox is a typically proportioned member of the dog family. The bushy and unusually long tail, pointed ears, slender muzzle, and slanted eyes coupled with its small dog size and typical reddish coloration, make the red fox instantly recognizable to most people. 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 from 3.5 kg to 7 kg (7.7 to 15.4 lbs), with males averaging about 1 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 as large as adults (Voigt 1987). They occur over most of North America, north and east from southern California, Arizona, and central Texas. 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, but were plentiful in many parts of Canada. However, it has been suggested that climatic factors, interbreeding with the introduced European red fox, extirpation of the wolves, and clearing of land for agriculture has possibly contributed to the present-day expansion and range of this species in North America (Voigt 1987).

Red fox are adaptable to most habitats within their range, but usually prefer open country with moderate cover. Some of the highest fox densities reported are in the north-central United States occur where woodlands are interspersed with farmlands. The range of the species has expanded in recent years to fill habitats formerly occupied by coyotes. The reduction of coyotes in many sagebrush/grassland areas of Montana and Wyoming has resulted in increased fox numbers. 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, commonly an enlarged woodchuck or badger den, usually in sparse ground cover on a slight rise, with a good view of all approaches (National Audubon Society 2000). Juvenile fox are able to breed before reaching a year old, but in areas of high red fox densities, most yearlings do not produce pups (Harris 1979, Voigt and MacDonald 1984, Voigt 1987). Gier (1968) reported average litter sizes of 4.8 to 5.1 in years with low rodent numbers, but litters of 5.8 to 6.2 during years with high rodent numbers. Litter sizes of 1 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. Red fox are 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).

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

Home ranges for red fox in the eastern United States are usually from 500 to 2,000 hectares (1,235 to 4,940 acres) in rural settings such as farmland (Voigt and Tinline 1980), but such sizes may not apply among fox populations in urban settings.

Red fox can be found statewide in North Carolina in a variety of habitats across the State. Red fox populations are considered to be stable with cyclic population changes occurring in local populations (C. Olfenbuttel, NCWRC, pers. comm. 2011). Similar to gray fox, red fox are considered a game animal in the State with restrictions on where fox can be harvested, restrictions on what methods can be used, and in some cases, with daily and season possession limits. Like gray fox, the harvest of red fox during hunting and trapping seasons is based on numerous "*local laws*" which can apply only to one county, to several counties, could vary within a county, or in some counties, could be prohibited (NCWRC 2011). The number of red fox reported as harvested from 2005 through 2010 is shown in Table 4.1. Between 2005 and 2010, a total of 4,726 red fox have been reported as lethally harvested in the State. The highest level of take occurred in 2008 when 1,180 fox were reported harvested. The average number of red fox harvested in the State from 2005 through 2010 has been 788 red fox. Red fox are also known to be taken to alleviate damage and threats of damage; however, the number of fox lethally taken annually to alleviate damage or threats of damage is currently unknown.

WS has lethally taken a total of 28 red fox in the State from FY 2005 through FY 2010 with the highest level of take occurring in FY 2007 when 13 red fox were taken to alleviate damage. Based on the number of requests for assistance received previously and based on the number of red fox addressed as part of those requests for assistance, WS could take up to 50 red fox total annually to alleviate damage or threats of damage, including red fox that could be unintentionally lethally taken as non-targets during other mammal damage management activities.

Based on an assumption that red fox only occupy 50% of the land area of North Carolina and the density of red fox in the State is 2.6 red fox per mi^2 (based on the lowest density estimates), the statewide population could be estimated at nearly 63,200 red fox using the land area of the State. Using a statewide red fox population estimated at 63,200 red fox, take of up to 50 red fox annually would represent 0.1% of the estimated population. Based on the average number of red fox harvested annually in the State during the hunting and trapping seasons estimated at 788 red fox, take of up to 50 red fox by WS would represent 6.4% of the average annual harvest of red fox in the State. When combined, the cumulative take by WS of 50 red fox and the average harvest of red fox in the State would be 838 fox. Based on a population estimated at 63,200 red fox, the cumulative take of 838 red fox would represent 1.3% of the estimated population. If WS' take of up to 50 red fox is combined with the highest level of red fox harvest in the State that occurred in 2008 when 1,180 red fox were harvested, the combined take would represent 2.0% of the estimated statewide population.

Despite previous levels of take, the red fox population appears to be at least stable which provides an indication that the cumulative take of red fox has not reached a level where declining trends have been observed. Similar to other game species, exact population estimates for red fox in the State are not available; however, the permitting of the take by the NCWRC ensures cumulative take occurs within allowable harvest levels to reach population objectives for red fox in the State.

Raccoon Population Information and Effects Analysis

The raccoon is a stocky mammal ranging from 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*).

The raccoon is one of the most omnivorous of animals. It will eat carrion, garbage, birds, mammals, insects, crayfish, mussels, other invertebrates, and a wide variety of grains, various fruits, other plant materials and most or all foods prepared for human or animal consumption (Sanderson 1987). They occasionally kill poultry (Boggess 1994*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 1994b, 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 kilometers (0.6 to 2.9 miles) maximum, with some home range diameters of dense suburban populations to be 0.3 to 0.7 kilometers (0.2 to 0.4 miles).

Absolute raccoon population densities are difficult or impossible to determine because of the difficulty in knowing what percentage of the population has been counted or estimated and the additional difficulty of knowing how large an area the raccoons are using (Sanderson 1987). Due to their adaptability, raccoon densities reach higher levels in urban areas than that of rural areas. Relative raccoon population densities have been variously inferred by take of animals per unit area. For instance, Twichell and Dill (1949) reported removing 100 raccoons from tree dens in a 41 hectare (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 hectares (19.3 acres) in New Jersey in predominantly agricultural land on the inner coastal plain. Kennedy et al. (1991) estimated 13 raccoons per 100 ha (1 raccoon per 19 acres) of lowland forest in Tennessee. Raccoon densities of 100 raccoons 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 which ranged from nearly two raccoons to almost 650 raccoons per mi^2 in rural habitats with an average of 10 to 80 raccoons per mi^2.

The statewide population of raccoons in North Carolina is currently unknown but the population is considered stable with cyclic population changes occurring in local populations, likely due to canine distemper outbreaks (C. Olfenbuttel, NCWRC, pers. comm. 2011). Raccoons can be found throughout the State and thrive in a variety of habitats including rural, suburban, and urban areas. Using the summarized density ranges for raccoons in rural areas provided by Riley et al. (1998) and the assumption that raccoons only inhabit 50% of the land areas of North Carolina, a statewide population could be estimated to range from a low of nearly 48,618 raccoons to a high of over 15.8 million raccoons. Using the average of 10 to 80 raccoon per square mile reported by Riley et al. (1998), the statewide population could be estimate at 243,100 to 1.9 million raccoons if raccoons only inhabited 50% of the land area of the State. Similar to estimates derived for the other mammal species in this EA, estimating that raccoons inhabit only 50% of the land area of the State is intended to determine a minimum population estimate to compare the potential range of WS' proposed take of raccoons and to determine the magnitude of WS' proposed take.

In North Carolina, 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*).

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

WS provides assistance in addressing the spread of raccoon rabies in North Carolina. Those activities are part of the national rabies barrier program covered under separate environmental analyses (USDA 2005*a*). Other rabies monitoring or control activities may occur as part of this program. Raccoons lethally taken during activities to address the spread of raccoon rabies are covered by the EA and FONSI – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Fox, and Coyotes in the United States (USDA 2005*a*) but are included in this EA for cumulative impact analysis.

Raccoons are classified as furbearers and a game species in North Carolina with a regulated annual hunting and trapping season with unlimited take allowed during the length of those seasons (NCWRC 2011). During the annual hunting season for raccoons, up to three raccoons can be taken daily with no limit on the number that can be possessed during the length of the season. During the development of this EA, there were no limits on the number of raccoons that could be trapped daily or in possession during the annual trapping season in the State. The total numbers of raccoons reported as harvested in the State from 2005 through 2010 are shown in Table 4.1. As with other furbearing species, raccoons can also be lethally taken to alleviate damage or threats of damage when authorized by the NCWRC through the issuance of a permit. The current number of raccoons lethally taken by other entities for damage management purposes from July 1, 2005 through June 30, 2011 in the State to alleviate damage or threats of damage is 8,542 raccoons (C. Olfenbuttel, NCWRC, pers. comm. 2011). The total take of raccoons to alleviate damage in the State for the 2010-2011 reporting period was not complete at the time this EA was developed (C. Olfenbuttel, NCWRC, pers. comm. 2011).

WS' annual take of raccoons during all projects from FY 2005 to FY 2010 never exceeded 1.0% of the annual reported harvest for the corresponding year. The average number of raccoons reported harvested in the State during the annual hunting and trapping seasons from 2005 through 2010 is 6,145 raccoons per year. WS' take of 190 raccoons total from FY 2006 through FY 2010 would represent 0.5% of the total annual harvest of raccoons from 2005 through 2010. WS' previous take of raccoons to alleviate damage and as part of rabies monitoring has been of a low magnitude when compared to the number of raccoons reported harvested in the State, especially given reported take is likely the minimum number of raccoons harvested.

Based on previous requests for assistance received by WS to alleviate damage and in anticipation of receiving additional requests for assistance with managing damage, up to 100 raccoons could be lethally removed by WS annually when requested. Using the lowest population estimate of 48,618 raccoons, the take of 100 raccoons would represent 0.2% of the population. Activities conducted to prevent the further spread of raccoon rabies in the State generally do not result in the lethal take of raccoons. Raccoons are live-captured, sampled, and released on-site as part of the post-baiting protocols. However, if raccoons are visibly injured or exhibit signs of disease, those raccoons are often euthanized. The number of raccoons lethally taken in the State during the post-baiting trapping varies, but is not likely to exceed 50 individuals (USDA 2005*a*).

As stated previously, an average of 6,145 raccoons are harvested annually in the State and when combined with the take of 100 raccoons by WS, the cumulative take would represent 12.8% of a statewide population estimated at 48,618 raccoons. The highest harvest level reported occurred in 2009 when 7,307 raccoons were reported harvested. When combined, the highest level of harvest reported at 7,307 and the take of 100 raccoons by WS would represent 15.2% of a population estimated at 48,618

raccoons. The statewide raccoon population is likely much higher than 48,618 raccoons and therefore, the cumulative take is likely an even smaller percentage of the actual population. Raccoon populations can remain relatively abundant if annual harvest levels are below 49% (Sanderson 1987, USDA 1997).

Virginia Opossum Population Information and Effects Analysis

Opossums are the only marsupials (*i.e.*, possess a pouch in which young are reared) found north of Mexico (Seidensticker et al. 1987). They frequent most of the eastern and central United States, except Minnesota, northern Michigan and New England, extending west to Wyoming, Colorado, and central New Mexico (National Audubon Society 2000). They are also found in parts of the southwestern United States, California, Oregon, and Washington (Jackson 1994*a*). Adults range in size from less than 1 kg (2.2 lbs) to about 6 kg (13 lbs), depending on sex and time of year. They grow throughout life (Seidensticker et al. 1987). They have a fairly broad range of pelage colors, but are usually considered as "*gray*" or "*black*" phase. Their fur is grizzled white above; long white hairs cover black tipped fur below. They climb well and feed on a variety of foods, including carrion which forms much of its diet. In addition, 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*a*), 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 which climb up the mothers belly to the marsupium (pouch), attach to teats, and begin to suckle (Gardner 1982, National Audubon Society 2000). Those young remain in the pouch for about two months at which time they will begin to explore and may be found traveling on their mother's back with their tails grasping hers (Whitaker, Jr., and Hamilton, Jr. 1998). Opossums live for one to two years, with as few as 8% of a population of those animals surviving into the second year in a study in Virginia conducted by Seidensticker et al. (1987). In that five year study, it was also observed that there was a wide variation in opossum numbers, in what was considered excellent habitat for the species. Those variations were observed seasonally and in different years. However, the mean density during the study was 10.1 opossum per mi^2 with a range of 1.3 opossum per mi^2 to 20.2 opossum per mi^2 (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 mi^2 in farmland areas in Illinois while Wiseman and Hendrickson (1950) found a density of 6.0 opossum per mi^2 in mixed pasture and woodlands in Iowa. However, VanDruff (1971) found opossum densities in waterfowl nesting habitat as high as 259 opossum per mi^2.

Opossum are common throughout North Carolina in appropriate habitat. Population trends show a stable to slightly increasing population especially in urban areas (C. Olfenbuttel NCWRC, pers. comm. 2011). Population estimates for opossum in the State are not available. Therefore, a population estimate will be derived based on the best available information for opossum to provide an indication of the magnitude of take proposed by WS to alleviate damage and threats of damage. The State of North Carolina covers 53,819 mi^2 with 48,618 mi^2 being land area. If opossum were only found on 50% of the land area of the State and using a mean density of 10.1 opossum per mi^2 found by Seidensticker et al. (1987) in Virginia, the population would be estimated at nearly 245,500 opossum. Using the range of opossum found by Seidensticker et al. (1987) estimated at 1.3 opossum per mi^2 to 20.2 opossum per mi^2 and only 50% of the land area of the State being occupied by opossum, the statewide population would range from a low of 31,600 opossum to a high of nearly 491,000 opossum. Opossum can be found in a variety of habitats, including urban areas, so opossum occupying only 50% of the land area of 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 take by WS to alleviate or prevent damage.

Opossum are considered a game and furbearing species in the State and can be harvested during annual hunting and trapping seasons (NCWRC 2011). During the development of the EA, opossum could be harvested during hunting and trapping season with no limit on the number that could be taken during those seasons. In addition, opossum can be lethally taken in the State when causing damage or posing a threat of damage when permitted by the NCWRC. The current number of opossum lethally taken by other entities for damage management purposes from July 1, 2005 through June 30, 2011 in the State to alleviate damage or threats of damage is 5,432 opossum (C. Olfenbuttel, NCWRC, pers. comm. 2011). The total take of opossum to alleviate damage or threats for the 2010-2011 reporting period was not complete at the time this EA was developed (C. Olfenbuttel, NCWRC, pers. comm. 2011).

As part of damage management activities conducted by WS in the State a total of 62 opossum have been lethally taken from FY 2005 through FY 2010, which is an average of 11 opossum lethally removed by WS per year. Based on previous requests for assistance received by WS and in anticipation of additional requests for assistance, WS could lethally remove up to 20 opossum annually in the State as part of efforts to reduce damage. Given the range of population estimates in the State, the take of 20 opossum by WS annually would represent from 0.004% to 0.1% of the estimated statewide population if the overall population remains at least stable.

