ENVIRONMENTAL ASSESSMENT

MAMMAL DAMAGE MANAGEMENT
IN THE COMMONWEALTH OF VIRGINIA

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

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TABLE OF CONTENTS

ACRONYMS ..... *iii*

CHAPTER 1: PURPOSE AND NEED FOR ACTION
1.1 PURPOSE 1
1.2 NEED FOR ACTION 2
1.3 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT 20
1.4 RELATIONSHIP OF THIS DOCUMENT TO OTHER ENVIRONMENTAL DOCUMENTS . 23
1.5 AUTHORITY OF FEDERAL AND COMMONWEALTH AGENCIES 25
1.6 COMPLIANCE WITH LAWS AND STATUTES 26
1.7 DECISIONS TO BE MADE 30

CHAPTER 2: AFFECTED ENVIRONMENT AND ISSUES
2.1 AFFECTED ENVIRONMENT 30
2.2 ISSUES ASSOCIATED WITH MAMMAL DAMAGE MANAGEMENT ACTIVITIES 32
2.3 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE 37

CHAPTER 3: ALTERNATIVES
3.1 DESCRIPTION OF THE ALTERNATIVES 44
3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL 49
3.3 STANDARD OPERATING PROCEDURES FOR MAMMAL DAMAGE MANAGEMENT .. 54
3.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES 55

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES
4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL 58
4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE 118

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED
5.1 LIST OF PREPARERS AND REVIEWERS 123
5.2 LIST OF PERSONS CONSULTED 124

LIST OF APPENDICES

APPENDIX A LITERATURE CITED A-1

APPENDIX B MAMMAL DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE B-1

APPENDIX C THREATENED AND ENDANGERED SPECIES THAT ARE LISTED IN THE COMMONWEALTH OF VIRGINIA C-1

ACRONYMS

ABC	American Bird Conservancy
ADC	Animal Damage Control
AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BO	Biological Opinion
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	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FeLV	Feline leukemia
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FIV	Feline immunodeficiency virus
FPV	Feline panleukopenia virus
FR	Federal Register
FY	Fiscal Year
IC	Intracardiac
IV	Intravenous
IWDM	Integrated Wildlife Damage Management
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
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
US	United States
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Services
VAC	Virginia Administrative Code
VDACS	Virginia Department of Agriculture and Consumer Services
VDGIF	Virginia Department of Game and Inland Fisheries
WDM	Wildlife Damage Management
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 Virginia continues to receive requests for assistance or anticipates receiving requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, and property, including threats to human safety, associated with black bear (*Ursus americanus*), coyote (*Canis latrans*), Eastern cottontail (*Sylvilagus floridanus*), feral cat (*Felis domesticus*), feral dog (*Canis familiaris*), feral swine (*Sus scrofa*), gray fox (*Urocyon cinereoargenteus*), gray squirrel (*Sciurus carolinensus*), nutria (*Myocastor coypus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), river otter (*Lutra canadensis*), striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), white-tailed deer (*Odocoileus virginianus*), woodchuck (*Marmota monax*), bats (family Vespertilionidae), bobcat (*Felis rufus*), and small mammals, such as insectivores (shrews and moles) and rodents (mice, rats, and voles).

Normally, individual wildlife damage management projects conducted by the WS program could be categorically excluded from further analysis under the National Environmental Policy Act (NEPA), in accordance with APHIS implementing regulations for the NEPA (7 CFR 372.5(c), 60 FR 6000-6003). However, the purpose of this Environmental Assessment (EA) is to evaluate cumulatively the individual projects conducted by WS to manage damage and threats to agricultural resources, property, natural resources, and threats to humans caused by those mammal species identified previously. This EA will assist in determining if the proposed cumulative management of mammal damage could have a significant impact on the environment for both humans and other organisms based on previous activities conducted and based on the anticipation of receiving additional requests for assistance. Because the goal of WS is to conduct a coordinated mammal damage management program in accordance with plans, goals, and objectives developed to reduce damage, and because the program's goals and directives[2] are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates those additional efforts and the analyses would be intended to apply to actions that may occur in any locale and at any time within Virginia as part of a coordinated program.

More specifically, 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 proposed activities; and 5) evaluate and determine if there would be any potentially significant or cumulative adverse effects from the implementation of a damage management program.

The EA evaluates the need for action to manage damage associated with mammals in the Commonwealth, the potential issues associated with mammal damage management, and the environmental consequences of conducting different alternatives to meet the need for action while addressing the identified issues. The issues and alternatives associated with mammal damage management were initially developed by WS after consultation with the Virginia Department of Game and Inland Fisheries (VDGIF). The VDGIF has regulatory authority to manage populations of mammal species in the Commonwealth. To assist with the identification of additional issues and alternatives to managing damage associated with mammals in

[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]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.

Virginia, this EA will be made available to the public for review and comment prior to the issuance of a Decision[3].

WS previously developed an EA that addressed WS' activities to manage damage associated with white-tailed deer in the Commonwealth (USDA 2000*a*). Based on the analyses in that EA, a Decision and Finding of No Significant Impact was signed selecting the proposed action alternative. The proposed action alternative implemented a deer damage management program using a variety of methods in an integrated approach (USDA 2000*a*). Changes in the need for action and the affected environment have prompted WS to initiate this new analysis to address damage management activities in the Commonwealth. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action, primarily a need to address damage and threats of damage associated with several species of mammals. Since activities conducted under the previous deer damage management EA will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EA that addresses deer damage will be superseded by this analysis and the outcome of the Decision issued for this EA.

1.2 NEED FOR ACTION

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

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

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

[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, either a decision will be made to 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 with the NEPA and the Council of Environmental Quality regulations.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (The Wildlife Society 1990, Berryman 1991). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. Those species have no intent to do harm. They utilize habitats (*e.g.*, reproduce, walk, forage) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or pose a threat to human safety, people seek assistance with resolving damage or reducing threats to human safety. The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (*e.g.*, economic, social, aesthetics). Therefore, what constitutes damage is often unique to the individual person and damage occurring to one individual may not be considered damage by another individual. However, the use of the term "*damage*" is consistently used to describe situations where the individual person has determined the losses associated with wildlife is actual damage requiring assistance (*i.e.*, has reached an individual threshold). The term "*damage*" is most often defined as economic losses to resources or threats to human safety; however, "*damage*" could also be defined as a loss in the aesthetic value of property and other situations where the behavior of wildlife is no longer tolerable to an individual person.

The need for action to manage damage and threats associated with mammals in Virginia arises from requests for assistance[4] received by WS. WS receives requests to reduce and prevent damage from occurring to four major categories: agricultural resources, natural resources, property, and threats to human safety. WS has identified those mammal species most likely to be responsible for causing damage to those four categories in the Commonwealth 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 Virginia from the federal fiscal year[5] (FY) 2006 through FY 2011. Technical assistance has been provided by WS to those persons requesting assistance with resolving damage or the threat of damage. Technical assistance provides information and recommendations on activities to alleviate mammal damage that can be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 3 of this EA. Table 1.1 does not include direct operational assistance projects conducted by WS where WS was requested to provide assistance through the direct application of methods.

The technical assistance projects conducted by WS are representative of the mammal species that cause damage and threats in Virginia. As shown in Table 1.1, WS has conducted 2,455 technical assistance projects in Virginia from FY 2006 through FY 2011 to address damage and threats associated with many of those mammal species identified in this EA. Nearly 50% of the technical assistance projects conducted by WS from FY 2006 through FY 2011 were associated with damage and threats of damage caused by coyotes (35%) and feral dogs (14%) in the Commonwealth.

Table 1.2 lists those mammal species identified in this EA and the resource types that those mammal species can cause damage to in Virginia. Many of the mammal species can cause damage to or pose threats to a variety of resources. In Virginia, most requests for assistance received by WS have been associated with those mammal species causing damage or threats of damage to property and agriculture.

[4] WS would only conduct 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 would be signed between WS and the cooperating entity that lists all the methods the property owner or manager would 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.

Table 1.1 – WS' Technical assistance projects conducted in Virginia, FY 2006 - FY 2011.