Between 2005 and 2010, a total of 26,590 opossum have been reported as harvested during the hunting and trapping season in the State, which is an average of 4,432 opossum harvested annually. The highest level of reported take occurred in 2008 when 6,393 opossum were reported harvested. During the 2010 hunting and trapping season, a total of 3,841 opossum were reported as lethally taken in the State. WS' take of eight opossum in FY 2010 would represent 0.2% of the reported harvest of opossum during 2010 in the State.

Given the range of population estimates in the State, the take of 20 opossum by WS annually when combined with the average harvest of opossum estimated at 4,432 would represent from 0.9% to 14.1% of the estimated statewide population if the overall population remains at least stable. Although the number of opossum actually lethally taken in the State during the annual hunting and trapping seasons and for damage management is unknown, the cumulative take of opossum, including the proposed cumulative take of up to 20 opossum annually by WS, would not reach a magnitude where adverse effects would occur to the statewide opossum population. The permitting of the take by the NCWRC, which is responsible for managing wildlife species in the State, ensures the cumulative take of opossum occurs within allowable take levels to achieve the desired population levels.

Striped Skunk Population Information and Effects Analysis

Although easily recognized by their black and white fur, the striped skunk may be most readily recognized by the odiferous smell of their musk. They are common throughout the United States and Canada (Rosatte 1987). Striped skunks are primarily nocturnal and do not have a true hibernation period, although during extremely cold weather skunks may become temporarily dormant. The striped skunk is an omnivore, feeding heavily on insects such as grasshoppers, crickets, beetles, bees, and wasp (Chapman and Feldhamer 1982). The diet of the striped skunk also includes small mammals and the eggs of ground-nesting birds and amphibians. Striped skunks are typically non-aggressive and will attempt to flee when approached by humans (Rosatte 1987). However, when provoked, skunks will give a warning and assume a defensive posture prior to discharging their foul-smelling musk. This musk is comprised of sulfur-alcohol compounds known as butylmercaptan (Chapman and Feldhamer 1982).

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 other than those based on harvest numbers and trapper/hunter observations. During the breeding season, males may travel larger areas in search of females. Skunk densities vary widely according to season, food sources and geographic area. Densities have been reported to range from 1 skunk per 77 acres to 1 per 10 acres (Rosatte 1987).

Population estimates for striped skunks in North Carolina are currently not available. Striped skunks can be found in a variety of habitats across North Carolina. Populations of striped skunks are thought to be stable to decreasing in some areas and increasing in other areas, primarily urban areas (C. Olfenbuttel NCWRC, pers. comm. 2011). If skunks only inhabit 50% of the land area of the State and densities occur at one skunk per 77 acres, the statewide population could be estimated at nearly 202,000 skunks based on the land area in the State estimated at 48,618 mi^2. Similarly to other furbearing species, skunks can be found throughout the State and the estimate is intended to evaluate the magnitude of take proposed under the proposed action.

Skunks can be lethally taken in the State throughout the year with no limit on the number that can be taken. In addition, skunks can be trapped during an annual season which places no limit on the number of skunks that can be harvested daily and no limit on the number of skunks that can be possessed throughout the trapping season. Skunks are also lethally taken to alleviate damage or threats of damage; however, the exact number of skunks lethally taken annually in the State to alleviate damage or threats of damage is currently unknown.

Based on previous requests for assistance received by WS to alleviate damage and in anticipation of receiving additional requests for assistance with managing damage, up to 200 skunks could be lethally removed by WS annually when requested. Using the lowest population estimate of 202,000 skunks, the take of 200 skunks would represent 0.1% of the estimated statewide population. Between 2005 and 2010, at least 1,903 skunks have been harvested in the State, which is an average of 318 skunks harvested annually. The actual harvest level is unknown since skunks can be lethally removed throughout the year in the State. The highest harvest level occurred during 2008 season when 641 skunks were reported harvested. If had WS lethally removed 200 skunks during 2008, the cumulative take would have represented 0.4% of the statewide population estimated at 202,000 skunks.

The unlimited take allowed by the NCWRC with no closed season provides an indication that skunk densities in the State are sufficient to maintain a sustain harvest level and adverse effects from harvest and damage management purposes are not likely to cause overharvest of the species leading to population declines.

Feral Cat Population Information and Effects Analysis

Feral cats are domesticated cats living in the wild. Free-ranging cats are those cats that are considered to belong to, possessed, or otherwise owned by a person, but are allowed the ability to wander freely within the environment. In general, most feral cats 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). Other cats that are not considered feral, but may be considered free-ranging are capable of attaining much higher weights.

Feral cats are typically found in commensal relationships wherever people are found. In some urban and suburban areas, cat populations equal human populations. In many suburban and eastern rural areas, feral cats are the most abundant predators. They are opportunistic predators and scavengers that feed on rodents, rabbits, shrews, moles, birds, insects, reptiles, amphibians, fish, carrion, garbage, vegetation, and leftover pet food (Fitzwater 1994).

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

Where it has been documented, the impact of feral and free ranging 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 may 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 and are one of the most important drivers of global bird extinctions (Dauphine and Cooper 2009). In addition, feral cats serve as a reservoir for human and wildlife diseases, including cat scratch fever, distemper, histoplasmosis, leptospirosis, mumps, plague, rabies, ringworm, salmonellosis, toxoplasmosis, tularemia, and various parasites (Fitzwater 1994).

A total of 15 feral cats have been lethally removed by WS in North Carolina from FY 2005 through FY 2010 to alleviated damage or threats of damage at the request of a resource owner. The population of feral cats in the State is currently unknown. Cats are not native to the State with feral cats 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 provide some benefits to native species by reducing predation and competition.

Based on previous requests for assistance and in anticipation of receiving additional requests for assistance, WS could lethally remove up to 50 feral cats to alleviate damage or threats of damage in the State. Based on the limited take proposed and given that feral cats often are known predators of native wildlife and often compete with other predators, the removal of feral cats would not a reach a magnitude where adverse effects to the statewide population would occur.

Feral Dog Population Information and Effects Analysis

Like domestic dogs, feral dogs (sometimes referred to as wild or free-ranging dogs) manifest themselves in a variety of shapes, sizes, colors, and even breeds. McKnight (1964) noted German shepherds, Doberman pinschers, and collies 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 humans, and in some respect, their behavior toward people. Feral dogs survive and reproduce independently of human intervention or assistance. While it is true that some feral dogs use human garbage for food, others acquire their primary subsistence by hunting and scavenging like other wild canids.

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

Feral dogs are usually secretive and wary of people. Thus, they are active during dawn, dusk, and at night, much like other wild canids. They often travel in packs or groups and may have rendezvous sites, similar to wolves. Travel routes to and from the gathering or den sites may be well defined. Food scraps and other evidence of concentrated activity may be observed at gathering sites. The appearance of tracks left by feral dogs varies with the size and weight of the animal. Generally, dog tracks are more round and show more prominent nail marks than those of coyotes, and they are usually larger than those of fox. Since a pack of feral dogs likely consists of animals in a variety of sizes and shapes, the tracks from a pack of dogs will be correspondingly varied, unlike the tracks of a group of coyotes (Green and Gipson 1994).

Feral dogs may occur wherever people are present and permit dogs to roam free, or 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 and are probably influenced by the availability of food. Dog packs that are primarily dependent on garbage may remain in the immediate vicinity of a landfill, while other packs that depend on livestock or wild game may forage over an area of 130 km^2 (50 mi^2) or more (Green and Gipson 1994).

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

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

Feral dogs are highly adaptable, social carnivores. Gipson (1983) suggested that family groups of feral dogs are more highly organized than previously believed. Pup-rearing may be shared by several members of a pack. Survival of pups born during autumn and winter has been documented, even in areas with harsh winter weather. Gipson found that only one female in a pack of feral dogs studied in Alaska gave birth during two years of study, even though other adult females were present in the pack. The breeding female gave birth during late September or early October during both years. It is noteworthy that all pups from both litters had similar color markings, suggesting that the pups had the same father. Adult males of different colors were present in the pack. Nesbitt (1975) commented on the rigid social organization of a pack of feral dogs where nonresident dogs were excluded, including females in estrus. In one instance, Nesbitt used three separate female dogs in estrus as bait (dogs were chained in the back of a corral-type

trap) over a 59-day period and captured no feral dogs. He then baited the same trap with carrion, and a pack of feral dogs, including four adult males, entered the trap within one week (Green and Gipson 1994).

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

Feral dogs can cause damage by preying on livestock, poultry, house cats, or domestic dogs. They may also feed on fruit crops including melons, berries, grapes, and native fruit. They may also attack people, especially children. This is especially true where they feed at and live around landfills near human dwellings (Green and Gipson 1994). In some locales, they may present a serious threat to deer (Lowry 1978) and other valuable wildlife (Green and Gipson 1994). WS provided technical assistance for three feral dog complaints related to human health and safety from FY 2005 to FY 2010. Most complaints regarding dogs are referred to local animal control agencies since requesters are usually unable to determine whether the dog is feral or a pet. A record is only generated when some kind of technical assistance is provided by WS as a result of the contact.

WS killed six feral dogs in North Carolina from FY 2005 through FY 2010 to alleviate damage or threats of damage. This number is insignificant to the total population of this species in the State. WS may be requested to address damage being caused by feral dogs anywhere in North Carolina to protect any resource being damaged or threatened. It is possible that WS could kill as many as 50 feral dogs each year in the State to alleviate damage when requested. Many of those dogs would be removed in projects aimed at protecting human health and safety, valuable wildlife or other natural resources, livestock, or other agriculture. Feral dogs are not viewed as furbearers in North Carolina.

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

Gray Squirrel Population Information and Effects Analysis

Eastern gray squirrels are variable in color with a distinct reddish cast to their gray coat. The black color phase is common in some northern parts of their range. Eastern gray squirrels measure 41 to 51 cm (16 to 20 inches). They weigh from 567 to 794 g (1 ¼ to 1 ¾ lbs) (National Audubon Society 2000).

Gray squirrels are found throughout most of the eastern United States, including North Carolina. They inhabit mixed hardwood forests, especially those containing nut trees such as oak/hickory mix. While this species are 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, berries, 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*b*).

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*b*). 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*b*). Home ranges of squirrels range from 1.2 to over 40 acres in size (Flyger and Gates 1982).

Gray squirrel populations periodically rise and fall, and during periods of high populations they may go on mass emigrations, during which time many animals die. 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*b*).

The current North Carolina squirrel hunting season runs for approximately 16 weeks from October to January (NCWRC 2011). Hunting pressure on squirrels has declined drastically in North Carolina since the 1960s. Hunting statistics in North Carolina combine the three squirrel species (gray, fox, and red). Since most squirrel hunting is for gray squirrels, the NCWRC interprets the totals as a slightly inflated representation of the gray squirrel harvest (J. Wooding, NCWRC, pers. comm. 2011). During the 1964-1965 seasons, 271,000 hunters spent 2.5 million days hunting squirrels, harvesting 3.5 million squirrels. In contrast, during the 2008-2009 season, 77,000 hunters spent 0.5 million days hunting squirrels, harvesting 0.6 million squirrels (J. Wooding, NCWRC, pers. comm. 2011). This represents an approximately 80% reduction in harvest. North Carolina is not alone in declining squirrel harvests as the trend has been observed nationally over the past 30 years, and it reflects a shift in hunting pressure from small game species such as squirrels to big game species such as deer and turkeys (Flather et al. 2009).

Gray squirrels remain abundant in North Carolina, and despite the drop in hunting pressure, they remain one of the most popular game animals in the State. They occur in a wide range of forested habitats, from eastern swamps to western mountain coves. In 2002, the most recent year forests were inventoried in North Carolina, the State contained 18 million acres of forested land (Brown 2004). The best quality forests for gray squirrels are hardwood dominated, rather than pine dominated. Hardwood forests covered 13 million acres in 2002 (Brown 2004).

Gray squirrel population size can be estimated using habitat quantities combined with squirrel density estimates. Biologists working in the Mid-Atlantic States have estimated squirrel densities in good habitat range from one squirrel per two acres to six squirrels per one acre (Burger 1969, Mosby 1969, Barkalow et al. 1970, Cordes and Barkalow 1972, Snyder 1972). A somewhat conservative approximation of those estimates is one squirrel per acre (J. Wooding, NCWRC, pers. comm. 2011).

At a density of one squirrel per acre, the hardwood forests of North Carolina could support approximately 13 million gray squirrels. About 1 million acres of hardwoods are in urban areas (United States Geological Survey 2006), and are not likely to be hunted. The remaining 12 million acres of habitat probably support most of the squirrel hunting in North Carolina, given that hunters tend to hunt where squirrels are most abundant. The 2008-2009 harvest of 0.6 million squirrels may represent about 5% of the gray squirrel population in hardwoods (J. Wooding, NCWRC, pers. comm. 2011).

Gray squirrel populations in North Carolina are not well documented. However, gray squirrel populations are generally considered stable to increasing, especially around urban areas (J. Wooding, NCWRC, pers. comm. 2011). Gray squirrel densities fluctuate based on available food sources but long-term densities

tend to be stable (Gurnell 1987). In continuous areas of woodlands in North Carolina, gray squirrel densities were typically less than 1.2 squirrels per acre. In urban parks, gray squirrel densities can be more than 8.4 squirrels per acre (Manski et al. 1981). Gray squirrels are considered a small game animal by the NCWRC in North Carolina with a regulated hunting season that allows an unlimited number of squirrels to be possessed during the length of the season. During the 2007-2008 hunting season, 567,431 squirrels were harvested in North Carolina (Pollock and Wen 2009) with a similar number harvested during the 2008-2009 harvest estimated at approximately 600,000 squirrels (J. Wooding, NCWRC, pers. comm. 2011), which represents the most current harvest data. Note that the total number of squirrels harvested is a combination of all three squirrel species (gray, fox, and red) in North Carolina. There is currently no harvest total that only represents gray squirrels.

WS has not previously received requests for direct operational assistance associated with gray squirrels. However, WS anticipates that requests for direct operational assistance could occur and based on those requests, WS may be requested to lethally remove squirrels when determined to be appropriate using the WS' Decision Model. In anticipation of receiving requests for assistance, WS could lethally remove up to 20 squirrels annually in the State to alleviate damage or threats of damage.