Species	Projects	Species	Projects
Bats	94	**Gray Squirrel**	25
Black Bear	100	**Meadow Vole**	5
Bobcat	5	**Nutria**	13
Coyote	850	**Raccoon**	160
Eastern Cottontail	6	**River Otter**	1
Feral Cat	23	**Striped Skunk**	285
Feral Dog	345	**Virginia Opossum**	44
Feral Swine	12	**White-tailed Deer**	112
Gray Fox	26	**Woodchuck**	232
Red Fox	117	**TOTAL**	**2,455**

As shown in Figure 1.1, damages to property and agricultural resources associated with mammals that have been reported to WS or verified by WS have totaled $4.7 million between FY 2006 and FY 2011. Although monetary damages to natural resources and human safety have been reported and verified by WS, requests for assistance often address threats that mammals can pose to human safety and natural resources for which monetary losses are difficult to determine. Since FY 2006, after receiving requests for assistance, WS has verified or those people requesting assistance have reported to WS nearly $116,596 in damages caused by mammals to natural resources and costs involved with human safety. For human safety, requests for WS' assistance have often been received to reduce the threat of disease transmission and the threat of aircraft striking mammals at airports.

Table 1.2 – Resource types damaged by those mammal species addressed

Species	Resource				Species	Resource			
	A	**N**	**P**	**H**		**A**	**N**	**P**	**H**
Bats			X	X	**Voles**	X		X	X
Black Bear	X		X	X	**Mice/Rats**	X		X	X
Bobcat	X	X	X	X	**Moles**			X	
Coyote	X	X	X	X	**Shrews**	X		X	X
Eastern Cottontail	X		X	X	**Nutria**	X	X	X	
Feral Cat	X	X	X	X	**Raccoon**	X	X	X	X
Feral Dog	X	X	X	X	**River Otter**	X	X		
Feral Swine	X	X	X	X	**Striped Skunk**	X	X	X	X
Gray Fox	X	X	X	X	**Virginia Opossum**	X	X	X	X
Red Fox	X	X	X	X	**White-tailed Deer**	X	X	X	X
Gray Squirrel			X		**Woodchuck**	X		X	

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

Most requests for assistance received by WS involving threats to human safety arise from the risks associated with disease transmission in areas where the public may encounter mammals. Aircraft striking mammals can cause catastrophic failure of the aircraft, which has the potential to threaten passenger safety. The difficulties of placing a monetary value on reducing threats to human safety and natural resources are similar. The damages shown in Figure 1.1 are only those damages reported to WS or verified by WS. The damages reported to or verified by WS are likely only a portion of the actual damages occurring in the Commonwealth since those damages reported to or verified by WS are based only on requests for assistance received by WS.

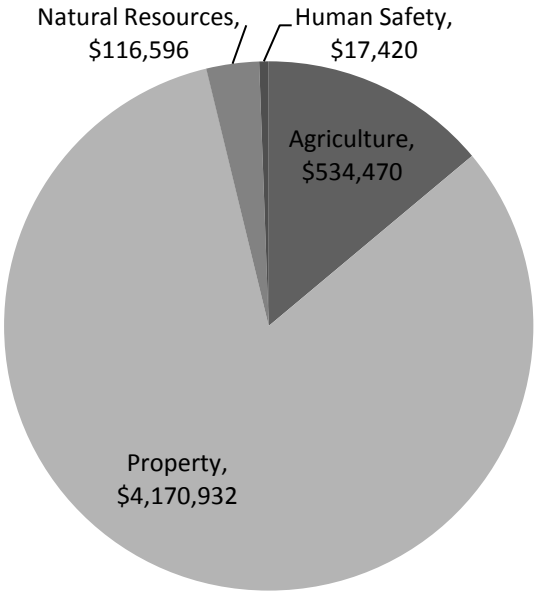


Figure 1.1 – Reported and verified damages caused by mammals in Virginia, FY 2006 – FY 2011

Information regarding the need for mammal damage to specific categories will be discussed in the following subsections of the EA:

Need for Mammal Damage Management to Protect Human Health and Safety

Zoonoses (*i.e.*, wildlife diseases transmissible to people) are a major concern of cooperators when requesting assistance with managing threats from mammals. Disease transmission could occur from direct interactions between humans and mammals or from interactions with pets and livestock that have direct contact with 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.

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

Table 1.3 - Wildlife diseases in the Eastern United States that pose potential health risks through transmission to humans (Beran 1994, Davidson 2006)[†]

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

Disease	Causative Agent	Hosts[‡]	Human Exposure
Swine brucellosis	*Brucella suis*	feral hog	ingestion, 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
Lyme disease	*Borellia burgdorferi*	deer, rodents	tick bite (vectored by deer)
Human ehrlichiosis	*Ehrlichia sp.*	deer	tick bite (vectored by deer)
Tularemia	*Francisella tularensis*	rodents, rabbits	direct contact, ingestion, inhalation
Hantavirus	Hantaviruses	rodents	direct contact, ingestion, inhalation

[†]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 (2006).

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

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

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

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

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

Raccoons have been associated with the spread of rabies in states throughout the eastern United States, including Virginia (USDA 2005*a*). In 2011, raccoons accounted for almost 46% of laboratory confirmed cases of animal rabies in Virginia (Virginia Department of Health 2012). Rabies in raccoons was virtually unknown prior to the 1950s. It was first described in Florida and spread slowly during the next three decades into Georgia, Alabama, and South Carolina. It was unintentionally introduced into the Mid-Atlantic States, probably by translocation of infected animals (Krebs et al. 1998). The first cases

appeared in West Virginia and Virginia in 1977 and 1978, respectively. Since then, raccoon 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 spread in the eastern United States (Sanderson and Huber, Jr. 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 have an encounter with rabid raccoons. Additionally, the number of pets and livestock examined and vaccinated for rabies, the number of diagnostic tests requested, and the number of post exposure treatments are all higher when raccoon rabies is present in an area. Human and financial resources allocated to rabies-related human and animal health needs also increase, often at the expense of other important activities and services.

Skunks are also an important wildlife host for the rabies virus in North America and are second only to raccoons in being the most commonly reported rabid wildlife species in the United States (Majumdar et al. 2005). Skunks accounted for nearly 31% of laboratory confirmed cases of animal rabies in Virginia during 2011 (Virginia Department of Health 2012). 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 extends from Georgia to Maine east of the Appalachians, Texas to the Canadian border, and throughout the northern two thirds of California (Majumdar et al. 2005).

The fox is one of the four major maintenance hosts for rabies in North America. In the 1950s, rabies in red fox spread throughout Canada, parts of New England, and Alaska. The range has since decreased, but fox rabies persists in Alaska and parts of Texas. Clinical signs of rabies in fox are often manifested as the "*furious*" form of rabies (Majumdar et al. 2005).

In an effort to halt the westward spread of the raccoon variant of the rabies virus and to limit the spread of the canine variant in Texas, WS began participating in the distribution of oral rabies vaccine (ORV) baits (fishmeal polymer containing Raboral V-RG® vaccine [Merial, Athens, Georgia, USA]). Currently, WS participates in the distribution of ORV baits and the surveillance of wildlife rabies vectors in 26 states, including Virginia. ORV baits were first distributed by WS in Virginia during the fall of 2002. In total, 405,331 baits were distributed (393,451 by air and 11,880 by hand) across a 6,404 km^2 area which included portions of Buchanan, Dickenson, Lee, Russell, Scott, Tazewell, Washington, and Wise Counties. Virginia has moved the barrier east, in five mile increments, to include larger portions of Smyth, Tazewell and Washington Counties. Since the inception of the program in the fall of 2001 through the bait distribution in October 2010, approximately 3,049,350 ORV baits have been distributed in Virginia. As part of a surveillance of rabies vectors in Virginia, between 2006 and 2010, WS collected 1,305 samples for rabies testing. Of those 1,305 samples, 24 samples tested positive for the Eastern United States raccoon rabies variant, four tested positive for north central plains skunk variant, and one tested positive for the big brown bat 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*).

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

Diseases and parasites affecting feral cats and dogs can have particularly serious implications to human health given the close association of those animals with humans and companion animals. The topic of feral animals and their impacts on native wildlife and human health elicits a strong response in numerous professional and societal groups with an interest in the topic. Feral cats are considered by most professional wildlife groups to be a non-native species that has detrimental impacts to the native ecosystems especially in the presence of a human altered landscape. However, a segment of society views feral animals to be an extension of companion animals that should be cared for and for which affection bonds are often developed especially when societal groups feed and care for individual feral animals. Of special concern are those cats and dogs considered companion animals that are not confined at all times but are allowed to range for extended periods. If interactions occur between companion animals and feral animals of the same species, companion animals could become exposed to a wide-range of zoonoses that could be brought back into the home where direct contact between the companion animal and people increases the likelihood of disease transmission. Feral animals that are considered companion animals are also likely to affect multiple people if disease transmission occurs since those animals are likely to come in direct contact with several members of families and friends before diagnosis of a disease occurs.