Take of up to 20 squirrels by WS would represent 0.003% of the approximate squirrel harvest during the 2008-2009 hunting season in the State. Although the actual number of gray squirrels harvested in the State is unknown, the proposed take of 20 gray squirrels by WS to alleviate damage is likely a small component of the actual harvest. The proposed take would be an even smaller percentage of the statewide population of gray squirrels. Take by WS would only occur when permitted by the NCWRC and only at levels permitted.

Woodchuck Population Information and Effects Analysis

The woodchuck, also known as the "*groundhog*," is a large rodent, often seen in pastures, meadows, and fields in North Carolina. They dig large burrows, generally eight to 12 inches at the opening, sometimes 5 feet deep and 30 feet long with more than one entrance to a spacious grass-filled chamber. Green vegetation such as grasses, clover, and alfalfa forms its diet; at times it 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 as a result of burrowing; gnaw electrical cables, and damage 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 (Chapman and Feldhamer 1982). The offspring breed at age one and live four to five years. Mammal species with high mortality rates, such as rodents (*i.e.*, woodchucks) and lagomorphs (*i.e.*, 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 life time. Woodchuck ranges in the United States extend throughout the East, northern Idaho, northeastern North Dakota, southeastern Nebraska, eastern Kansas, northeastern Oklahoma, and south to Virginia and Alabama.

Woodchuck populations in North Carolina are not monitored by the NCWRC or by WS. This species is classified as a wild animal in the State. Woodchucks can be harvested during a regulated trapping season and an open hunting season with no possession limits. A total of 72 woodchucks have been lethally removed by WS in the State to alleviate damage, which is an average of 12 woodchucks taken annually. Based on previous requests for assistance, up to 20 woodchucks could be removed by WS per year under the proposed action alternative.

Gas cartridges would be employed to fumigate woodchuck burrows in areas where damages are occurring. Gas cartridges act as a fumigant by producing carbon monoxide when ignited. The cartridges contain sodium nitrate which when burnt, produces carbon monoxide gas. The cartridges are placed inside active burrows at the entrance, the cartridge is ignited, and the entrance to the burrow is sealed with dirt which allows the burrow to fill with carbon monoxide. Carbon monoxide is a method of euthanasia considered conditionally acceptable by the American Veterinary Medical Association (AVMA) for free-ranging mammal species (AVMA 2007).

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 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 take of woodchucks would also occur using other methods, such as shooting, live traps, and body-gripping traps. However, the number of woodchucks lethally taken using gas cartridges and by other methods is not expected to exceed 20 woodchucks.

Woodchuck damage management activities 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 as a result of damage management activities conducted under the proposed action alternative aimed at reducing damage at a local site. Although population estimates and density information is currently unavailable to determine a population estimate, the limited take proposed by WS would not reach a magnitude where adverse effects would occur. The unlimited take and continuous open season for woodchucks provides an indication that densities are sufficient that overharvest is unlikely to occur.

River Otter Population Information and Effects Analysis

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

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

River otter population densities 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. However, the results of a Missouri study most likely represents similar conditions found in North Carolina (C. Olfenbuttel, NCWRC, pers. comm. 2011), which found one otter per 2.5 to 5.0 miles of linear waterways (Erickson et al. 1984). As was discussed previously, there are approximately 242,691

miles of streams in the State with an estimated 123,772 miles of perennial streams (American Rivers 2011). As was discussed previously, otter are closely associated with aquatic habitats where they forage and den along shorelines of rivers and streams. Using 123,772 miles of perennial streams in North Carolina and one otter per 5.0 miles of waterway would result in a statewide population estimated at 24,800 otter, which is likely close to the actual statewide population (C. Olfenbuttel, NCWRC, pers. comm. 2011).

River otter are considered a furbearing species in the State with annual trapping seasons which allow for an unlimited number of otter to be trapped during the length of the season. Between 2005 and 2010, a total of 12,650 river otter have been trapped in the State during the annual trapping season, which is an average of 2,109 otter per year. The highest harvest level occurred in 2006 when 3,675 otter were harvested in the State.

WS has also received requests for assistance to manage damage caused by otters in the State, primarily at aquaculture farms and fish hatcheries where otter consume fish and other natural resources. In addition, river otters are unintentionally lethally taken during other wildlife damage management activities, primarily damage associated with aquatic rodents. Between FY 2005 and FY 2010, WS has lethally removed a total of 211 river otters in the State, which is an average of 36 otter per year. Of those river otters removed by WS in the State, 188 otters were removed unintentionally during other wildlife damage management activities from FY 2006 through FY 2010. In addition, eight otters were live-captured and released unharmed. The highest level of take by WS occurred in FY 2010 when 58 river otters were lethally removed, including otters unintentionally lethally taken during other wildlife damage management activities. All otters lethally taken by WS during FY 2010 were taken unintentionally as non-targets.

Based on previous requests received by WS to alleviate damage or threats of damage associated with river otters, WS could lethally remove up to 35 otters annually in the State to alleviate damage. As was discussed previously, river otters are also likely to be lethally removed by WS as unintentional non-targets during other wildlife damage management activities. Based on non-target take occurring previously and to evaluate cumulative impacts on the river otter population, a total of up to 100 river otters could be removed by WS annually, including non-target take and take to alleviate damage.

A take of 100 otters by WS would represent 0.4% of a statewide population estimated at 24,800 otters. When combined with the annual harvest of otters in the State, the cumulative take would represent 8.9% of the estimated population based on the average number of otter harvested in the State from 2005 through 2010. Using the highest level of take of 3,675 otters that occurred in 2006, the cumulative take would represent 15.2% of the estimated population.

The unlimited take allowed by the NCWRC during the annual trapping season provides an indication that population densities of river otter in the State are sufficient to allow unlimited harvest and that overharvesting is not likely to occur. All take by WS would occur when permitted by the NCWRC and only at permitted levels; therefore, WS' take would be considered as part of management objects established by the NCWRC for river otter in the State.

Feral Swine Population Information and Effects Analysis

Feral swine, also known as "*wild pigs*," "*wild boars*," and "*feral hogs*," are medium-size hoofed mammals that look like domestic pigs and are all the same species. 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 up to 23 cm (9 inches) long. The 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 ft) in height and 1.32 to 1.82 m (4.5 to 6 ft). Males may attain a weight of 75 to 200 kg (165 to 440 lbs) while females may weigh 35 to 150 kg (7 to 330 lbs). Those animals mate any time of year, but peak breeding times usually occur in January-February and early summer. Litters sizes are usually three to 12 (National Audubon Society 2000). Given adequate nutrition, a wild pig population 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).

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. This species is found in variable habitat in much of the southern United States, including North Carolina. Populations are usually clustered and not widespread. Due to recent statute changes, wild boars are no longer classified as big game or as a game species in North Carolina. Feral swine are now classified as wild animals and are under the regulatory authority of NCWRC which allow feral swine to be harvested throughout the year with no limit on the number that can be harvested. The number of feral swine harvested in the State during the 2007-2008 seasons was 13,970 swine (Pollock and Wen 2009), which represents the most current harvest data for feral swine in the State.

Damage in areas supporting feral swine populations is sometimes a serious natural resource management concern for land managers. Substantial damage has occurred to natural resources, including destruction of fragile plant communities, killing and destruction of tree seedlings, and erosion of soils (Barrett and Birmingham 1994). Food sources for feral swine include acorns, hickory nuts, pecans, beech nuts, and a wide variety of vegetation, including roots, tubers, grasses, fruit, and berries. 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).

WS has lethally removed a total of 274 feral swine in the State from FY 2005 through FY 2010. The highest level of take by WS occurred in FY 2008 when 78 swine were lethally taken to alleviate damage. On average, a total of 46 feral swine have been lethally removed by WS in the State to alleviate damage. Based on previous requests for assistance, WS could lethally remove up to 200 feral swine annually in the State under the proposed action alternative.

Feral swine can be found statewide in North Carolina; however, the number of feral swine in the State is currently unknown. Feral swine are a non-native species in the State that often competes with native wildlife for resources, such as food and habitat. Based on the wide distribution of feral swine in the State and the limited take proposed by WS to alleviate damage, take of up to 200 feral swine by WS would be of low magnitude when feral swine are found nearly statewide and can be harvested throughout the year. Take of up to 200 feral swine would represent 1.4% of the number of feral swine harvested during the 2007-2008 season in the State and is likely to represent an even smaller percentage of the actual statewide population of feral swine.

Eastern Cottontail Population Information and Effects Analysis

There are nine species of cottontail rabbits in North America, north of Mexico. The eastern cottontail is the most abundant and widespread of all the species. The eastern cottontail is approximately 37 to 48 cm (15 to 19 inches) in length and weighs 0.9 to 1.8 kg (2 to 4 lbs). Males and females are basically the same size and color. 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. Rabbits are rarely found in dense forest or open grasslands, but fallow crop fields may provide suitable habitat. Within these habitats they spend their entire lives in an area of 10 acres or less. Occasionally they may move a mile or so from summer range to winter cover or to a new food supply. In suburban areas, rabbits are numerous and mobile enough to fill any "*empty*" habitat created when other rabbits are removed. Population densities vary with habitat quality, but one rabbit per 0.4 hectares (1 acre) is a reasonable average (Craven 1994). Rabbits live only 12 to 15 months, yet make the most of the time available reproductively. They can raise as many as six litters per year of one to nine young (usually four to six), having a gestation period of 28 to 32 days. If no young were lost, a single pair together with their offspring could produce 350,000 rabbits in five years (National Audubon Society 2000).

No population estimates were available for cottontail rabbits in North Carolina. Based on the land area of North Carolina, there were over 31.1 million acres of land in North Carolina. Using the assumption that 25% of the land area of the State has sufficient habitat to support rabbits, home ranges of rabbits do not overlap, and rabbit densities average one rabbit per acre, a statewide rabbit population could be estimated at over seven million rabbits. The population of rabbits within the State is likely higher than seven million rabbits given that rabbits occur at higher densities and can be found statewide. Therefore, the population estimated at seven million rabbits would be considered a minimum population estimate.

Rabbits can be harvested in the State during annual regulated hunting seasons. In 2008, Pollock and Wen (2009) estimated the number of rabbits harvested in the State at 382,407 rabbits. Studies show that even if hunters take 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).

Between FY 2005 and FY 2010, WS has employed lethal methods to take seven rabbits to alleviate damage to property. Most requests for assistance associated with cottontail rabbits are associated with airports. Although strike risks directly associated with rabbits at airports are minimal, the presence of rabbits in areas of operations at an airport can act as attractants for other wildlife species that can pose risks of aircraft strikes, such as raptors and predators.

Based on the number of airports that have requested assistance from WS previously, WS could lethally take up to 20 cottontail rabbits annually in the State to alleviate damage or threats of damage. If the population of cottontail rabbits remains at least stable in the State, WS' take of up 20 rabbits annually would represent a very small percentage of the minimum statewide population. Pollock and Wen (2009) estimated 382,407 rabbits were harvested during the 2007-2008 hunting seasons. If WS' estimated annual take of up to 20 rabbits is included with the average annual harvest of rabbits estimated at 382,407 rabbits, the cumulative take would represent a very small percentage of the minimum statewide population estimate. Damages and threats of damages associated with rabbits most often occur in urban areas and at airports within the State where hunting is restricted or not allowed. Therefore, WS' proposed take would not adversely affect the ability to harvest rabbits during the annual regulated hunting season in the State.

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). The black bear has a wide but patchy distribution in the United States with populations found primarily in areas of dense forest, swamps, and thickets. Black bears can be found throughout the Rockies and West Coast mountain ranges; the lower Mississippi Valley, Gulf Coast, and Florida; and the northern Great Lakes area, Appalachian Mountains, and Northeastern States. In those areas, bears can also be found in a variety of other habitats as they forage for food, including cropland, orchards, and forest plantations (USDA 1997). Bears are omnivorous and will feed on a variety of food

sources, including berries, fruits, nuts, and grasses. Although it comprises a small portion of their diet, bears will prey on wildlife and domestic livestock, including sheep, goats, and cattle. Bears can also cause damage to telephone poles and tree plantings through clawing activities, raid apiaries in search of honey, and rummage through human refuse.

This species is a compact, heavily structured mammal with relatively massive legs and feet. Adult male black bears 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 182 kg (100 to 400 lbs) and measure from 110 to 170 cm (45 to 67 inches) in total length. The normal color is black with a brownish muzzle and infrequently, a white V-shape across the chest (Novak et al. 1987). Black bears mate in June and July.

Female black bears reach reproductive maturity at approximately 3.5 years (Kohn 1982, Graber 1981). Following a seven to eight month gestation period, they may have one to five cubs (Rogers 1976, Alt 1981, Kolenosky and Strathearn 1987), although the typical litter size is two to three cubs. Juvenile black bear annual mortality ranges between 20% and 70%, with orphaned cubs having the highest mortality (Kolenosky and Strathearn 1987). Natural mortality in adult black bears is approximately 10% to 20% (Fraser et al. 1982). Densities of bears vary between 0.3 and 3.4 per mi^2, depending on habitat. Black bears in the wild can also live more than 25 years (Rogers 1976).

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 can be 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 bears will rip open bee trees to feed on honey, honeycomb, bees, and larvae. They will also tear apart rotting logs for grubs, beetles, crickets, and ants. The black bear's diet also includes small to medium-sized mammals or other vertebrates, and, on rare occasions, livestock such as cattle, sheep, and goats. Bears are often a problem around open dumps, and may become dangerous if they lose their fear of humans. Occasionally, people have been killed by black bears (National Audubon Society 2000). Habituated, food-conditioned bears pose the greatest threat to humans and such bears are usually found in association with campgrounds and sites where people regularly feed them (Herrero 1982, Herrero 1985, Kolenosky and Strathearn 1987). With the rise in the bear population and the human population, bears are more likely to live in close proximity to people. In North Carolina, black bears have also been seen at airports, parks and even shopping centers, possibly jeopardizing the safety of aircraft and human life. However, for all the incidents of human/bear interaction in recent years, conflict is rare and serious injury and death has not occurred in North Carolina.

In North America, black bear densities range from 0.1 to 1.3 bears per km^2, depending on region and habitat. Densities are greatest in highly diverse forests at a relatively early stage of development. In non-hunted and lightly hunted populations, the annual survival rate of adult female black bears is about 80 to 90%, while adult male survival is 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).

Black bear populations in North Carolina are stable to increasing, with populations in the eastern and western portions of the State (C. Olfenbuttel, NCWRC, pers. comm. 2011). The NCWRC estimates that there are 14,000 to 17,000 black bears in North Carolina (C. Olfenbuttel, NCWRC, pers. comm. 2011). Black bears are a protected big game species in North Carolina. The NCWRC is currently managing black bears with the objective of stabilizing populations in the coastal and mountain regions and limiting

the establishment of a bear population in the Piedmont region (C. Olfenbuttel, NCWRC, pers. comm. 2011).

Between FY 2005 and FY 2011, WS has lethally removed a total of two black bears in the State. During FY 2011, WS responded to two requests for assistance with black bears at airports. One request for assistance was received from airport authorities when a bear entered a building on airport property. Due to human safety concerns, WS was requested to euthanize the bear using a firearm. WS was also requested during FY 2011 to euthanize an injured bear at an airport after airport personnel shot the bear due to their concerns that the bear posed a risk to incoming and outgoing flights. After obtaining permission from the NCWRC, the injured bear was euthanized by WS. Multiple attempts were made to disperse the bears using non-lethal harassment techniques in both situations, but were unsuccessful. Any direct damage management actions by WS to address black bear damage in North Carolina, including any lethal take of bears, would be conducted only with permission from NCWRC and only for the purpose of meeting state wildlife resource management objectives. WS would be required to obtain permits from NCWRC for any activities involving the handling of bears. If permitted by the NCWRC, bears handled by WS would be euthanized to protect human safety or to address seriously injured bears. Based on those requests for assistance received during FY 2011, up to five black bears could be addressed by WS annually. Any lethal take of bears by WS would occur only after permission has been received from the NCWRC.

Based upon the above information, WS' limited lethal take of black bears would have no adverse impacts on overall black bear populations in the state. The NCWRC has determined that there is no evidence to suggest that human-mediated mortality resulting from damage management activities, including removal of bears by WS, would be detrimental to the survival of the black bear population in the State of North Carolina (C. Olfenbuttel, NCWRC, pers. comm. 2011).

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 will facilitate planning and execution at regional and state levels, and coordination of surveillance data for risk assessment. It will 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.[13]

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 blooding, tissue sample, fecal sample) and the subsequent release of live-captured mammals would not result in adverse effects since those mammals are released unharmed on site. In addition, sampling of sick, dying, or hunter harvested mammals would not result in the additive lethal take of mammals that would not have already occurred in the absence of a disease sampling program. Therefore, the sampling of mammals for diseases would not adversely affect the populations of any of the mammals addressed in this EA nor would result in any take of mammals that would not have already occurred in the absence of disease sampling (*e.g.*, hunter harvest).

[13]Data collected by organizations/agencies conducting research and monitoring will provide a broad species and geographic surveillance effort.

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, or take no action. However, those persons requesting assistance are likely 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 take mammals despite WS' lack of direct involvement in the management action. Therefore, under this alternative the number of mammals lethally taken would likely be similar to the other alternatives since take could occur through the issuance of a permit by the NCWRC, take of unregulated mammals species can occur without the need for a permit from the NCWRC, and take would continue to occur during the harvest season for those species. WS' participation in a management action would not be additive to an action that would occur in the absence of WS' participation.

With the oversight of the NCWRC, 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 NCWRC, private entities, and/or municipal authorities. If direct operational assistance is not available from WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal take, which could lead to real but unknown effects on other wildlife populations. People have resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (*e.g.*, White et al. 1989, USDA 1997, USFWS 2001, FDA 2003).

Alternative 3 – No Mammal Damage Management Conducted by WS

Under this alternative, WS would not conduct mammal damage management activities in the State. WS would have no direct involvement with any aspect of addressing damage caused by mammals and would provide no technical assistance. No take of mammals by WS would occur in the State. Mammals could continue to be lethally taken to resolve damage and/or threats occurring either through permits issued by the NCWRC, during the regulated hunting or trapping seasons, or in the case of non-regulated species, take can 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 impacts similar to the proposed action. Since mammals would still be taken under this alternative, the potential effects on the populations of those mammal species in the State would be similar among all the alternatives for this issue. Therefore, any actions to resolve damage or reduce threats associated with mammals could occur by other entities despite WS' lack of involvement under this alternative.

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

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

Alternative 1 - Continue the Current Adaptive Integrated Approach to Managing Mammal Damage (Proposed Action/No Action)

The potential for adverse effects to non-targets occurs from the employment of methods to address mammal damage. Under the proposed action, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The 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 are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse impacts to non-target 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 are not the primary reason the exclusion was erected; therefore, non-target species excluded from areas may potentially be adversely impacted if the area excluded is large enough. The use of auditory and visual dispersal methods used to reduce damage or threats caused by mammals are also likely to disperse non-targets in the immediate area the methods are 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 are expected to be temporary with target and non-target species often returning after the cessation of dispersal methods.

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

Non-lethal methods that use auditory and visual stimuli to reduce or prevent damage are intended to elicit fright responses in wildlife. When employing those methods to disperse or harass target species, any non-targets in the vicinity of those methods when employed are also likely dispersed from the area. Similarly, any exclusionary device constructed to prevent access by target species also could exclude access to non-target species. The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas where non-lethal methods are employed of both target and non-target species. Therefore, any use of non-lethal methods has similar results on both non-target and target species. Though non-lethal methods do not result in lethal take of non-targets, the use of non-lethal methods can restrict or prevent access of non-targets to beneficial resources. Non-lethal methods are not employed over large geographical areas or applied at such intensity that essential resources (*e.g.*, food sources, habitat) would be unavailable for extended durations or over a wide geographical scope that long-term

adverse effects would occur to a species' population. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife since individuals of those species are unharmed. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely impact populations since those methods are often temporary.

Only those repellents registered with the EPA pursuant to the FIFRA and the NCDA would be recommended and used by WS under this alternative. Therefore, the use and recommendation of repellents would not have negative impacts on non-target species when used according to label requirements. Most repellents for mammals pose a very low risk to non-targets when exposed to or when ingested.

Impacts to non-targets from the use of non-lethal methods would be similar to the use of non-lethal methods under any of the alternatives. Non-targets would generally be unharmed from the use of non-lethal methods under any of the alternatives since no lethal take would occur. Non-lethal methods would be available under all the alternatives analyzed. WS' involvement in the use of or recommendation of non-lethal methods would ensure non-target impacts are considered under WS' Decision Model. 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 would also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage. Lethal methods available for use to manage damage caused by mammals under this alternative would include live-capture followed by euthanasia, body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, and shooting. Available methods and the application of those methods to resolve mammal damage is further discussed in Appendix B.

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

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

Fumigants would be used in active burrows only, which would minimize risk to non-targets. Dolbeer et al. (1991) found a total of one cottontail rabbit and three mice (*Permyscus* sp.) in three of the 97 woodchuck burrows treated with gas cartridges during the late-summer. During 2,064 trap nights at 86 woodchuck burrow entrances targeting small mammals, Swihart and Picone (1995) captured 99 individuals of four small mammal species, which included short-tailed shrews, meadow voles (*Microtus pennsylvanicus*), meadow jumping mouse (*Zapus hudsonius*), and white-footed mice. Risks to non-targets can be minimized by treating only burrows that appear to be active (Dolbeer et al. 1991). There are no secondary poisoning risks involved with the use of gas cartridges as the gas produced dissipates into the atmosphere shortly after activation. Primary risks to non-targets would be minimized by treating only active, by covering entrances of burrows, and by following the pesticide label. Although non-targets could be present in burrows, even after WS' conducts site investigations, the risks are relatively low and unintentional take from the use of fumigants would be limited.

The unintentional take and capture of wildlife species during damage management activities conducted under the proposed action alternative would primarily be associated with the use of body-gripping traps and in some situations, with live-capture methods, such as foothold traps, cage traps, and cable restraints. The unintentional take of non-targets by WS from FY 2006 through FY 2010 is shown in Table 4.2. In total, WS has unintentionally lethally removed 258 non-targets during damage management activities conducted from FY 2006 through FY 2010. In addition, 944 non-targets have been live-captured and released unharmed during damage management activities from FY 2006 through FY 2010.

Table 4.2 – Non-target mammals captured by WS in North Carolina, FY 2006 – FY 2010

Species	Killed	Freed		Species	Killed	Freed
Bobcat	2	1		**Virginia Opossum**	2	692
Feral Cat	0	93		**Striped Skunk**	0	13
Feral Dog	0	17		**Woodchuck**	1	10
Coyote	3	1		**American Mink**	1	1
Gray Fox	1	35		**River Otter**	188	8
Red Fox	0	2		**Gray Squirrel**	0	8
Raccoon	57	54		**Eastern Cottontail**	3	9
				TOTAL	**258**	**944**

The species with the highest level of take were river otters which are primarily lethally taken during damage management activities targeting beaver (*Castor canadensis*). WS has lethally removed a total of 188 river otters as non-targets between FY 2006 and FY 2010 which is an average of 38 otter per year. Of those species lethally removed by WS as non-targets, all are also known to cause damage and could be addressed to alleviate damage or threats of damage by WS when requested under the proposed action alternative.

As shown in Table 4.2, most non-targets captured by WS during damage management activities are live-captured and subsequently released unharmed. The primary species live-captured are opossum, feral cats, raccoons, and gray fox. Non-targets released are primarily live-captured during activities targeting raccoons as part of the ORV program (USDA 2005*b*) addressed in Chapter 1 in which WS employs cage traps to live-capture raccoons for sampling. The ORV program and the post-baiting trapping program are further described in the EA addressing those activities (USDA 2005*b*). The capture and limited lethal take that could occur as part of the ORV program and trapping activities are further addressed in the ORV program EA (USDA 2005*b*), but non-targets captured and lethally taken as part of the ORV program are addressed in this EA to ensure a cumulative evaluation of potential effects on non-target populations from those activities that could be conducted under the proposed action alternative.

WS would monitor the take of non-target species to ensure program activities or methodologies used in mammal damage management do not adversely impact non-targets. Methods available to resolve and prevent mammal damage or threats when employed by trained, knowledgeable personnel are selective for target species. WS would report to the NCWRC any non-target take to ensure take by WS is considered as part of management objectives established. The potential impacts to non-targets are similar to the other alternatives and are considered to be minimal to non-existent.

As discussed previously, the use of non-lethal methods to address damage or threats are generally regarded as have no impact on a species' population since those individuals addressed using non-lethal methods are generally unharmed and no actual reduction in the number of individuals in a species' population occurs. Similarly, the live-capture and release of non-targets is generally regarding as having no adverse effects on a species' population since those individuals are released unharmed and no actual

reduction in the number of individuals in a population occurs. Therefore, the live-capture and subsequent releasing of non-targets during damage management activities conducted under the proposed action alternative would not result in declines in the number of individuals in a species' population.

The lethal take of non-targets could result in declines in the number of individuals in a population; however, as shown in Table 4.2, the lethal take of non-targets by WS during damage management activities occurs rarely. A total of 258 non-targets have been lethally taken by WS during damage management activities conducted from FY 2006 through FY 2010 which is an average of 52 non-targets lethally taken annually by WS. The non-targets taken previously by WS are representative of non-targets that could be lethally taken by WS under the proposed action alternative. Although additional species of non-targets could be lethally taken by WS, take of individuals from any species is not likely to increase substantively above the number of non-targets taken annually by WS during previous damage management activities. In addition, all of the species lethally taken or live-captured from FY 2006 through FY 2010 are also considered targets species in the EA and the level of take analyzed for each species under Issue 1 includes non-target take that could occur by WS. Therefore, the take of those species is evaluated cumulatively under Issue 1, including take that could occur when a species is considered a target or non-target. WS would continue to monitor activities, including non-target take to ensure the annual take of non-targets does not result in adverse effects to a species' population. All the species lethally taken previously except feral cats and feral dogs can be harvested in the State during annual harvest seasons.

While every precaution is 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 can result in the incidental take of unintended species. Those occurrences are rare and should not affect the overall populations of any species under the proposed action.

T&E Species Effects

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

Federally Listed Species - The current list of species designated as threatened and endangered in North Carolina as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix C contains the list of species currently listed in the State along with common and scientific names. Consultation with the USFWS under Section 7 of the ESA concerning potential impacts of WS' programmatic activities on T&E species was conducted as part of the development of WS' programmatic FEIS (USDA 1997). WS obtained a BO from the USFWS addressing WS' programmatic activities. For the full context of the BO, see Appendix F of WS' programmatic FEIS (USDA 1997).

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 (P. Benjamin, USFWS, pers. comm. 2012).

State Listed Species – The current list of State listed species as endangered or threatened by the State as determined by the NCWRC was obtained and reviewed during the development of the EA (see Appendix

D). Based on the review of species listed in the State, WS has determined that the proposed activities will not adversely affect those species currently listed by the State. The NCWRC has concurred with WS' determination for State listed species (R. Myers, NCWRC, pers. comm. 2011).

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 are employed, as recommended by WS and cooperating agencies, the potential impacts to non-targets are likely similar to the proposed action. If recommended methods and techniques are not followed or if other methods are employed that were not recommended, the potential impacts on non-target species, including T&E species is likely higher compared to the proposed action.

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

Those persons experiencing damage from mammals may implement methods and techniques based on the recommendations of WS. The potential for impacts would be based on the knowledge and skill of those persons implementing recommended methods. Potential impacts from providing only technical assistance could be greater than those described in the proposed action if those persons experiencing damage do not implement methods or techniques correctly. Incorrectly implemented methods or techniques recommended by WS could lead to an increase in non-target take.

If requestors are provided technical assistance but do not implement any of the recommended actions, the potential impacts to non-targets would be lower 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. Methods or techniques not implemented as recommended or used inappropriately would likely increase potential impacts to non-targets. 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 persons requesting assistance, lethal methods could be employed by those persons experiencing damage. Those persons requesting assistance are those likely to use lethal methods since a damage threshold has been met for that individual requestor that has 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 take of non-target wildlife than the proposed action. When those persons experiencing damage caused by wildlife reach a level where assistance does not adequately reduce damage or where no assistance is available, people have resorted to using chemical toxicants that are illegal for use on the intended target species that often results in loss of both target and

non-target wildlife (*e.g.*, USDA 1997, White et al. 1989, USFWS 2001, FDA 2003). The use of illegal toxicants by those persons frustrated with the lack of assistance or assistance that inadequately reduces damage to an acceptable level can often result in the indiscriminate take of wildlife species.

The ability to reduce negative impacts caused by mammals to wildlife species and their habitats, including T&E species, would be variable 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.

Alternative 3 – No Mammal Damage Management Conducted by WS

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

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

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

A common concern is the potential adverse effects 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 Approach to Managing Mammal Damage (Proposed Action/No Action)

The cooperator requesting assistance is made aware through a MOU, cooperative service agreement, or a similar document that those methods agreed upon could potentially be used on property owned or managed by the cooperator; thereby, making the cooperator aware of the use of those methods on property they own or manage to identify any risks to human safety associated with the use of those methods.