Several known diseases that are infectious to humans, including rabies, have been found in feral cats. Another common zoonoses 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 that are infectious to humans are not life threatening if diagnosed and treated early. However, certain societal segments are at higher risks if exposed to zoonoses. Women who are pregnant, people receiving chemotherapy for immunologic diseases and organ transplants, and those with weakened immune systems are at increased risk of clinical disease if exposed to 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 infestations afflicting 84 children and faculty. The fleas were from a feral cat colony that had grown from 100 cats to over 1,000, despite a trap, neuter, and release effort (AVMA 2004).

A study in France determined that stray cats serve as major reservoirs for the bacterium *Bartonella* spp. Consequently, stray cats and their fleas (*Ctenocephalides felis*) are the only known vectors for infecting house bound cats and humans with this bacterium. Humans are not infected via the flea, but pet cats often are infected by fleabites. Human infections that may result from exposure of this bacterium via stray cats include cat scratch disease in immunocompetent patients, bacillary angiomatosis, hepatic peliosis in immunocompromised patients, endocarditis, bacteremia, osteolytic lesions, pulmonary nodules, neuroretinitis, and neurologic diseases (Heller et al. 1997). In areas where canine 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 (Samuel et al. 2001, Williams and Barker 2001, Davidson 2006) and 37 parasites (Forrester 1991) that are transmissible to humans. Brucellosis, salmonellosis, toxoplasmosis, trichinosis, tuberculosis, and tularemia are some of the common diseases that can be carried by feral swine that are also known to infect humans (Stevens 1996, Hubalek et al. 2002, Seward et al. 2004). In addition, feral swine can pose risks to domestic livestock through the potential transmission of diseases between feral swine populations and domestic livestock where interactions may occur.

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

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

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

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

However, wildlife and feral animals are known carries of diseases infectious to people which can increase 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 technical leaflets on the risks of exposure.

As stated previously, a common concern among those people 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 humans are likely to encounter are those most likely to adapt to and thrive in human altered habitat. Several predatory and omnivorous wildlife species thrive in human altered habitat due to the availability of food, water, and shelter. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting the act in many areas. The constant presence of human created refuse, readily available water supplies, and abundant rodent populations found in some areas often increases the survival rates and carrying capacity of wildlife species that are adaptable to those habitats. Often the only limiting factor of wildlife species in and around areas inhabited by people is the prevalence of diseases, which can be confounded by the overabundance of wildlife congregated into a small area that can be created by the unlimited amount of food, water, and shelter found within those habitats.

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by people toward many species of wildlife has led to a decline in the fear wildlife have toward people. When wildlife species begin to habituate to the presence of humans and human activity, a loss of apprehension occurs that can lead to threatening behavior toward humans. This threatening behavior continues to increase as human populations expand and the populations of those species that adapt to human activity increase. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward people, or abnormal behavior. Although wildlife attacking people occurs rarely, the number of attacks appears to be on the increase. Timm et al. (2004) reported that coyotes attacking people have increased in California and the recent, highly publicized coyote attacks, including a fatal attack on a 19-year old woman in Nova Scotia (CBC 2009), have only heightened people's awareness of the threat of such encounters. WS has received requests for assistance related to the threat of an attack by wildlife in Virginia. Often, wildlife exhibiting threatening behavior or a loss of apprehensiveness to the presence of humans is a direct result and indication of an animal inflicted with a disease. So, requests for assistance are caused by both a desire to reduce the threat of disease transmission and from fear of aggressive behavior either from an animal that is less apprehensive of people or induced as a symptom of disease.

Black bears occasionally threaten human health and safety. Most of those injuries are minor; although, sometimes the results are more severe. Herrero et al. (2011) documented that at least 63 people were killed in 59 incidents by non-captive black bears from 1900 to 2009, 86% of those fatalities (54) occurred from 1960 to 2009. In contrast to injurious attacks, only 38% of fatal black bear attacks involved people's food or garbage. Most fatal black bear attacks were predatory and all fatal attacks were carried out by a single bear (Herrero et al. 2011). The number of bear attacks could be considered low considering the geographic overlap of human and black bear populations. There have been no documented fatalities to humans caused by black bears in Virginia (J. Sajecki, VDGIF, pers. comm. 2011). However, situations could arise where WS is requested to assist with addressing bears that have posed a threat to human safety in the Commonwealth.

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

Disease Surveillance and Monitoring

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

Need for Mammal Damage Management at Airports

Airports provide ideal conditions for many wildlife species due to the large grassy areas adjacent to brushy, forested habitat used as noise barriers. Access to most airport properties is restricted so wildlife living within airport boundaries would be protected during hunting and trapping seasons and 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 2009). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety, result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Thorpe 1997, Keirn et al. 2010). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995).

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

About 59% of mammal strikes in the United States have resulted in damage compared to 13% for birds from 1990 through 2010 (Dolbeer et al. 2012). In addition to direct damage, an aircraft striking a mammal can pose serious threats to human safety if the damage from the strike causes a catastrophic

failure of the aircraft leading to a crash. For example, damage to the landing gear during the landing roll and/or takeoff run can cause a loss of control of the aircraft, causing additional damage to the aircraft and increasing the threat to human safety. Nearly 63% of the reported mammal strikes from 1990 through 2010 occurred at night, with 63% occurring during the landing roll or the takeoff run (Dolbeer et al. 2012).

In Virginia, there were 63 reported strikes with terrestrial mammals from 1990 through 2010 (Dolbeer et al. 2012). In addition, four aircraft strikes involving bats have been reported in Virginia (Dolbeer et al. 2012). From January 1990 through January 2012, there were 43 reported strikes in Virginia involving white-tailed deer, with the damages to the aircraft being reported as moderate to severe damage (FAA 2012). Preventing damage and reducing threats to human safety is the goal of those cooperators requesting assistance at airports in Virginia given that a potential strike can lead to the loss of human life and considerable damage to property.

Wildlife populations near or found confined within perimeter fences at airports can be a threat to human safety and cause damage to property when struck by aircraft. Those wildlife confined inside the airport perimeter fence would not be considered distinct populations nor separate from those populations found outside the perimeter fence. Wildlife found within the boundaries of perimeter fences originate from populations outside the fence. Those individuals of a species inside the fence neither exhibit nor have unique characteristics from those individuals of the same species that occur outside the fence; therefore, those individuals of a species confined inside an airport perimeter fence do not warrant consideration as a unique population under this analysis.

Need for Mammal Damage Management to Protect Agricultural Resources

Black bears, red fox, gray fox, bobcats, deer, and other mammals can cause losses or injury to crops, livestock (*e.g.*, sheep, goats, cattle, pigs, horses), and poultry (*e.g.*, chickens, turkeys, geese, ducks) through predation. WS previously developed an EA that addressed WS' activities to manage predation on livestock from coyotes, red fox, and feral dogs in the Commonwealth (USDA 2002) and documented losses reported to WS. 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). Deer were responsible for 58% of the total damage to field crops and 33% of the total damage to vegetables, fruits, and nuts in 2001 (NASS 2002).

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

In Virginia, the NASS (2011) reported 600 cattle and 4,800 calves were killed in 2010 by animal predators. Of the calf losses reported by producers in the Commonwealth, 65% were attributed to

coyotes, 7.5% were attributed to dogs, and 5.4% were attributed to bears (NASS 2011). The economic loss to cattle and calves from animal predators in Virginia was estimated at nearly $2.1 million in 2010 (NASS 2011). Virginia cattle producers reported using a number of non-lethal methods to reduce losses due to predators. The use of exclusion fencing was reported as employed by 17.8% of the livestock producers surveyed in Virginia along with 36.8% reporting the use of guard animals (NASS 2011). In addition, the NASS (2010) reported that 800 sheep and 5,200 lambs were lost to predation in Virginia during 2009, resulting in $466,000 in monetary losses. The NASS (2011) reported no losses to cattle from bobcat predation in Virginia. However, cattle producers in the United States indicated mountain lions and bobcats[6] caused 7.8% of the cattle and calf losses attributed to animal predators in 2010 (NASS 2011). Bobcats are also known to predate on other livestock.

Although most bear-related complaints in Virginia involve garbage and bird feeders (80% of complaints), 13% of bear damage complaints in the Commonwealth are related to agriculture (J. Sajecki, VDGIF, pers. comm. 2012). The VDGIF has documented agricultural damage from black bears in Virginia for over 60 years. Most reported bear damage involves corn crops and orchards, though bears may also cause damage to beehives, vineyards, wheat, oats, soybeans, and peanuts (VDGIF 2002). Black bears may also prey on livestock such as goats, sheep, and cattle. Although the full extent of bear damage in Virginia is unknown, the VDGIF reported in 2002 that agricultural damage had increased substantially since 1980 (VDGIF 2002).

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

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

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

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

[6]The 2010 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.

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

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

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

Although several diseases that are carried by swine are also transmissible to other livestock, the primary concern is the potential transmission of diseases from feral swine to domestic swine. Pseudorabies is a viral disease associated with an extremely contagious herpes virus that can have negative effects on reproduction in domestic swine. Brucellosis is a bacterial disease that can also have negative effects on reproduction in swine. Many of the other diseases associated with feral swine also negatively affect the health and marketability of domestic swine that can lead to economic losses to the livestock producer. The United States is one of the world's largest producers of pork and is the second largest exporter of pork. Pork production in the United States accounts for about 10% of the total world supply. The retail value of pork sold to consumers exceeds $30 billion annually. In addition, the pork industry supports more than 600,000 jobs. An economic analysis estimated that the annual cost of pseudorabies to pork producers in the United States at more than $30 million annually in lost production as well as testing and vaccination costs (USDA 2008).

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

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

Nutria depredation on crops has also been documented (LeBlanc 1994). Crops that have been damaged include corn, milo (grain sorghum), sugar and table beets, alfalfa, wheat, barley, oats, peanuts, various melons, and a variety of vegetables from home gardens and truck farms.

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 include: parks and recreation areas; natural areas, including unique habitats or topographic features; threatened and endangered plants or animals; and any plant or animal populations which have been identified by the public as a natural resource.

Mammals can cause damage to natural resources. Mammals causing damage are often locally overabundant at the damage site and threaten the welfare of a species population identified as a natural resource. An example of this would be nest predation of a local ground-nesting bird population by mammalian carnivores, such as raccoons, opossum, feral cats, coyotes, or fox. WS previously developed an EA that addressed WS' activities to manage predation losses to native bird populations on the barrier and Chesapeake Bay islands and coastal areas of the Commonwealth of Virginia (USDA 2005*b*). Mammal damage to T&E species has also been reported in other parts of the Commonwealth. WS has received requests for assistance with raccoon predation on T&E species of mussels in freshwater streams in the western part of the Commonwealth. T&E species could be jeopardized by mammals in Virginia, primarily from predation and competition for habitat.

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

The alteration and degradation of habitat from over-browsing by deer can have a detrimental effect on deer herd health and may displace other wildlife communities (*e.g.*, neotropical migrant songbirds and small mammals) that depend upon the understory vegetative habitat destroyed by deer browsing (VDGIF 2007). Similarly, DeCalesta (1997) reported that deer browsing affected vegetation that songbirds need for foraging surfaces, escape cover, and nesting. Species richness and abundance of intermediate canopy nesting songbirds was reduced in areas with higher deer densities (DeCalesta 1997). Intermediate canopy-nesting birds declined 37% in abundance and 27% in species diversity at higher deer densities. Five species of birds were found to disappear at densities of 38.1 deer per square mile and another two disappeared at 63.7 deer per square mile. Casey and Hein (1983) found that three species of birds could no longer be found in a research preserve stocked with high densities of ungulates and that the densities of several other species of birds were lower than in an adjacent area with lower deer density. Waller and Alverson (1997) hypothesize that by competing with squirrels and other fruit-eating animals for oak mast, deer may further affect many other species of animals and insects.

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

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

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

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

Reptiles are thought to provide an important food source to cats when birds and mammals are less abundant, and in some situations, cats have been observed to prey on threatened species of reptiles. Domesticated cats have been identified as significant nest and/or hatchling predators of sea turtles. A study on the Aldabra Atoll, Seychelles found feral cats had an adverse effect on green turtle hatchlings. Seabrook (1989) found a positive correlation in cat activity and green turtle nesting at Aldabra Atoll.

Cats are known to have contributed to the near extirpation of the West Indian rock iguana (*Cyclura carinata*) on Pine Cay in the Caicos Islands (Iverson 1978).

Cats can adversely affect local wildlife populations, especially in habitat "*islands*", such as suburban and urban parks, wildlife refuges, and other areas surrounded by human development (Wilcove 1985). The loss of bird species from habitat islands is well documented and nest predation is an important cause of the decline of neotropical migrants (Wilcove 1985). A two-year study was conducted in two parks with grassland habitat. One park had no cats but more than 25 cats were being fed daily in the other park. There were almost twice as many birds seen in the park with no cats as in the park with cats. California thrasher and California quail, both ground-nesting birds, were seen during surveys in the no-cat area; whereas, they were never seen in the cat area. In addition, more than 85% of the native seer mice and harvest mice trapped were in the no-cat area; whereas, 79% of the house mice (*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).

Feral swine compete with over 100 species of native wildlife for important and limited natural food supplies. Some species including quail, turkey, endangered sea turtles, and shorebirds are at risk of predation by nest destruction and the consuming of eggs. Feral swine cause damage to natural areas such as parks and wildlife management areas in Virginia. 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). Feral swine are not native to North America, and many native species have not evolved to deal with feral swine competition or predation. Many state and federal natural resource managers are now in the process of controlling hog numbers because of their known impact to endangered plants and animals (Thompson 1977, West et al. 2009). Feral swine are known to occur in Virginia (see Figure 1.2).

Feral swine are known to feed on many smaller animals (some T&E species), disrupt ecosystems via rooting, and feeding on rare and endangered plants. Many experts in the fields of botany and herpetology have observed marked declines in some rare species of plants, reptiles, amphibians, and soil invertebrates in areas inhabited by feral swine (Singer et al. 1982). It has been well documented that feral swine disturb large areas of vegetation and soil through rooting, and it is documented that hogs inhabiting coastal, upland, and wetland ecosystems are uprooting, damaging, and feeding on rare native species of plants and animals (Means 1999). Feral swine can disrupt natural vegetative communities, eliminate rare plants and animals, alter species composition within a forest, including both canopy and low growing species (Lipscomb 1989, Frost 1993), increase water turbidity in streams and wetlands (reducing water quality and impacting native fish), and increase soil erosion and alter nutrient cycling (Singer et al. 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 were negatively affected by feral swine (Kaller and Kelso 2006).

Nutria may also cause damage to natural resources in Virginia. Nutria are also a non-native species in the United States that were introduced from South America. Nutria primarily inhabit brackish or freshwater marshes, but are also found in swamps, rivers, ponds, and lakes. They live in dense vegetation, in abandoned burrows, or in burrows they dig along stream banks or shorelines (Wade and Ramsey 1986). Nutria are almost entirely herbivorous and eat animal material (mostly insects) incidentally. Freshwater mussels and crustaceans can be eaten by nutria in some parts of their range.