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

Lethal methods available under the proposed action would include the use of live-capture followed by euthanasia, body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, and shooting. 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 are restricted to use by WS only.

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

The use of live-capture traps have also been identified as a potential issue. Live-capture traps are typically set in situations where human activity is minimal to ensure public safety. Traps rarely cause serious injury and are triggered through direct activation of the device. Live-capture traps available for mammals are typically walk-in style traps where mammals enter but are unable to exit. Therefore, human safety concerns associated with live traps used to capture mammals require direct contact to cause bodily harm. Therefore, if left undisturbed, risks to human safety would be minimal. A formal risk assessment of live-capture methods determined risks to human safety associated with the use patterns of those methods was low (USDA 1997).

The use of restraining devices (*e.g.*, foot-hold traps) and body-gripping traps have also been identified as a potential issue. Restraining devices and body-gripping traps are typically set in situations where human activity is minimal to ensure public safety. Restraining devices and body-gripping traps rarely cause serious injury and are triggered through direct activation of the device. Therefore, human safety concerns associated with restraining devices and body-gripping traps used to capture wildlife, including mammals, require direct contact to cause bodily harm. Again, restraining devices are not located in high-use areas to ensure the safety of the public and pets. Signs warning of the use of those tools in the area are posted for public view at access points to increase awareness that those devices are being used and to avoid the area, especially pet owners.

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

Safety issues related to the misuse of firearms and the potential human hazards associated with firearms use are issues identified when employed to reduce damage and threats. To help ensure safe use and awareness, WS' employees who use firearms during official duties are required to attend an approved firearm safety training course and to remain certified for firearm use must attend a safety training course in accordance with WS Directive 2.615. As a condition of employment, WS' employees who carry and use firearms are subject to the Lautenberg Domestic Confiscation Law, which prohibits firearm

possession by anyone who has been convicted of a misdemeanor crime of domestic violence (18 USC § 922(g)(9)). A safety assessment based on site evaluations, coordination with cooperating and local agencies (if applicable), and consultation with cooperators would be conducted before firearms are deemed appropriate to alleviate or reduce damage and threats to human safety when conducting activities in the State. WS would work closely with cooperators requesting assistance to ensure all safety issues are considered before firearms are deemed appropriate for use. The use of all methods, including firearms, must be agreed upon with the cooperator to ensure the safe use of those methods. A risk assessment conducted during the development of WS' programmatic FEIS, determined the risks to human safety from the use of firearms was low based on the use profile of the method (USDA 1997).

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 are used to temporary handle and transport animals to lessen the distress of the animal from the experience and for the safety of handlers. Drug delivery to immobilize mammals is likely to occur on site with close monitoring of the animal to ensure proper care of the animal. Immobilizing drugs are fully reversible with a full recovery of sedated animals occurring. A list and description of immobilizing drugs available for use under the identified alternatives can be found in Appendix B and are further described in WS' programmatic FEIS (1997).

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

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

Drugs used in capturing, handling, and euthanizing wildlife for wildlife hazard management purposes include ketamine, a mixture of ketamine/xylazine, sodium pentobarbital, potassium chloride, and Beuthanasia-D. Meeting the requirements of the Animal Medicinal Drug Use Clarification Act (AMDUCA) should prevent any adverse impacts on human health with regard to this issue (see Appendix D). SOPs would include:

- All drug use in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS.
- As determined on a state-level basis by those veterinary authorities (as allowed by AMDUCA), wildlife hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Ear tagging or other marking of animals drugged and released to alert hunters and trappers that they should contact state officials before consuming the animal.
- Most animals administered drugs would be released well before controlled hunting/trapping seasons which would give the drug time to completely metabolize out of the animals' systems before they might be taken and consumed by humans. In some instances, animals collected for

control purposes would be euthanized when they are captured within a certain specified time period prior to the legal hunting or trapping season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems.

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

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 be directly used by WS under this alternative would also be available under any of the alternatives. Therefore, risks to human safety from the recommendation of repellents or the direct use of repellents would be similar across all the alternatives. Risks to human safety associated with the use or recommendation of repellents is addressed under the technical assistance only alternative (Alternative 2) and 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 are 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.

Additionally, a risk assessment concluded that no adverse effects were expected to human health and safety from the use of registered fumigants (*i.e.*, gas cartridges) that may be used to remove burrowing species addressed in this EA (USDA 1997). Gas cartridges are ignited and placed inside of burrows with the entrance covered by dirt which traps carbon monoxide inside the burrow. The carbon monoxide produced dissipates into the atmosphere and is diluted into the air (EPA 1991).

The recommendation by WS that mammals be harvested during the regulated hunting and/or trapping season which is established by the NCWRC 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 NCWRC for the regulated hunting and trapping season would further minimize risks associated with hunting and trapping. Although hunting and trapping accidents do occur, the recommendation of allowing hunting or trapping to reduce localized populations of mammals would not increase those risks.

No adverse effects to human safety have occurred from WS' use of methods to alleviate mammal damage in the State from FY 2005 through FY 2010. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, is considered low (USDA 1997).

As stated earlier, the cooperator requesting assistance would be made aware through a MOU, cooperative service agreement, or a similar document that those devices agreed upon could potentially be used on property owned or managed by the cooperator; thereby, making the cooperator aware of the use of those methods on property they own or manage to identify any risks to human safety associated with the use of those methods.

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

Under this alternative, WS would be restricted to making recommendations of methods and the demonstration of methods only to resolve damage. WS would only provide technical assistance to those persons requesting assistance with mammal damage and threats. Although hazards to human safety from non-lethal methods exist, those methods are generally regarded as safe when used by trained individuals

who are experienced in their use. Risks to human safety from the use of non-lethal methods were considered low when evaluated in a formal risk assessment in WS' programmatic FEIS (USDA 1997). 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 were considered low based on their use profile for alleviating damage associated with wildlife (USDA 1997). Although some risk of fire and bodily harm exists from the use of pyrotechnics and propane cannons, when used appropriately and in consideration of those risks, they can be used with a high degree of safety.

Under a technical assistance only alternative, the use of immobilizing drugs and euthanasia drugs would not be available to the general public. Personnel employing nets are present at the site during application to ensure the safety of the public and operators. Although some fire and explosive hazards exist with rocket nets during ignition and storage of the explosive charges, safety precautions associated with the use of the method, when adhered to, pose minimal risks to human safety and primarily occur to the handler. Nets would not be employed in areas where public activity is high which further reduces the risks to the general public. Nets would be employed in areas where public access is 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 also be available under this alternative. Chemical methods available would include repellents. There are few chemical repellents registered for use to manage mammal damage in the State. Most repellents require ingestion of the chemical to achieve the desired affects on target species. Repellents that require ingestion are intended to discourage foraging on vulnerable resources and to disperse mammals from areas where the repellents are applied. Repellents, when used according to label directions, are generally regarded as safe especially when the ingredients are considered naturally occurring. Some risk of exposure to the chemical occurs to the applicator and to others from the potential for drift as the product is applied. Some repellents also have restrictions on whether application can occur on edible plants with some restricting harvest for a designated period after application. All restriction on harvest and required personal protective equipment would be included on the label and if followed, would minimize risks to human safety associated with the use of those products.

The recommendation by WS that mammals be harvested during the regulated hunting and/or trapping season which is established by the NCWRC 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 mammal populations which could then reduce mammal damage or threats would not increase risks to human safety. Safety requirements established by the NCWRC for the regulated hunting and trapping season would further minimize risks associated with hunting. 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 either as a method of direct lethal take could occur under this alternative. Safety issues due 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 are minimal. If firearms are 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 are employed according to recommendations and as demonstrated by WS, the potential risks to human safety would be similar to the proposed action. If methods are 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.

Given the use profile of many methods to manage damage and threats associated with mammals, the risks to human safety from the use of those methods are low (USDA 1997). The cooperator requesting assistance is also made aware of threats to human safety associated with the use of those methods. SOPs for methods are discussed in Chapter 3 of this EA. Risks to human safety from activities and methods recommended under this alternative would be similar to the other alternatives since the same methods would be available. If misused or applied inappropriately, any of the methods available to alleviate mammal damage could threaten human safety. However, when used appropriately, methods available to alleviate damage would not threaten human safety.

Alternative 3 – No Mammal Damage Management Conducted by WS

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

Similar to the technical assistance only alternative, immobilizing drugs and euthanasia chemicals would not be available under this alternative to those persons experiencing damage or threats from mammals. Since most methods available to resolve or prevent mammal damage or threats are available to anyone, the threats to human safety from the use of those methods are similar between the alternatives. However, methods employed by those persons not experienced in the use of methods or are not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

Issue 4 - Effects on the Socio-cultural Elements and Economics of the Human Environment

Another concern often raised is the potential impact the proposed action would 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 Approach to Managing Mammal Damage (Proposed Action/No 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 are dispersed or removed, the ability of interested persons to observe and enjoy those mammals would likely temporarily decline.

Even the use of exclusionary devices can lead to the dispersal of wildlife if the resource being damaged was acting as an attractant. Thus, once the attractant has been removed or made unavailable, the wildlife would likely disperse to other areas where resources are 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 is 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 still remain if a reasonable effort is made to locate mammals outside the area in which damage management activities occurred. Those mammals removed by WS are those that could be removed by the person experiencing damage.

All activities are conducted where a request for assistance has been received and only after agreement for such services have been agreed upon by the cooperator. Some aesthetic value would be gained by the removal of mammals and the return of a more natural environment, including the return of native wildlife and plant species that may be suppressed or displaced by high mammal densities.

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

WS' take of mammals from FY 2005 through FY 2010 has been of low magnitude compared to the total mortality and populations of those species. WS' activities are not likely additive to the mammals that would be taken in the absence of WS' involvement. Although mammals removed by WS are no longer present for viewing or enjoying, those mammals would likely be taken by the property owner or manager if WS was not involved in the action since take by the property owner or manager could occur under a depredation permit, during the regulated hunting and trapping seasons, or if the mammals are unregulated, take could occur without the need for a permit. Given the limited take proposed by WS under this alternative when compared to the known sources of mortality of mammals, 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 is likely 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 mammal damage management activities in the absence of WS' involvement, then technical assistance provided by WS would not adversely affect the aesthetic value of mammals in the State similar to Alternative 1. Mammals could be lethally taken under this alternative by those entities experiencing mammal damage or threats which would result in localized reductions in the presence of mammals at the location where damage was occurring. The presence of mammals where damage was occurring would be reduced where damage management activities are conducted under any of the alternatives. Even the recommendation of non-lethal methods is likely to result in the dispersal of mammals from the area if those non-lethal methods recommended by WS are 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.

Alternative 3 – No Mammal Damage Management Conducted by WS

Under the no mammal damage management by WS alternative, the actions of WS would have no impact on the aesthetic value of mammals in the State. Those persons experiencing damage or threats from mammals would be responsible for researching, obtaining, and using all methods as permitted by federal, state, and local laws and regulations. Mammals would continue to be dispersed and lethally taken under this alternative in the State. Lethal take would continue to occur when permitted by the NCWRC through

the issuance of permits, take could occur during the regulated harvest season, and in the case of non-native species, take could occur any time without the need for a permit.

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

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

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

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

Alternative 1 - Continue the Current Adaptive Integrated Approach to Managing Mammal Damage (Proposed Action/No 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 which are generally regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, cage traps, foothold traps, nets, 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 is to use methods as humanely as possible to effectively resolve requests for assistance to reduce damage and threats to human safety. WS would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

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

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

Although some issues of humaneness could occur from the use of cage traps, foothold traps, 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 are from injuries to animals while 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 are to be live-captured by WS, WS' personnel would be present on-site during capture events or methods would be checked frequently to ensure mammals captured are addressed timely 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 resolve requests for assistance to resolve or prevent mammal damage and threats. Lethal methods would include live-capture followed by euthanasia, body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, and shooting. WS' use of euthanasia methods under the proposed action would follow those required by WS' directives (WS Directive 2.430) and recommended by the AVMA for use on free-ranging wildlife under field conditions (AVMA 2007).

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. Personnel from WS are experienced and professional in their use of management methods. Consequently, management methods are implemented in the most humane manner possible under the constraints of current technology. Most of those 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. Therefore, the issue of humanness associated with methods would be similar across any of the alternatives since those methods could be employed. 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 are used by WS as humanely as possible are listed in Chapter 3.

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

The issues of humaneness of methods under this alternative are likely to be perceived to be similar to humaneness issues discussed under the proposed action. This perceived similarity is derived from WS' recommendation of methods that some people may consider inhumane. WS would not directly be

involved with damage management activities under this alternative. However, the recommendation of the use of methods would likely result in the requester employing those methods. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to the proposed action.

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

Alternative 3 – No Mammal Damage Management Conducted by WS

Under this alternative, WS would have no involvement in any aspect of mammal damage management in North Carolina. Those persons experiencing damage or threats associated with mammals could continue to use those methods legally available. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the general 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 general public to use to resolve damage and threats caused by mammals.

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 NCWRC. Those species addressed in this EA that have established hunting and/or trapping seasons include: bobcats, coyotes, gray fox, red fox, raccoons, opossum, skunks, river otter, woodchucks, mink, feral swine, gray squirrels, Eastern cottontails, and black bears. For many mammal species considered harvestable during hunting and/or trapping season, the estimated number of mammals harvested during the season is reported by the NCWRC in published reports.

Alternative 1 - Continue the Current Adaptive Integrated Approach to Managing Mammal Damage (Proposed Action/No Action)

As addressed under Issue 1, the magnitude of take of mammals addressed in the proposed action would be low when compared to the mortality of those species from all known sources. When WS' proposed take of mammals was included as part of the known mortality of those species and compared to the estimated population, the impact on those species' populations was below the level of removal required to lower population levels.

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

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

WS would have no impact on regulated hunting and trapping since WS would not lethally remove mammals under this alternative. However, resource/property owners may remove mammals under depredation permits, during the regulated hunting seasons, and in the case of unregulated species, without the need for a permit resulting in impacts similar to the proposed action and the other alternatives. The recommendation of non-lethal methods could disperse or exclude mammals from areas under this alternative which could limit the ability of those persons interested to harvest those mammals in the damage management area. However, the recommendation of harassment techniques to disperse mammals could increase opportunities to harvest mammals by dispersing those mammals from areas where hunting is prohibited or restricted. However, the populations of those mammals species would be unaffected by WS under this alternative.

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 NCWRC would continue to regulate populations through adjustments of the allowed take during the regulated harvest season and the continued use of permits.

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such 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/or 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 mammal damage management activities at adjacent sites within the same time frame. In addition, commercial companies may conduct mammal damage management activities in the same area. The potential cumulative impacts analyzed below could occur either as a result of WS' damage management program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and private entities. Through ongoing coordination and collaboration between WS and the NCWRC, activities of each agency and the take of mammals would be available. Mammal damage management activities in the State would be monitored to evaluate and analyze activities to ensure they are 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 as a result of any of the proposed alternatives. Those alternatives would meet the requirements of applicable laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

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

Evaluation of activities relative to target species indicated that program activities would likely have no cumulative adverse effects on mammal populations when targeting those species responsible for damage. 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 are not limited to:

- Natural mortality of mammals
- 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 are constrained as to scope, duration, and intensity for the purpose of minimizing or avoiding impacts to the environment. WS uses the Decision Model to evaluate damage occurring, including other affected elements and the dynamics of the damaging species; to determine appropriate strategies to minimize effects on environmental elements; applies damage management actions; and subsequently monitors and adjusts/ceases damage management actions (Slate et al. 1992, USDA 1997). This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

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

WS' take of mammals in North Carolina from FY 2005 through FY 2010 was of a low magnitude when compared to the total known take and the populations of those species. The NCWRC considers all known take when determining population objectives for mammals and can adjust the number of mammals that can taken during the regulated harvest season and the number of mammals taken for damage management purposes to achieve the population objectives. Any take by WS would occur at the discretion of the NCWRC. Any mammal population declines or increases would be the collective objective for mammal populations established by the NCWRC through the regulation of take. Therefore, the cumulative take of mammals annually or over time by WS would occur at the desire of the NCWRC as part of management objectives for mammals in the State. No cumulative adverse impacts on target and non-target wildlife are expected from WS' mammal damage management actions based on the following considerations:

1. Historical outcomes of WS' damage management activities on wildlife

Mammal damage management activities are conducted by WS only at the request of a cooperator to reduce damage that is occurring or prevent damage from occurring and only after methods to be used are agreed upon by all parties involved. WS' monitors activities to ensure any potential impacts are identified and addressed. WS works closely with state and federal resource agencies to ensure damage management activities are not adversely impacting mammal populations and that WS' activities are considered as part of management goals established by those agencies. Historically, WS' activities to manage mammals in North Carolina have not reached a magnitude that would cause adverse impacts to mammal population in the State.

2. SOPs built into the WS program

SOPs are designed to reduce the potential negative effects of WS' actions on mammals, and are tailored to respond to changes in wildlife populations which could result from unforeseen environmental changes. This would include those changes occurring from sources other than WS. Alterations in programs are defined through SOPs and implementation is insured through monitoring, in accordance with the WS' Decision Model (Slate et al. 1992, USDA 1997).

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

Potential effects on non-target species from conducting mammal damage management arise from the use of non-lethal and lethal methods to alleviate or prevent those damages. The use of non-lethal methods during activities to reduce or prevent damage caused by mammals has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods are often temporary and often do not involve the take (killing) of non-target wildlife species. When using exclusion devices and/or repellents, both target and non-target wildlife can be prevented from accessing the resource being damaged. Since exclusion does not involve lethal take, cumulative impacts on non-target species from the use of exclusionary methods would not occur but would likely disperse those individuals to other areas. Exclusionary methods are often expensive and require constant maintenance to ensure effectiveness. Therefore, the use of exclusionary devices would be somewhat limited to small, high-value areas and not used to the extent that non-targets are excluded from large areas that would cumulatively impact populations from the inability to access a resource, such as potential food sources or escape cover. The use of visual and auditory harassment and dispersion methods are generally temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the take (killing) of non-target species and similar to exclusionary methods are not 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 impact non-target wildlife through the take (killing) or capture of non-target species. Capture methods used are often methods that are set to confine or restrain target wildlife after being triggered by a target individual. Capture methods are 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 are employed to confine or restrain wildlife that are subsequently euthanized using humane methods. With all live-capture devices, non-target wildlife captured could be released on site if determined to be able to survive following release. SOPs are intended to ensure take of non-target wildlife is minimal during the use of methods to capture target wildlife.

The use of firearms and euthanasia methods are essentially selective for target species since identification of an individual is made prior to the application of the method. Euthanasia methods are applied through direct application to target wildlife. Therefore, the use of those methods would not impact 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. The amount of chemicals used or stored by WS would be minimal to ensure human safety. Based on this information, WS' use of chemical methods, as part of the proposed action, would not have cumulative impacts on non-targets.

The methods described in Appendix B all have a high level of selectivity and can be employed using SOPs to ensure minimal impacts to non-targets species. A total of 258 non-target mammals were lethally taken by WS during all mammal damage management activities from FY 2006 through FY 2010, while 944 animals were live-captured and released unharmed. All of the species lethally taken as unintentional non-targets are also considered as target species in this EA. The cumulative take of those species, including target and non-target take were evaluated in Chapter 4 of this EA. Based on the methods available to resolve mammal damage and/or threats, WS does not anticipate the number of non-targets taken to reach a magnitude where declines in those species' populations would occur. Therefore, take under the proposed action of non-targets would not cumulatively impact non-target species. WS' has reviewed the T&E species listed by the NCWRC, the USFWS, and the National Marine Fisheries Services and has determined that mammal damage management activities proposed by WS would not likely adversely affect T&E species. Cumulative impacts would be minimal on non-targets from any of the alternatives discussed**.**

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

All non-chemical methods described in Appendix B are used within a limited time frame, are not residual, and do not possess properties capable of inducing cumulative adverse impacts on human health and safety. All non-chemical methods are used after careful consideration of the safety of those persons employing methods and to the public. All capture methods are employed where human activity is 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 are agreed upon by the requesting entities which are made aware of the safety issues of those methods when entering into a MOU, cooperative service agreement, or other comparable document between WS and the cooperating entity. SOPs also ensure the safety of the public from those methods used to capture or take wildlife. A formal risk assessment conducted by APHIS determined that WS' non-chemical methods, when used as intended, posed a low risk to human safety (USDA 1997). Firearms used to alleviate or prevent damage, though hazards do exist, are 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 safety of the applicator and to the public. Based on the use patterns of non-chemical methods, those methods would not cumulatively impact human safety.

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

Given the use patterns of repellents and fumigants, no cumulative adverse effects would occur to human safety (USDA 1997).

WS has received no reports or documented any adverse effects to human safety from WS' mammal damage management activities conducted from FY 2005 through FY 2010. No cumulative adverse effects from the use of those methods discussed in Appendix B are expected given the use patterns of those methods for resolving mammal damage in the State (USDA 1997).

Issue 4 - Effects on the Socio-cultural Elements and Economics of the Human Environment

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 are being adversely affected by the target species identified in this EA.

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

In the wild, few animals in the United States have life spans approaching that of humans. Mortality is high among wildlife populations and specific individuals among a species may experience death early in life. This is a natural occurrence and humans who form affectionate bonds with animals experience loss of those animals over time in most instances. A number of professionals in the field of psychology have studied human behavior in response to attachment to pet animals (Gerwolls and Labott 1994, Marks and Koepke 1994, Zasloff 1996, Archer 1999, Ross and Baron-Sorensen 1998, Meyers 2000). Similar observations are probably applicable to close bonds which 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 which die or are no longer accessible, they usually find a similar meaningfulness by establishing an association with new individual animals or through other relational activities (Weisman 1991). Through this process of coping with the loss and establishing new affectionate bonds, people may avoid compounding emotional effects resulting from such losses (Parkes 1979, Lefrancois 1999).

Some mammals with which humans have established affectionate bonds may be removed from some project sites by WS. However, other individuals of the same species would likely continue to be present in the affected area and people would tend to establish new bonds with those remaining animals. In addition, human behavior processes usually result in individuals ultimately returning to normalcy after experiencing the loss of association with a wild animal which might be removed from a specific location. Other activities that may impact human affection bonds on wildlife include those activities identified in Chapter 4. WS' activities are not expected to have any cumulative adverse effects on this element of the human environment.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

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

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

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

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

As discussed in this EA, the magnitude of WS' mammal take for damage management purposes from FY 2005 through FY 2010 was low when compared to the total take of mammals and when compared to the estimated statewide populations. Since all take of wild animals is regulated by the NCWRC, the take of wild animals by WS that would occur annually and cumulatively would occur pursuant to mammal population objectives established in the State. WS' take of mammals (combined take) annually to alleviate damage would be a minor component to the known take that occurs annually during the harvest seasons.

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

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APPENDIX A
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APPENDIX B
MAMMAL DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDATION

Resource owners and government agencies have used a variety of techniques to reduce mammal damage. However, all lethal and non-lethal methods developed to date have limitations based on costs, logistics, or effectiveness. Below is a discussion of methods that currently would be available to the WS program in North Carolina. Further discussion and the application of many of the methods available are further discussed in WS' programmatic FEIS (USDA 1997).

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, cable restraints). If WS personnel apply these methods on private lands, an *Agreement for Control on Private Property* must be signed by the landowner or administrator authorizing the use of each damage management method. Non-chemical methods used or recommended by WS include:

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

Cultural Methods and Habitat Management includes the application of practices which 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 raccoons.

Some mammals which cause damage in urban environments are attracted to homes by the presence of garbage or pet food left outside and unprotected. Removal or sealing of garbage in tight trash receptacles, and elimination of all pet foods from outside areas can reduce the presence of unwanted mammals. If raccoons are a problem, making trash and garbage unavailable, and removing all pet food from outside during nighttime hours can reduce their presence.

Lure crops/alternate foods are crops planted or other food resources provided to mitigate the potential loss of higher value crops

Animal behavior modification refers to tactics that deter or repel damaging mammals and thus, reduce damage to the protected resource. These 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, and the discharge of a firearm.

Live Capture and Translocation can be accomplished through the use of cage traps, cable restraints, and foothold traps to capture some species of mammals for the purpose of translocating them for release to wild sites. WS would not usually use this method to alleviate damage in North Carolina because the NCWRC prohibits relocation of rabies vector species and beaver in North Carolina. Live capture and handling of wild mammals poses an additional level of human health and safety threat if target animals are aggressive, large, or extremely sensitive to the close proximity of humans. For that reason, WS may limit this method to specific situations and certain species. Excessive populations may make this a poor wildlife management strategy for some 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. 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 in many cases be logistically impractical and biologically unwise in North Carolina, and is evaluated by WS on a case-by-case basis.

Trapping can utilize a number of devices, including foothold traps, cage-type traps, and body gripping (conibear) traps, foot snares, and neck/body snares. For a description of these methods the reader is referred to Appendix J in WS' programmatic FEIS (USDA 1997). These techniques are implemented by WS' personnel because of the technical training required to use such devices.

Foothold Traps can be effectively used to capture a variety of mammals. Foothold traps are either 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 foothold trap's selectivity. An additional advantage is that foothold traps can allow for the on-site release of non-target animals. The use of foothold traps requires more skill than some methods, but they are indispensable in resolving many damage problems.

Snares are capture devices comprised of a cable formed in a loop with a locking device and placed in travel ways. Most snares are also equipped with a swivel to minimize cable twisting and breakage. Snares are also easier than foothold traps to keep operational during periods of inclement weather. Snares set to catch an animal around the body or legs are usually a live-capture method. In North Carolina, snares are legal to use only on beaver. Otherwise, only the Collarum™-type trap is legal to use on mammals, and only on coyotes causing damage.

Cage traps are live capture traps used to trap a variety of small to medium sized mammals. Cage traps come in a variety of sizes and are made of galvanized wire mesh, and consist of a treadle in the middle of the cage that triggers the door to close behind the animal being trapped.

Body-grip (*e.g.*, Conibear-type) Traps are designed to cause the quick death of the animal that activates the trap. Placement is at burrow entrances created or used by the target species. The animal captured as it travels through the trap and activates the triggering mechanism. Safety

hazards and risks to humans are usually related to setting, placing, checking, or removing the traps.

Shooting is selective for target species and may involve the use of spotlights and either a handgun, shotgun or rifle. Shooting is an effective method to remove a small number of mammals in damage situations, especially where trapping is not feasible. Removal of specific animals in the problem area can sometimes provide immediate relief from a problem. Shooting is sometimes utilized as one of the first lethal damage management options because it offers the potential of resolving a problem more quickly and selectively than some other methods, but it is not always effective. Shooting may sometimes be one of the only damage management options available if other factors preclude setting of damage management equipment. WS' personnel receive firearms safety training to use firearms that are necessary for performing their duties.

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.

Chemical Wildlife Damage Management Methods

All pesticides used by WS are registered under the FIFRA and administered by the EPA and NCDA. All WS' personnel in North Carolina who apply restricted-use pesticides are certified pesticide applicators by the NCDA and have specific training by WS for pesticide application. The EPA and NCDA require pesticide applicators to adhere to all certification requirements set forth in the FIFRA. Pharmaceutical drugs, including those used in wildlife capture and handling, are administrated by FDA and/or the DEA.

No chemicals are used by WS on public or private lands without authorization from the land management agency or property owner or manager. The following chemical methods have been proven to be selective and effective in reducing damage by mammals.

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calms fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

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.

Telazol (tiletamine) is another anesthetic used in wildlife capture. It is 2.5 to 5 times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telazol produces extensive muscle tension in dogs, but produces

a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for those wild species (Fowler and Miller 1999). This drug is sold in a powder form and must be reconstituted with sterile water before use. Once mixed with sterile water, the shelf life is four days at room temperature and 14 days if refrigerated.

Sodium Pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are DEA restrictions on who can possess and administer this drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA and state regulations.

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 (Beaver et al. 2001). 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 DEA registration. However, Schedule III drugs are subject to the same security and record-keeping requirements as Schedule II drugs.

CO_2 is sometimes used to euthanize mammals which 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 also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

Repellents are usually naturally occurring substances or chemicals formulated to be distasteful or to elicit pain or discomfort for target animals when they are smelled, tasted, or contacted. Only a few repellents are commercially available for mammals, and are registered for only a few species. Repellents are not available for many species which may present damage problems, such as some predators or furbearing species. Repellents are variably effective and depend to a great extent on resource to be protected, time and length of application, and sensitivity of the species causing damage. Again, acceptable levels of damage control are usually not realized unless repellents are used in conjunction with other techniques.