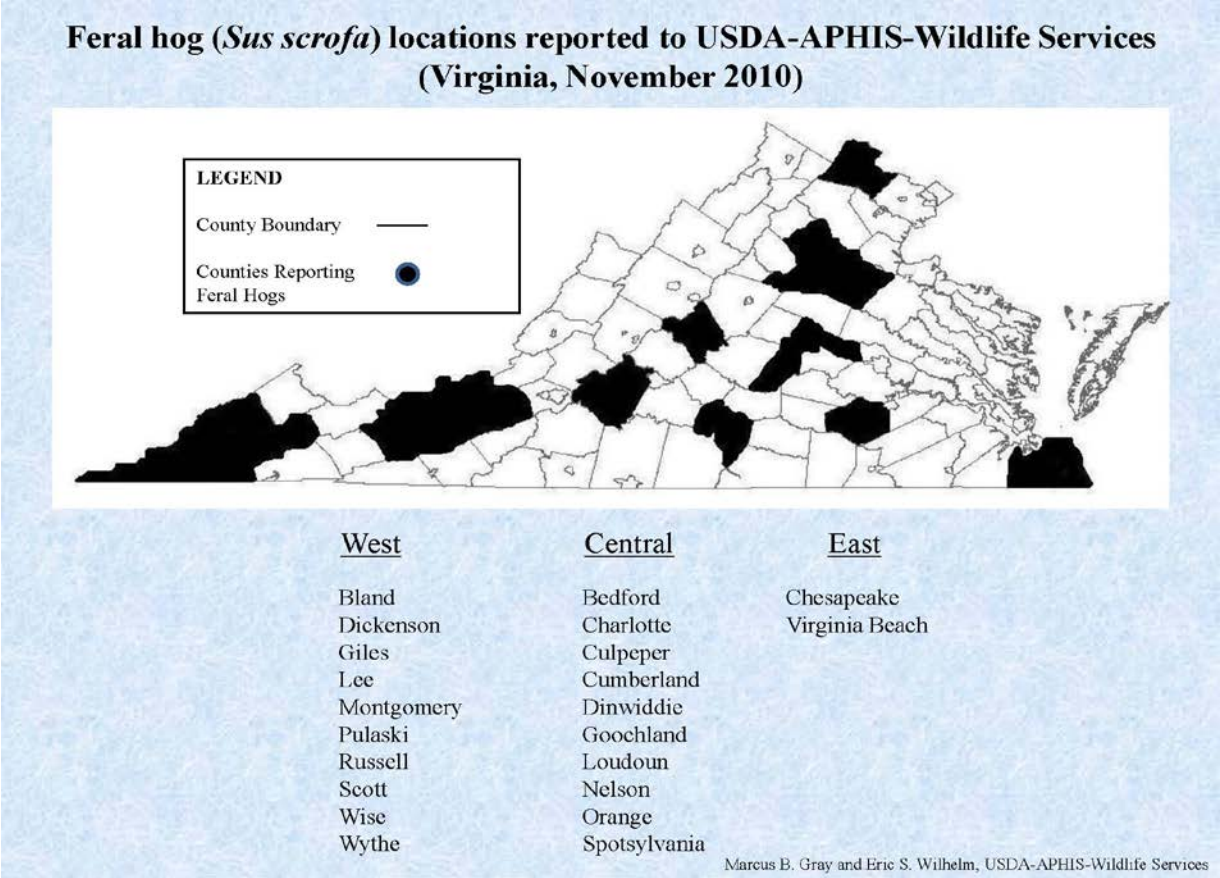


Figure 1.2 – Counties in Virginia where feral swine are known to occur

The digging and feeding behavior of nutria can be destructive to marsh ecosystems. Nutria forage directly on the vegetative root mat, leaving marshes pitted with digging sites and fragmented with deeply cut swimming canals. The denuding of marsh vegetation can accelerate erosion associated with tidal currents and wave action. The loss of vegetation can also facilitate salt-water intrusion into marsh interiors. Nutria also cause damage by eating lawn grasses found adjacent to aquatic habitats. Nutria are opportunistic feeders and eat approximately 25% of their body weight daily (LeBlanc 1994). At high densities and under certain environmental conditions, nutria foraging in coastal marsh areas can substantially influence natural plant communities, creating "*eat-outs*" which exacerbate coastal erosion (LeBlanc 1994).

WS has received requests for assistance in the past involving damage to natural resources caused by mammals, and could be requested to provide services for management of damage to natural resources caused by any mammal at any location in the Commonwealth.

Need for Mammal Damage Management to Protect Property

Mammals cause damage to a variety of property types in Virginia each year. From FY 2006 through FY 2011, WS received reports of $4,170,932 in damages caused by all mammals to all types of property in the Commonwealth. Damage was caused by many species of mammals, including deer, bear, nutria, feral swine, raccoons, beaver, skunks, woodchucks, and many others. One frequently reported damage type is the threat of aircraft striking mammals. The direct threat of aircraft strikes with mammals can cause substantial damage requiring costly repairs and aircraft downtime. Indirect threats to aircraft may result

from large populations of small mammals such as rabbits, rodents, and voles attracting mammalian and avian predators to the airfield and increasing the risk of a wildlife strike.

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 also pose a threat to property from being struck by motor vehicles and aircraft.

Deer-vehicle collisions are a serious concern nationwide because of losses to property and the potential for human injury and death (Conover et al. 1995, Romin and Bissonette 1996, Conover 1997). The economic costs associated with deer-vehicle collisions include vehicle repairs, human injuries and fatalities, and picking up and disposing of deer (Drake et al. 2005). The Insurance Institute for Highway Safety (2005) estimated that 1.5 million deer-vehicle collisions occur annually in the United States causing approximately 150 fatalities and $1.1 billion in damage to property. In 1995, the damage to vehicles associated with vehicles striking deer was estimated at $1,500 per strike in damages (Conover et al. 1995). Damage costs associated with deer collisions in 2011 were estimated at $3,171 per incident, which was an increase of 2.2% over the 2010 estimate (State Farm Mutual Automobile Insurance Company 2011*a*). An estimated 48,658 deer-vehicle collisions occurred in Virginia from July 1, 2010 through June 30, 2011 (State Farm Mutual Automobile Insurance Company 2011*b*). Based on the average repair costs associated with vehicle strikes estimated at $3,171 in 2010 and the number of strikes that have occurred in Virginia estimated at 48,658 from July 2010 through June 2011, deer-vehicle collisions resulted in nearly $154.3 million in damage to property in the Commonwealth. Often, deer-vehicle collisions in which a deer carcass was not recovered or little vehicle damage occurred go unreported. A Cornell University study estimated that the actual number of deer-vehicle collisions could be as high as six times the reported number (Decker et al. 1990).

Burrowing activities of nutria can severely damage levees, dikes, earthen dams, and other structures (Federal Emergency Management Agency 2005). Additionally, nutria burrows can weaken flood control levees that protect low-lying areas. In some cases, tunneling in levees is so extensive that water will flow unobstructed from one side to the other, necessitating their complete reconstruction. Nutria can also burrow into the styrofoam floatation under boat docks and wharves, causing those structures to lean and sink. Nutria burrow under buildings, which may lead to uneven settling or failure of the foundations. Burrows can weaken road beds, steam banks, dams, and dikes, which may collapse when the soil is saturated by rain or high water or when subjected to heavy objects on the surface (such as vehicles, farm machinery, or grazing livestock). Rain and wave action can enlarge collapsed burrows and compound the damage.

Burrowing activities of woodchucks can severely damage levees, dikes, earthen dams, landfills, and other structures (Federal Emergency Management Agency 2005). Woodchuck burrows under roadbeds and embankments and could potentially weaken or cause the collapse of these structures. Woodchucks also cause damage by chewing underground utility cables, sometimes resulting in power outages. Additionally, woodchuck burrows may cause damage to property when tractors and other equipment drop into a burrow or roll over due to a burrow.

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, commonwealth, tribal, municipal, and private land within the Commonwealth of Virginia wherever such management is

requested by a cooperator. This EA discusses the issues associated with conducting mammal damage management in the Commonwealth to meet the need for action and evaluates different alternatives to meeting that need while addressing those issues.

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

Federal, Commonwealth, County, City, and Private Lands

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

Native American Lands and Tribes

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

Period for which this EA is Valid

If the analyses in this EA 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 activities conducted under the selected alternative occur within the parameters evaluated in the EA. If the alternative analyzing no involvement in mammal damage activities by WS

[7]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.

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

Site Specificity

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

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

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

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Virginia. 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 Virginia were initially developed by WS in consultation with the VDGIF. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document will be noticed to the public for review and comment. The public will be noticed through legal notices published in local print media, through direct mailings to parties that have requested to be notified, or have been identified to have an

interest in the reduction of threats and damage associated with mammals in the Commonwealth, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlife_damage/nepa.shtml.

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

1.4 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

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

Supplemental Environmental Assessment – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Fox, and Coyotes in the United States: WS issued an EA that analyzed the environmental effects of WS' involvement in the funding of and participation in Oral Rabies Vaccination programs to eliminate or stop the spread of raccoon rabies in a number of eastern states (including Virginia) 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. WS determined the proposed action alternative would not have any significant impact on the quality of the human environment.

WS' Environmental Assessment - Management of Coyote, Dog, and Red Fox Predation on Livestock in the Commonwealth of Virginia: In 2002, the WS program in the Commonwealth developed an EA to address the need to reduce threats and damage to livestock associated with coyotes, feral dogs, and red fox (USDA 2002). The EA evaluated the issues associated with managing damage and threats to livestock in the Commonwealth and developed alternatives to address those issues. Based on the analyses in the EA, a Finding of No Significant Impact (FONSI) was issued on May 8, 2002 selecting the proposed action alternative in the EA to address the identified need. The proposed action evaluated an integrated approach using lethal and non-lethal methods to address the need for action. After a review of program activities under the proposed action, a new Decision/FONSI was issued on May 18, 2007. The analyses in the EA will remain appropriate for WS' activities conducted to reduce threats and predation on livestock associated with coyotes, feral dogs, and red fox in the Commonwealth. The analyses in that EA will be discussed in this EA to ensure WS' activities to address damage associated with coyotes, feral dogs, and red fox are evaluated cumulatively. A cumulative assessment of activities conducted by WS in the Commonwealth allows a complete evaluation to insure those cumulative activities are not sufficient to warrant the preparation of an EIS.

WS' Environmental Assessment - Management of Predation Losses to Native Bird Populations on the Barrier and Chesapeake Bay Islands and Coastal Areas of the Commonwealth of Virginia: WS has also prepared an EA to evaluate the need to reduce nest predation on native ground nesting threatened and endangered birds, colonial nesting waterbirds, and black ducks nesting on barrier islands and on Chesapeake Bay islands within the Commonwealth (USDA 2005*b*). The EA evaluated nest predation by several species of mammals and birds, including several mammal species addressed in this EA. Those nest predators addressed that are also addressed in this EA include raccoons, opossum, and red fox. The

EA evaluated five alternatives to address the need for action while addressing those issues associated with reducing predation risks. After review of the analyses in the EA and after review of comments received during the public involvement process, a Decision and FONSI were issued selecting the proposed action alternative, which implemented an integrated approach using available methods to reduce predation risks (USDA 2005*b*). Activities conducted under the selected alternatives will also be discussed in this EA to ensure activities are evaluated cumulatively.

WS' Environmental Assessment – Reducing Aquatic Rodent Damage through an Integrated Wildlife Damage Management Program In The Commonwealth Of Virginia: An EA was prepared by WS to evaluate alternatives for the reduction of beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) damage to property, agricultural and natural resources, and threats to public health and safety in the Commonwealth of Virginia (USDA 2000*a*). The EA evaluated the need for WS' activities and the relative effectiveness of five alternatives to meet that proposed need, while accounting for the potential environmental effects of those activities. The proposed action in the EA describes an integrated approach to managing damage associated with beaver and muskrats in which a variety of methods are used or recommended to reduce damage. After consideration of the analysis contained in the EA and review of public comments, a Decision and FONSI for the EA was issued on November 1, 2000. The Decision and FONSI selected the proposed action alternative to implement an integrated damage management program using multiple methods to address adequately the need for beaver and muskrat damage management. After a review of program activities under the proposed action, a new Decision/FONSI was issued on May 2, 2007. Although, beaver and muskrats are not directly addressed in this EA, many of the methods available to meet the need for action described in that EA are similar to methods available under this EA.

WS' Environmental Assessment - Deer Damage Management in the Commonwealth of Virginia: As was stated previously, WS previously developed an EA that addressed WS' activities to manage damage associated with white-tailed deer in the Commonwealth (USDA 2000*b*). Based on the analyses in that EA, a Decision and Finding of No Significant Impact was signed selecting the proposed action alternative. The proposed action alternative implemented a damage management program using a variety of methods in an integrated approach (USDA 2000*b*). Changes in the need for action and the affected environment have prompted WS to initiate this new analysis to address activities to alleviate deer damage in the Commonwealth. This EA will address more recently identified changes and will assess the potential environmental impacts of program alternatives based on a new need for action. Since activities conducted under the previous EA will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EA that addresses deer damage will be superseded by this analysis and the outcome of the Decision issued based on the analyses in this EA. However, information in the need for action section of the previous EA relative to deer continues to be appropriate to the need for action associated with this EA (USDA 2000*b*).

Virginia Deer Management Plan 2006-2015: The VDGIF developed a multi-year plan to guide the management of white-tailed deer in the Commonwealth of Virginia (VDGIF 2007). The plan includes goals that specify the general directions for deer populations, deer habitat, deer damage, and deer-related recreation in Virginia. Activities conducted under the alternatives associated with deer would be considered as those activities relate to the management plan. This consideration would ensure that activities are evaluated cumulatively and damage management objectives coincide with those objectives established by the VDGIF for the deer population in the Commonwealth.

Virginia Black Bear Management Plan 2001-2010. The VDGIF developed a multi-year plan to guide the management of black bears in the Commonwealth (VDGIF 2002). The plan includes goals that specify the general directions for bear population viability, desirable population levels, habitat conservation and management, hunting seasons and demands, ethics of bear hunting methods, landowner and citizen conflicts with bear hunting, non-hunting recreation, and human/bear problems. WS' activities

to reduce black bear damage in the Commonwealth would be conducted in cooperation with the VDGIF to ensure that activities are evaluated cumulatively and management goals/objectives coincide with the VDGIF. A revised Black Bear Management Plan is currently being finalized with an expected completion date of mid-2012. The revised plan will have a new set of goals and objectives in four major categories: Population; Habitat; Recreation; and Human/Bear Problems (J. Sajecki, VDGIF, pers. comm. 2012). The activities that could be conducted pursuant to the alternatives evaluated would be conducted in consideration of the new Plan when released.

1.5 AUTHORITY OF FEDERAL AND COMMONWEALTH AGENCIES

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

WS' Legislative Authority

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

United States Environmental Protection Agency (EPA)

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

Virginia Department of Game and Inland Fisheries Legislative Mandate

The VDGIF, under the direction of the Governor-appointed Board of Directors, is specifically charged by the General Assembly with the management of the Commonwealth's wildlife resources. Although many legal mandates of the Board and the Department are expressed throughout the Code of Virginia, the primary statutory authorities include wildlife management responsibilities (VAC§§29.1-103), public education charges (VAC§§29.1-109), law enforcement authorities (VAC§§29.1-109), and regulatory powers (VAC§§29.1-501). The mission of the VDGIF is:

- To manage Virginia's wildlife and inland fish to maintain optimum populations of all species to serve the needs of the Commonwealth;
- To provide opportunity for all to enjoy wildlife, inland fish, boating and related outdoor recreation and to work diligently to safeguard the rights of the people to hunt, fish and harvest game as provided for in the Constitution of Virginia;
- To promote safety for persons and property in connection with boating, hunting and fishing;
- To provide educational outreach programs and materials that foster an awareness of and appreciation for Virginia's fish and wildlife resources, their habitats, and hunting, fishing, and boating opportunities.

For the purposes of regulating the harvest of mammals in the Commonwealth, the VDGIF establishes annual take limits during hunting and trappings seasons along with the permitting of take to alleviate damage.

1.6 COMPLIANCE WITH LAWS AND STATUTES

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

National Environmental Policy Act

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

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

The NEPA requires federal agencies to incorporate environmental planning into federal agency actions and decision-making processes. The two primary objectives of the NEPA are: 1) agencies must have available and fully consider detailed information regarding environmental effects of federal actions and 2) agencies must make information regarding environmental effects available to interested persons and agencies before decisions are made and before actions are taken.

Endangered Species Act

Under the Endangered Species Act (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)). Evaluation of the alternatives in regards to the ESA will occur in Chapter 4 of this EA.

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

The NHPA and its implementing regulations (36 CFR 800) require federal agencies to initiate the section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further

obligations under section 106. None of the mammal damage management methods described in this EA that might be used operationally by WS would cause major ground disturbance, any physical destruction or damage to property, any alterations of property, wildlife habitat, or landscapes, nor involves the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the alternatives 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 were planned under an alternative selected because of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

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

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 Virginia's Coastal Zone Management Program.

Environmental Justice in Minority and Low Income Populations (Executive Order 12898)

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

WS would use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. All chemicals used by WS and cooperating agencies would be regulated by the

EPA through the FIFRA, by the Virginia Department of Agriculture and Consumer Services (VDACS), by the Drug Enforcement Agency (DEA), by MOUs with land managing agencies, and by WS' Directives. WS would properly dispose of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the alternatives may benefit minority or low-income populations by reducing threats to public health and safety and property damage.

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

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

Invasive Species (Executive Order 13112)

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

The Native American Graves and Repatriation Act of 1990

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

Occupational Safety and Health Act of 1970

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

Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. All chemical methods that would be available for use by WS or could be recommended by WS under any of the alternatives would be registered with and regulated by the EPA and the VDACS, and would be used by WS in compliance

with labeling procedures and requirements. There are several products registered for the control of mammals (fumigants, toxicants, repellents) in the Commonwealth of Virginia listed in Appendix B.

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

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

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

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

Animal Medicinal Drug Use Clarification Act of 1994

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

Possession, Transportation, and Release of Wildlife by Authorized Persons (4 VAC 15-30-50)

Under the Virginia Administrative Code (VAC), "*...U.S. government agencies' employees whose responsibility includes fisheries and wildlife management...will be deemed to be permitted...to capture, temporarily hold or possess, transport, release, and when necessary humanely euthanize wildlife, provided that the methods of and documentation for the capture, possession, transport, release and euthanasia shall be in accordance with board policy.*

Nuisance Species Designated (4 VAC 15-20-160)

Virginia Administrative Code specifically defines 10 species as "*nuisance species*" which may be killed at any time using any method allowed by state and local laws. The nuisance species list includes the following mammals: house mouse, Norway rat (*Rattus norvegicus*), black rat (*Rattus rattus*), coyote, feral hog, nutria, and woodchuck.