The **Gas Cartridge** is registered as a fumigant by the EPA (Reg. No. 56228-21). 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 den. Carbon monoxide euthanasia is recognized by the AVMA as an approved and humane method to kill animals (Beaver et al. 2001).

> ***Sodium nitrate*** is the principle active chemical in gas cartridges, 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). Burning sodium nitrate however, 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). The gas along with other components of the cartridge, are likely to form oxides of nitrogen, carbon, phosphorus, and sulfur. These products are environmentally non-persistent because they are likely to be metabolized by soil microorganisms or 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 are 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). No gas residues remain at the treatment site where either formulation is used, for any period of time (USDA 1997).

APPENDIX C
THREATENED AND ENDANGERED SPECIES IN NORTH CAROLINA

Federal Listed Threatened And Endangered Species In North Carolina

Taxa	Common Name	Species	Status in NC
Arachnids	Spruce-fir moss spider	*Microhexura montivaga*	E
Birds	Bachman's warbler	*Vermivora bachmanii*	E*
	Eskimo curlew	*Numenius borealis*	E*
	Ivory-billed woodpecker	*Campephilus principalis*	E*
	Kirtland's warbler	*Dendroica kirtlandii*	E*
	Piping plover (Atlantic)	*Charadrius melodus*	T
	Red-cockaded woodpecker	*Picoides borealis*	E
	Roseate tern	*Sterna dougallii dougallii*	E
	Cahow	*Pterodroma cahaw*	E
	Wood stork	*Mycteria Americana*	E
	Cape Fear shiner	*Notropis mekistocholas*	E
Fishes	Shortnose sturgeon	*Acipenser brevirostrum*	E
	Spotfin chub	*Cyprinella monacha*	T
	Waccamaw silverside	*Menidia extensa*	T
	Smalltooth sawfish	*Pristis pectinata*	E
	Roanoke logperch	*Percina rex*	E
Insects	American burying beetle	*Nicrophorus americanus*	E*
	Saint Francis' satyr butterfly	*Neonympha mitchellii francisci*	E
Mammals	Carolina northern flying squirrel	*Glaucomys sabrinus coloratus*	E
	Eastern cougar	*Puma (=Felis) concolor couguar*	E*
	Finback whale	*Balaenoptera physalus*	E
	Gray bat	*Myotis grisescens*	E
	Gray wolf	*Canis lupus*	E*
	Humpback whale	*Megaptera novaeangliae*	E
	Indiana bat	*Myotis sodalis*	E
	Red wolf	*Canis rufus*	E
	Right whale	*Balaena glacialis*	E
	Sei whale	*Balaenoptera borealis*	E
	Sperm whale	*Physeter catodon*	E
	Virginia big-eared bat	*Corynorhinus (=Plecotus) townsendii virginianus*	E
	West Indian manatee	*Trichechus manatus*	E
Mussels	Appalachian elktoe	*Alasmidonta raveneliana*	E
	Carolina heelsplitter	*Lasmigona decorata*	E
	Cumberland bean	*Villosa trabalis*	E*
	Dwarf wedgemussel	*Alasmidonta heterodon*	E
	Littlewing pearlymussel	*Pegias fabula*	E
	James spiny mussel	*Pleurobema collina*	E
	Tan riffleshell	*Epioblasma florentina walker*	E
	Tar spinymussel	*Elliptio steinstansana*	E

E: endangered T: threatened E*: believed extirpated from North Carolina S/A: federally protected due to similarity of appearance
Printed August 2010

Taxa	Common Name	Species	Status in NC
Plants	American chaffseed	*Schwalbea Americana*	E
	Blue Ridge goldenrod	*Solidago spithamaea*	T
	Bunched arrowhead	*Sagittaria fasciculata*	E
	Canby's dropwort	*Oxypolis canbyi*	E
	Cooley's meadowrue	*Thalictrum cooleyi*	E
	Dwarf-flowered heartleaf	*Hexastylis naniflora*	T
	Golden sedge	*Carex lutea*	E
	Green pitcher plant	*Sarracenia oreophila*	E
	Harperella	*Ptilimnium nodosum*	E
	Heller's blazing star	*Liatris helleri*	T
	Michaux's sumac	*Rhus michauxii*	E
	Mountain golden heather	*Hudsonia montana*	T
	Mountain sweet pitcher plant	*Sarracenia rubra* ssp. *jonesii*	E
	Pondberry	*Lindera melissifolia*	E
	Roan Mountain bluet	*Hedyotis purpurea* var. *Montana*	E
	Rock gnome lichen	*Gymnoderma lineare*	E
	Rough-leaved loosestrife	*Lysimachia asperulaefolia*	E
	Schweinitz's sunflower	*Helianthus schweinitzii*	E
	Seabeach amaranth	*Amaranthus pumilus*	T
	Sensitive joint-vetch	*Aeschynomene virginica*	T
	Small-anthered bittercress	*Cardamine micranthera*	E
	Small whorled pogonia	*Isotria medeoloides*	T
	Smooth coneflower	*Echinacea laevigata*	E
	Spreading avens	*Geum radiatum*	E
	Swamp pink	*Helonias bullata*	T
	Virginia spiraea	*Spiraea virginiana*	T
	White irisette	*Sisyrinchium dichotomum*	E
Reptiles	American alligator	*Alligator mississippiensis*	T(S/A)
	Bog turtle	*Clemmys muhlenbergii*	T(S/A)
	Green sea turtle	*Chelonia mydas*	T
	Hawksbill sea turtle	*Eretmochelys imbricata*	E
	Kemp's (=Atlantic) Ridley sea turtle	*Lepidochelys kempii*	E*****
	Leatherback sea turtle	*Dermochelys coriacea*	E
	Loggerhead sea turtle	*Caretta caretta*	T
Snails	Noonday globe (snail)	*Petera (Mesodon) clarki nantahala*	T

PROTECTED WILDLIFE SPECIES OF NORTH CAROLINA

15A NCAC 10I .0103 ENDANGERED SPECIES LISTED

(a) The following species of resident wildlife are designated as federally-listed endangered species:

(1) Amphibians:
None Listed At This Time.

(2) Birds:
(A) Bachman's warbler (Vermivora bachmanii);
(B) Ivory-billed woodpecker (Campephilus principalis);
(C) Kirtland's warbler (Dendroica kirtlandii);
(D) Piping plover (Charadrius melodus circumcinctus);
(E) Red-cockaded woodpecker (Picoides borealis);
(F) Roseate tern (Sterna dougallii dougallii);
(G) Wood stork (Mycteria americana).

(3) Crustacea: None Listed At This Time.

(4) Fish:
(A) Cape Fear shiner (Notropis mekistocholas);
(B) Roanoke logperch (Percina rex);
(C) Shortnose sturgeon (Acipenser brevirostrum), when found in inland fishing waters.

(5) Mammals:
(A) Carolina northern flying squirrel (Glaucomys sabrinus coloratus);
(B) Eastern cougar (Puma concolor);
(C) Gray bat (Myotis grisescens);
(D) Indiana bat (Myotis sodalis);
(E) Manatee (Trichechus manatus), when found in inland fishing waters;
(F) Virginia big-eared bat (Corynorhinus townsendii virginianus).

(6) Mollusks:
(A) Appalachian elktoe (Alasmidonta raveneliana);
(B) Carolina heelsplitter (Lasmigona decorata);
(C) Dwarf wedge mussel (Alasmidonta heterodon);
(D) James spinymussel (Pleurobema collina);
(E) Little-wing pearlymussel (Pegias fabula);
(F) Tan riffleshell (Epioblasma florentina walkeri);
(G) Tar River spinymussel (Elliptio steinstansana).

(7) Reptiles:
(A) Kemp's ridley seaturtle (Lepidochelys kempii);
(B) Atlantic hawksbill seaturtle (Eretmochelys imbricata imbricata);
(C) Leatherback seaturtle (Dermochelys coriacea).

(b) The following species of resident wildlife are designated as state-listed endangered species:

(1) Amphibians: Green salamander (Aneides aeneus).

(2) Birds:
(A) American peregrine falcon (Falco peregrinus anatum);
(B) Bewick's wren (Thryomanes bewickii).

(3) Crustacea: Bennett's Mill cave water slater (Caecidotea carolinensis).

(4) Fish:
(A) Blotchside logperch (Percina burtoni);
(B) Bridle shiner (Notropis bifrenatus);
(C) Dusky darter (Percina sciera);
(D) Orangefin madtom (Noturus gilberti);
(E) Paddlefish (Polyodon spathula);
(F) Robust redhorse (Moxostoma robustum);
(G) Rustyside sucker (Thoburnia hamiltoni);
(H) Stonecat (Noturus flavus).

(5) Mammals: None Listed At This Time.

(6) Mollusks:
(A) Atlantic pigtoe (Fusconaia masoni);

(B) Barrel floater (Anodonta couperiana);
(C) Brook floater (Alasmidonta varicosa);
(D) Carolina creekshell (Villosa vaughaniana);
(E) Fragile glyph (Glyphyalinia clingmani);
(F) Green floater (Lasmigona subviridis);
(G) Greenfield rams-horn (Helisoma eucosmium)
(H) Knotty elimia (Elimia christyi);
(I) Magnificent rams-horn (Planorbella magnifica);
(J) Neuse spike (Elliptio judithae);
(K) Purple wartyback (Cyclonaias tuberculata);
(L) Savannah lilliput (Toxolasma pullus);
(M) Slippershell mussel (Alasmidonta viridis);
(N) Tennessee clubshell (Pleurobema oviforme);
(O) Tennessee heelsplitter (Lasmigona holstonia);
(P) Tennessee pigtoe (Fusconaia barnesiana);
(Q) Yellow lampmussel (Lampsilis cariosa);
(R) Yellow lance (Elliptio lanceolata).

(7) Reptiles:
(A) Eastern coral snake (Micrurus fulvius fulvius);
(B) Eastern diamondback rattlesnake (Crotalus adamanteus).

History Note: *Authority G.S. 113-134; 113-291.2; 113-292; 113-333;*
Eff. June 11, 1977;
Amended Eff. May 1, 2008; April 1, 2001; February 1, 1994; November 1, 1991; April 1, 1991; June 1, 1990.

15A NCAC 10I .0104 THREATENED SPECIES LISTED

(a) The following species of resident wildlife are designated as federally-listed threatened species:
(1) Amphibians: None Listed At This Time.
(2) Birds: Piping plover (Charadrius melodus melodus).
(3) Crustacea: None Listed At This Time.
(4) Fish:
(A) Spotfin chub (Cyprinella monacha);
(B) Waccamaw silverside (Menidia extensa).
(5) Mammals: None Listed At This Time.
(6) Mollusks: Noonday globe (Patera clarki nantahala).
(7) Reptiles:
(A) Bog turtle (Glyptemys muhlenbergii);
(B) American alligator (Alligator mississipiensis);
(C) Green seaturtle (Chelonia mydas);
(D) Loggerhead seaturtle (Caretta caretta).

(b) The following species of resident wildlife are designated as state-listed threatened species:
(1) Amphibians:
(A) Carolina gopher frog (Rana capito capito);
(B) Eastern tiger salamander (Ambystoma tigrinum tigrinum);
(C) Junaluska salamander (Eurycea junaluska);
(D) Wehrle's salamander (Plethodon wehrlei).
(2) Birds:
(A) Bald eagle (Haliaeetus leucocephalus)
(B) Gull-billed tern (Sterna nilotica aranea);
(C) Northern saw-whet owl (Aegolius acadicus).
(3) Crustacea: None Listed At This Time.
(4) Fish:
(A) American brook lamprey (Lampetra appendix);
(B) Banded sculpin (Cottus carolinae);
(C) Bigeye jumprock (Scartomyzon ariommus);

(D) Blackbanded darter (Percina nigrofasciata);
(E) Carolina madtom (Noturus furiosus);
(F) Carolina pygmy sunfish (Elassoma boehlkei);
(G) Carolina redhorse (Moxostoma sp.) (Pee Dee River and its tributaries and Cape Fear River and its tributaries);
(H) Least brook lamprey (Lampetra aepyptera);
(I) Logperch (Percina caprodes);
(J) Rosyface chub (Hybopsis rubrifrons);
(K) Sharphead darter (Etheostoma acuticeps);
(L) Sicklefin redhorse (Moxostoma sp.) (Hiwassee River and its tributaries and Little Tennessee River and its tributaries);
(M) Turquoise darter (Etheostoma inscriptum);
(N) Waccamaw darter (Etheostoma perlongum).

(5) Mammals:
(A) Eastern woodrat (Neotoma floridana floridana);
(B) Rafinesque's big-eared bat (Corynorhinus rafinesquii rafinesquii).

(6) Mollusks:
(A) Alewife floater (Anodonta implicata);
(B) Big-tooth covert (Fumonelix jonesiana);
(C) Cape Fear threetooth (Triodopsis soelneri);
(D) Carolina fatmucket (Lampsilis radiata conspicua);
(E) Clingman covert (Fumonelix wheatleyi clingmanicus);
(F) Eastern lampmussel (Lampsilis radiata radiata);
(G) Eastern pondmussel (Ligumia nasuta);
(H) Engraved covert (Fumonelix orestes);
(I) Mountain creekshell (Villosa vanuxemensis);
(J) Roan supercoil (Paravitrea varidens);
(K) Roanoke slabshell (Elliptio roanokensis);
(L) Sculpted supercoil (Paravitrea ternaria);
(M) Seep mudalia (Leptoxis dilatata);
(N) Smoky Mountain covert (Inflectarius ferrissi);
(O) Squawfoot (Strophitus undulatus);
(P) Tidewater mucket (Leptodea ochracea);
(Q) Triangle floater (Alasmidonta undulata);
(R) Waccamaw ambersnail (Catinella waccamawensis);
(S) Waccamaw fatmucket (Lampsilis fullerkati);
(T) Waccamaw spike (Elliptio waccamawensis).

(7) Reptiles: None Listed At This Time.

History Note: *Authority G.S. 113-134; 113-291.2; 113-292; 113-333;*
Eff. March 17, 1978;
Amended Eff. June 1, 2008; April 1, 2001; November 1, 1991; April 1, 1991; June 1, 1990; September 1, 1989.