Memorandum of Understanding between the VDGIF and WS

A Memorandum of Understanding (MOU) between the VDGIF and WS was developed in 2007 to facilitate the planning, coordination, and implementation of policies developed (1) to prevent or minimize damage caused by wildlife to public and private resources, including T&E species, agriculture, property, and natural resources; (2) to address public health and safety issues associated with wildlife damage and wildlife diseases; (3) to facilitate a regular exchange of information; and (4) to provide a framework for

procedures and authorizations required to conduct wildlife damage management activities in the Commonwealth of Virginia.

1.7 DECISIONS TO BE MADE

Based on agency relationships, MOUs, and legislative authorities, WS is the lead agency for this EA, and therefore, responsible for the scope, content, and decisions made. As the authority for the management of mammal populations in the Commonwealth, the VDGIF 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 VDGIF is responsible for managing wildlife in the Commonwealth, including those mammal species addressed in this EA. The VDGIF establishes and enforces regulated hunting and trapping seasons in the Commonwealth. WS' activities to reduce and/or prevent mammal damage in the Commonwealth would be coordinated with the VDGIF, which ensure WS' actions would be incorporated into population objectives established for mammal populations in the Commonwealth.

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 VDGIF 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 Virginia, 4) if not, should WS attempt to implement one of the alternatives to an integrated damage management strategy as described in the EA, and 5) would the proposed action or the alternatives result in significant effects to the human 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 Virginia wherever those mammals occur. However, mammal damage management would only be conducted by WS when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document were signed between WS and a cooperating entity. Most species of mammals addressed in this EA can be found throughout the year across the Commonwealth where suitable habitat exists for foraging and shelter. Those mammal species addressed in this EA are capable of utilizing a variety of habitats in the Commonwealth. Since those mammals addressed in this EA can be found throughout most of the Commonwealth, requests for assistance to manage damage or threats of damage could occur in areas occupied by those mammal species. Additional information on the affected environment is provided in Chapter 4.

Upon receiving a request for assistance, activities to reduce mammal damage or threats could be conducted on federal, Commonwealth, tribal, municipal, and private properties in Virginia. Areas where damage or threats of damage could occur include, but are not limited to: agricultural fields, vineyards, orchards, farmyards, dairies, ranches, livestock operations, aquaculture facilities, fish hatcheries, grain mills, grain handling areas, railroad yards, waste handling facilities, industrial sites, natural resource

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

Environmental Status Quo

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

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

When a non-federal entity (*e.g.*, agricultural producers, municipalities, counties, private companies, individuals, or any other non-federal entity) takes an action to alleviate mammal damage or threats, 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 even the particular methods that will be used, WS' involvement in the action would not affect the environmental status quo since the entity could take the action in the absence of WS' involvement. WS' involvement would not change the environmental status quo if the requestor had conducted the action in the absence of WS' involvement in the action.

A non-federal entity could lethally take mammals to alleviate damage without the need for a permit when those species are non-native or are designated as a "*nuisance species*" by the Commonwealth (4 VAC 15-20-160). In addition, mammals could be removed to alleviate damage during the hunting and/or trapping season, and/or through the issuance of permits by the VDGIF. In addition, most methods available for resolving damage associated with mammals are available for public use. Therefore, WS' decision-making ability is restricted to one of three alternatives. WS could take the action using the specific methods as decided upon by the non-federal entity, provide technical assistance only, or take no action. If no action is taken by WS, the non-federal entity could take the action anyway using the same methods without the need for a permit, during the hunting or trapping season, or through the issuance of a permit

by the VDGIF. Under those circumstances, WS would have virtually no ability to affect the environmental status quo since the action would likely occur in the absence of WS' direct involvement.

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

2.2 ISSUES ASSOCIATED WITH MAMMAL DAMAGE MANAGEMENT ACTIVITIES

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed action. Such issues must be considered in the NEPA decision-making process. Issues relating to managing damage associated with mammals in Virginia were developed by WS in consultation with the VDGIF along with those issues addressed during the scoping process during the development of the deer damage management EA (USDA 2000*b*). 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 available to resolve damage or threats to human safety under the alternatives are categorized into lethal and non-lethal methods.

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 were employed. Lethal methods would be employed to remove a mammal or those mammals responsible for causing damage or posing threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring. The number of target species removed from the population using lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individuals involved with the associated damage or threat, and the efficacy of methods employed.

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

The effects of damage management activities on the populations of target mammals from implementation of the alternatives addressed in detail, including the proposed action, are analyzed in Chapter 4.

Information on mammal populations and trends are often derived from several sources including the fur harvest reports, damage complaints, ground surveys, aerial surveys, and published literature.

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

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

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

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

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

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

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

Safety of Chemical Methods Employed

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

Immobilizing drugs would include ketamine and telazol which are anesthetics (*i.e.*, general loss of pain and sensation) used during the capture of wildlife to eliminate pain, calm fear, and reduce anxiety in wildlife when handling and transporting wildlife. Xylazine is a sedative that is often used in combination

with ketamine to calm nervousness, irritability, and excitement in wildlife during the handling and transporting of wildlife. Euthanasia chemicals would include sodium pentobarbital, Beuthanasia®-D, Fatal-Plus™ and potassium chloride, which are administered after an animal has been anesthetized.

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

Rodenticides would include products containing the active ingredient zinc phosphide, warfarin, brodifacoum, or diphacinone, which could be used to address damage and threats, associated with those small rodent species addressed in this EA. Rodenticides are pesticides, which require a restricted-use pesticide applicators license from the VDACS. Zinc phosphide when ingested reacts with the acids in the gut releasing phosphine gas, which interferes with cell respiration leading to the death of the animal (EPA 1998). Warfarin, brodifacoum, and diphacinone are anticoagulant rodenticides, which prevents the clotting of blood. Products containing the active ingredients, warfarin, brodifacoum, or diphacinone are currently registered for use in Virginia. Rodenticides containing those active ingredients are generally restricted-use pesticides, which, if available, can be purchased and applied by appropriately licensed people, and are not products that are restricted to use by WS only. Those active ingredients are discussed in this EA as possible methods that could be available under the alternatives, since products are available containing those active ingredients and are registered for use in the Commonwealth.

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

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

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

Safety of Non-Chemical Methods Employed

Non-chemical methods employed to reduce damage and threats to safety caused by mammals, if misused, could potentially be hazardous to human safety. Non-chemical methods may include but are not limited to firearms, live-traps, exclusion, cable restraints, body-gripping traps, pyrotechnics, and other scaring

devices. A complete list of non-chemical methods available to alleviate damage associated with mammals is provided in Appendix B of this EA.

Effects of Not Employing Methods to Reduce Threats to Human Safety

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

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

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). Those include direct benefits related to consumptive and non-consumptive uses, indirect benefits derived from vicarious wildlife related experiences, and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (Bishop 1987). Direct benefits are derived from a personal relationship with animals and may take the form of direct consumptive use (*i.e.*, using parts of or the entire animal) or non-consumptive use (*i.e.*, 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 agencies to teach tolerance for damage and threats caused by wildlife, and that wildlife should never be killed. Some of the people who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. Those human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

Some individuals are offended by the presence of overabundant mammal species, such as raccoons, deer, 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). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

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

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 animals. The AVMA states "*For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible*" (Beaver et al. 2001).

Pain and suffering, as it relates to methods available for use to manage wildlife 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 can cause "*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 decision-making process involves trade-offs between the above aspects of pain and humaneness. Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering.

The issue of humanness and animal welfare concerns will be further discussed in Chapter 4. SOPs to alleviate pain and suffering are discussed in Chapter 3.

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

Another issue commonly identified is a concern that damage management activities conducted by WS would affect the ability of persons to harvest 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 can be hunted or trapped during regulated seasons in the Commonwealth include black bear, bobcat, Eastern cottontail, gray fox, red fox, gray squirrel, raccoon, river otter, striped skunk, Virginia opossum, and white-tailed deer. Feral swine, nutria, coyotes, and woodchucks are considered nuisance species in Virginia and may be killed at any time (except on Sunday) by any method legal under Commonwealth and local laws.