15A NCAC 10I .0105 SPECIAL CONCERN SPECIES LISTED

The following species of resident wildlife are designated as state-listed special concern species:

(1) Amphibians:
(a) Crevice salamander (Plethodon longicrus);
(b) Dwarf salamander (Eurycea quadridigitata);
(c) Eastern hellbender (Cryptobranchus alleganiensis alleganiensis);
(d) Four-toed salamander (Hemidactylium scutatum);
(e) Longtail salamander (Eurycea longicauda longicauda);
(f) Mole salamander (Ambystoma talpoideum);
(g) Mountain chorus frog (Pseudacris brachyphona);
(h) Mudpuppy (Necturus maculosus);
(i) Neuse River waterdog (Necturus lewisi);

(j) River frog (Rana heckscheri);
(k) Southern zigzag salamander (Plethodon ventralis);
(l) Weller's salamander (Plethodon welleri).

(2) Birds:
(a) American oystercatcher (Haematopus palliatus);
(b) Bachman's sparrow (Aimophila aestivalis);
(c) Black-capped chickadee (Poecile atricapillus);
(d) Black rail (Laterallus jamaicensis);
(e) Black skimmer (Rynchops niger);
(f) Brown creeper (Certhia americana nigrescens);
(g) Cerulean warbler (Dendroica cerulea);
(h) Common tern (Sterna hirundo);
(i) Glossy ibis (Plegadis falcinellus);
(j) Golden-winged warbler (Vermivora chrysoptera);
(k) Henslow's sparrow (Ammodramus henslowii);
(l) Least bittern (Ixobrychus exilis);
(m) Least tern (Sterna antillarum);
(n) Little blue heron (Egretta caerulea);
(o) Loggerhead shrike (Lanius ludovicianus);
(p) Olive-sided flycatcher (Contopus cooperi);
(q) Painted bunting (Passerina ciris);
(r) Red crossbill (Loxia curvirostra);
(s) Snowy egret (Egretta thula);
(t) Tricolored heron (Egretta tricolor);
(u) Vesper sparrow (Pooecetes gramineus);
(v) Wilson's plover (Charadrius wilsonia);
(w) Yellow-bellied sapsucker (Sphyrapicus varius appalachiensis).

(3) Crustacea:
(a) Broad River spiny crayfish (Cambarus spicatus);
(b) Carolina skistodiaptomus (Skistodiaptomus carolinensis);
(c) Carolina well diacyclops (Diacyclops jeannelli putei);
(d) Chowanoke crayfish (Orconectes virginiensis);
(e) Graceful clam shrimp (Lynceus gracilicornis);
(f) Greensboro burrowing crayfish (Cambarus catagius);
(g) Hiwassee headwaters crayfish (Cambarus parrishi);
(h) Little Tennessee River crayfish (Cambarus North Carolinae);
(i) North Carolina spiny crayfish (Orconectes carolinensis);
(j) Oconee stream crayfish (Cambarus chaugaensis);
(k) Waccamaw crayfish (Procambarus braswelli).

(4) Fish:
(a) Atlantic sturgeon (Acipenser oxyrinchus);
(b) Bluefin killifish (Lucania goodei);
(c) Blue Ridge sculpin (Cottus caeruleomentum);
(d) Blueside darter (Etheostoma jessiae);
(e) Broadtail madtom (Noturus sp.) (Lumber River and its tributaries and Cape Fear River and its tributaries);
(f) Carolina darter (Etheostoma collis);
(g) Cutlip minnow (Exoglossum maxillingua);
(h) Freshwater drum (Aplodinotus grunniens) (French Broad River);
(i) Highfin carpsucker (Carpiodes velifer) (Cape Fear River and its tributaries);
(j) Kanawha minnow (Phenacobius teretulus);
(k) Lake sturgeon (Acipenser fulvescens);
(l) Least killifish (Heterandria formosa);
(m) Longhead darter (Percina macrocephala);
(n) Mooneye (Hiodon tergisus);
(o) Mountain madtom (Noturus eleutherus);

(p) Olive darter (Percina squamata);
(q) Pinewoods darter (Etheostoma mariae);
(r) River carpsucker (Carpiodes carpio);
(s) Riverweed darter (Etheostoma podostemone);
(t) Sandhills chub (Semotilus lumbee);
(u) Sharpnose darter (Percina oxyrhynchus);
(v) Smoky dace (Clinostomus sp.) (Little Tennessee River and tributaries);
(w) Striped shiner (Luxilus chrysocephalus);
(x) Tennessee snubnose darter (Etheostoma simoterum);
(y) Thinlip chub (Cyprinella zanema) (Lumber River and its tributaries and Cape Fear River and its tributaries);
(z) Waccamaw killifish (Fundulus waccamensis);
(aa) Wounded darter (Etheostoma vulneratum);
(bb) Yellowfin shiner (Notropis lutipinnis) (Savannah River and its tributaries);

(5) Mammals:
(a) Allegheny woodrat (Neotoma magister);
(b) Buxton Woods white-footed mouse (Peromyscus leucopus buxtoni);
(c) Coleman's oldfield mouse (Peromyscus polionotus colemani);
(d) Eastern big-eared bat (Corynorhinus rafinesquii macrotis);
(e) Eastern small-footed bat (Myotis leibii leibii);
(f) Elk (Cervus elaphus);
(g) Florida yellow bat (Lasiurus intermedius floridanus);
(h) Pungo white-footed mouse (Peromyscus leucopus easti);
(i) Southeastern bat (Myotis austroriparius);
(j) Southern rock shrew (Sorex dispar blitchi);
(k) Southern rock vole (Microtus chrotorrhinus carolinensis);
(l) Southern water shrew (Sorex palustris punctulatus);
(m) Star-nosed mole (Condylura cristata parva).

(6) Mollusks:
(a) Appalachian gloss (Zonitoides patuloides);
(b) Bidentate dome (Ventridens coelaxis);
(c) Black mantleslug (Pallifera hemphilli);
(d) Blackwater ancylid (Ferrissia hendersoni);
(e) Blue-foot lancetooth (Haplotrema kendeighi);
(f) Cape Fear spike (Elliptio marsupiobesa);
(g) Dark glyph (Glyphyalinia junaluskana);
(h) Dwarf proud globe (Patera clarki clarki);
(i) Dwarf threetooth (Triodopsis fulciden);
(j) Fringed coil (Helicodiscus fimbriatus);
(k) Glossy supercoil (Paravitrea placentula);
(l) Great Smoky slitmouth (Stenotrema depilatum);
(m) High mountain supercoil (Paravitrea andrewsae);
(n) Honey glyph (Glyphyalinia vanattai);
(o) Lamellate supercoil (Paravitrea lamellidens);
(p) Mirey Ridge supercoil (Paravitrea clappi);
(q) Notched rainbow (Villosa constricta);
(r) Open supercoil (Paravitrea umbilicaris);
(s) Pink glyph (Glyphyalinia pentadelphia);
(t) Pod lance (Elliptio folliculata);
(u) Queen crater (Appalachina chilhoweensis);
(v) Rainbow (Villosa iris);
(w) Ramp Cove supercoil (Paravitrea lacteodens);
(x) Saw-tooth disc (Discus bryanti);
(y) Spike (Elliptio dilatata);
(z) Spiral coil (Helicodiscus bonamicus);
(aa) Velvet covert (Inflectarius subpalliatus);

(bb) Waccamaw amnicola (Amnicola sp.);
(cc) Waccamaw lampmussel (Lampsilis crocata);
(dd) Waccamaw siltsnail (Cincinnatia sp.);
(ee) Wavy-rayed lampmussel (Lampsilis fasciola).

(7) Reptiles:
(a) Carolina pigmy rattlesnake (Sistrurus miliarius miliarius);
(b) Carolina watersnake (Nerodia sipedon williamengelsi);
(c) Diamondback terrapin (Malaclemys terrapin);
(d) Eastern smooth green snake (Opheodrys vernalis vernalis);
(e) Eastern spiny softshell (Apalone spinifera spinifera);
(f) Mimic glass lizard (Ophisaurus mimicus);
(g) Northern pine snake (Pituophis melanoleucus melanoleucus);
(h) Outer Banks kingsnake (Lampropeltis getula sticticeps);
(i) Southern hognose snake (Heterodon simus);
(j) Stripeneck musk turtle (Sternotherus minor peltifer);
(k) Timber rattlesnake (Crotalus horridus).

History Note: *Authority G.S. 113-134; 113-291.2; 113-292; 113-333;*
Eff. September 1, 1989;
Amended Eff. May 1, 2008; July 18, 2002; April 1, 2001; November 1, 1991; April 1, 1991; June 1, 1990.

APPENDIX D
AUTHORITY AND COMPLIANCE

I. AUTHORITIES

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

WS' Legislative Authorities

The primary statutory authorities for WS' program are the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 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 to manage wildlife damage management.

North Carolina Wildlife Resources Commission

The NCWRC was established by Article 24 of Chapter 143 of the General Statutes and Part 3 of Article 7 of Chapter 143B of the General Statutes. (1965, c. 957, s. 2; 1973, c. 1262, s. 28; 1977, c. 512, s. 5; c. 771, s. 4; 1979, c. 388, s. 1; c. 830, s. 1; 1987, c. 641, s. 4; 1989, c. 727, s. 218(57); 1997-443, s. 11A.119(a); 1998-225, s. 1.1.). Under Chapter 143, Article 24, Section 143-239, "[t]*he purpose of...the North Carolina Wildlife Resources Commission,...shall be to manage, restore, develop, cultivate, conserve, protect, and regulate the wildlife resources of the State of North Carolina, and to administer the laws relating to game, game and freshwater fishes, and other wildlife... (1947, c. 263, s. 3; 1965, c. 957, s. 13.)*".

North Carolina Department of Agriculture and Consumer Services

The Pesticide Section of the Structural Pest Control and Pesticide Division within the NCDA enforces state laws pertaining to the use and application of pesticides. The North Carolina Pesticide Law of 1971 requires the registration of pesticide products in the state, the licensing and certification of commercial and private applicators and pest control consultants, the proper handling, transportation, storage and disposal of pesticides, and the licensing of dealers selling restricted use pesticides. The purpose of the Law is to protect the health, safety, and welfare of the people of this State, and to promote a more secure, healthy and safe environment for all people of the state. This is accomplished by regulation in the public interest of the use, application, sale, disposal, and registration of pesticides.

Environmental Protection Agency

The EPA is responsible for implementing and enforcing the FIFRA which regulates the registration and use of pesticides, including repellents for dispersing mammals.

II. COMPLIANCE

Several laws and regulations pertaining to wildlife damage management activities, including activities conducted in the State are discussed below. Additional laws and regulations pertaining to wildlife damage management activities are addressed in WS' programmatic FEIS (USDA 1997). Those laws and regulations relevant to mammal damage management activities in the State are addressed below:

National Environmental Policy Act

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

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

Endangered Species Act

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

WS obtained a Biological Opinion (BO) on programmatic activities from the USFWS in 1992 describing potential effects on T&E species, and prescribing reasonable and prudent measures for avoiding jeopardy (see Appendix F in USDA 1997). Evaluation of the alternatives in regards to the ESA occurred in Chapter 4 of this EA.

Federal Insecticide, Fungicide, and Rodenticide Act

FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing FIFRA. All chemical methods used or recommended by the WS' program in North Carolina are registered with and regulated by the EPA and NCDA and are used by WS in compliance with labeling procedures and requirements.

National Historic Preservation Act of 1966, as Amended

The NHPA and its implementing regulations (36 CFR 800) require federal agencies to initiate the section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under section 106. None of the mammal damage management methods described in this EA that might be used operationally by WS causes major ground disturbance, any physical destruction or

damage to property, any alterations of property, wildlife habitat, or landscapes, nor involves the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the alternatives are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

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

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act require federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort had been made to protect the items and the proper authority had been notified.

Invasive Species - Executive Order 13112

Executive Order 13112 establishes guidance to federal agencies to prevent the introduction of invasive species, provide for the control of invasive species, and to minimize the economic, ecological, and human health impacts that invasive species cause. 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.

Environmental Justice - Executive Order 12898

Environmental Justice has been defined as the pursuit of equal justice and equal 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. A critical goal of the Order is to improve the scientific basis for decision-making by conducting assessments that identify and prioritize environmental health risks and procedures for risk reduction. Environmental Justice is a priority within USDA, APHIS, and WS. APHIS plans to implement the order principally through compliance with the provisions of NEPA.

WS' activities are evaluated for their impact on the human environment and compliance with the Order to ensure Environmental Justice. WS' personnel use methods in as selective and environmentally conscious

a manner as possible. All chemicals used by WS are regulated by the EPA through FIFRA, NCDA, by MOUs with federal land management agencies, and by WS' Directives. Based on a thorough Risk Assessment, USDA (1997) concluded that when WS' utilities chemicals according to label directions, they are highly selective for the target species or populations and such use has negligible impacts on the environment. The WS' operational program properly disposes of any excess solid or hazardous waste. WS' assistance is to provide on a request basis, in cooperation with state and local governments and without discrimination against people who are of low income or in minority populations. The nature of WS' mammal damage management activities is such that they do not have much, if any, potential to result in the disproportionate environmental effects on minority or low-income populations. Therefore, no such adverse or disproportionate environmental impacts to such persons or populations are expected.

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

Children may suffer disproportionately from environmental health and safety risks, including the development of their physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that alternative analyzed might have on children. A Risk Assessment (USDA 1997) concluded that when non-chemical and chemical methods are used according to label directions and in compliance with normally accepted safety practices and WS' SOPs, such use has negligible impacts on the environment or on human health and safety, including the health and safety of children.

Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360)

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

Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.)

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

Animal Medicinal Drug Use Clarification Act of 1994

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

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.

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

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

Authority of the NCWRC to Issue Permits to Take Wildlife Resources

Under Article 21, Section 113-274 of the North Carolina General Statutes, the NCWRC may issue depredation permits that "*...Authorizes the taking, destruction, transfer, removal, transplanting, or driving away of undesirable, harmful, predatory, excess, or surplus wildlife or wildlife resources. Livestock or poultry owners shall be issued a depredation permit for coyotes upon request. The permit must state the manner of taking and the disposition of wildlife or wildlife resources authorized or required and the time for which the permit is valid, plus other restrictions that may be administratively imposed in accordance with rules of the Wildlife Resources Commission. No depredation permit or any license is needed for the owner or lessee of property to take wildlife while committing depredations upon the property. The Wildlife Resources Commission may regulate the manner of taking and the disposition of wildlife taken without permit or license, including wildlife killed accidentally by motor vehicle or in any other manner.*" Permits are defined as "*...written authorization issued without charge by an employee or agent of the Wildlife Resources Commission to an individual or a person to conduct some activity over which the Wildlife Resources Commission has jurisdiction. When sale of wildlife resources is permitted, rules or the directives of the Executive Director may require the retention of invoices or copies of invoices in lieu of a permit.*"