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. 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 VDGIF during the scoping process of this EA. Those additional issues were considered but detailed analyses will not occur for the reasons provided. The following issues were considered:

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 Commonwealth of Virginia would not meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of federal or other regulatory agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to describe accurately such locations or times in an EA or EIS. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage could occur, the program cannot predict the specific locations or times at which affected resource owners would determine a damage problem has become intolerable to the point

that they request assistance from WS. In addition, the WS program would not be able to prevent such damage in all areas where it might occur without resorting to destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and other agencies. Such broad scale population management would also be impractical or impossible to achieve within WS' policies and professional philosophies.

Lead agencies have the discretion to determine the geographic scope of their analyses under the NEPA (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA was to determine if the proposed action would potentially have significant individual and/or cumulative impacts on the quality of the human environment that would warrant the preparation of an EIS. This EA addresses impacts for managing damage and threats to human safety associated with mammals in the Commonwealth 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 Commonwealth would provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. If a determination were made through this EA that the proposed action or the other alternatives might have a significant impact on the quality of the human environment, then an EIS would be prepared. Based on previous requests for assistance, the WS program in Virginia would continue to conduct mammal damage management in a very small area of the Commonwealth 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 Commonwealth. WS operates in accordance with federal and Commonwealth 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 Virginia 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 Commonwealth.

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of the NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss would likely be tolerated by cooperators until the damage reaches a threshold where the damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations.

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

criterion such as a percentage of loss of a particular resource to justify the need for damage management actions.

Mammal Damage Management Should Not Occur at Taxpayer Expense

An issue identified 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 damage management activities would be derived from federal appropriations and through cooperative funding. Activities conducted in the Commonwealth for the management of damage and threats to human safety from mammals would be funded through cooperative service agreements with individual property owners or managers. A minimal federal appropriation is allotted for the maintenance of a WS program in Virginia. The remainder of the WS program would mostly be fee-based. Technical assistance would be provided to requesters as part of the federally funded activities, but the majority of direct assistance in which WS' employees perform damage management activities would be funded through cooperative service agreements between the requester and WS.

Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with the NEPA. Consideration of this issue is not essential to making a reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce damage and threats to human safety caused by mammals and that prove to be the most cost effective would likely receive the greatest application. As part of an integrated approach and as part of the WS Decision Model, evaluation of methods would continually occur to allow for those methods that 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. The effectiveness can also be dependent upon how accurately practitioner's diagnosis the problem, the species responsible for the damage, and 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. The most effective approach to resolving any wildlife damage problem is to use an adaptive integrated approach, which may call for the use of several management methods simultaneously or sequentially (Courchamp et al. 2003).

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

The goal would be to reduce damage, risks, and conflicts with wildlife as requested and not to reduce/eliminate populations. Localized population reduction could be short-term with new individuals

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

immigrating into the area or born to animals remaining at the site (Courchamp et al. 2003). The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels does not mean individual management actions were unsuccessful, but that periodic management may be necessary. The return of wildlife to pre-management levels also demonstrates that limited, localized damage management methods have minimal impacts on species' populations.

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

Therefore, any method that disperses or removes mammals from areas would only be temporary if habitat containing preferred habitat characteristics continues to exist. Dispersing mammals using non-lethal methods addressed in Appendix B often requires repeated application to discourage mammals from returning to locations, which increases costs, moves mammals to other areas where they could cause damage, and would be temporary if habitat conditions that attracted those mammals to damage areas remained unchanged. Dispersing and translocating mammals could be viewed as moving a problem from one area to another, which would require addressing damage caused by those mammals at another location, which increases costs and could be perceived as creating a financial incentive to continue the use of those methods since mammals would have to be addressed annually and at multiple locations. WS' recommendation of or use of techniques to modify existing habitat or making areas unattractive to mammals is discussed in Appendix B. WS' objective would be to respond to 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 management approaches. Short-term approaches focus on redistribution and dispersal of mammals to limit use of an area where damage or threats were occurring. Short-term redistribution approaches may include prohibiting feeding, the use of pyrotechnics, propane cannons, effigies, and other adverse noise, erecting access barriers such as fencing, and taste aversion chemicals. Population reduction by limiting survival or reproduction, removing mammals, and habitat modification would be considered long-term solutions to managing damage.

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 is often a short-term solution that moves those mammals to other areas where damages or threats could occur. Some short-term methods may become less effective in resolving damage as a mammal population increases, as mammals become more acclimated to human activity, and as mammals become habituated to harassment techniques. Non-lethal methods often require a constant presence at locations when mammals are present and must be repeated every day or night until the desired results are achieved, which can increase the costs associated with those activities. Non-lethal methods may also require constant monitoring and maintenance to insure proper results. For example, fencing could be used to prevent access to a resource; however, constant monitoring of the fencing would be required and

necessary repairs completed to ensure the use of fencing would be successful in preventing access to resources. Long-term solutions to resolving mammal damage often require management of the population and identifying the habitat characteristics that attract mammals to a particular location.

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

Mammal Damage Should Be Managed By Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce mammal damage for property owners or property managers 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 enter into an agreement with a government agency. In particular, those persons seeking assistance may prefer to use WS because of security and safety issues. WS further clarifies interfacing with private business and establishing cooperative projects in WS Directive 3.101.

Effects from the Use of Lead Ammunition in Firearms

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

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

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a mammal, if misses occur, or if the mammal carcass was not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns occur that lead from bullets deposited in soil from shooting activities could lead to contamination of water, ground water or surface water, from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "*transport*" readily in surface water when soils were neutral or slightly alkaline in pH (*i.e.*, not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in

the shot "*fall zones*" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot. Stansley et al. (1992) believed the lead contamination near the parking lot was due to runoff from the lot, and not from the shooting range areas. The study also indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead levels in water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

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

Since the take of mammals can occur during regulated hunting seasons, through the issuance of kill permits by the VDGIF, or without the need to obtain a permit for take if those species are considered a "*nuisance species*", WS' assistance with removing mammals would not be additive to the environmental status quo. WS' assistance 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 could be lowered by WS' involvement in damage management activities due to efforts by WS to ensure projectiles do no pass through but are contained within the mammal carcass, which limits the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS' employees in firearm use and accuracy would increase the likelihood that mammals were lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS' involvement ensures mammal carcasses lethally removed using firearms would be retrieved and disposed of properly to limit the availability of lead in the environment and ensures mammal carcasses were removed from the environment to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that could be deposited into the environment from WS' activities due to misses, the bullet passing through the carcass, or from mammal carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water.

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

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

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

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

Effects on Urban Landscaping and Natural Resources from Deer Damage Management

During the development of the previous deer damage management EA by WS, one issue identified was the potential effects on urban landscaping and natural resources from the management of deer damage (USDA 2000*b*). Many property owners experience substantial damage to landscaping and vegetation from deer. Those people are concerned about reducing such damage to more acceptable levels. Some people are also concerned that high deer populations cause excessive damage to the native vegetation and subsequently adversely affect the natural ecosystem and other species of wildlife whose habitat is destroyed by deer over-browsing (USDA 2000*b*). Reducing damage to landscaping and eliminating or substantially reducing the problem of overbrowsing by deer on native vegetation would reduce the adverse effects on other wildlife species (*e.g.*, neotropical migrant songbirds and small mammals) that depend upon the understory vegetative habitat destroyed by deer browsing (Casey and Hein 1983, DeCalesta 1994, DeCalesta 1997, VDGIF 2007).

Based on the analyses in the previously developed deer damage management EA, the application of damage management methods under any of the alternatives would provide some benefit to property owners and resource managers by reducing deer damage (USDA 2000*b*). Therefore, this issue was not analyzed in detail.

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

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

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

consumption and would be disposed of by deep burial or incineration. WS' adherence to policy would not result in adverse effects to human health from the donation of deer meat.

CHAPTER 3: ALTERNATIVES

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

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

The proposed action/no action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by mammals in Virginia. A major goal of the program would be to resolve and prevent mammal damages and to reduce threats to human safety. To meet this goal, WS, in consultation with the VDGIF, would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding was available, operational damage management. Funding could occur through federal appropriations or from cooperative funding.

The adaptive approach to managing damage associated with mammals would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by 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. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). WS would work with those persons experiencing mammal damage in addressing those mammals responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as mammals begin to cause damage. Mammal damage that has been ongoing can be difficult to resolve using available methods since mammals would be conditioned to an area and would be familiar with a particular location. Subsequently, making that area unattractive using available methods could be difficult to achieve once damage was ongoing. WS would work closely with those entities requesting assistance to identify situations where damage could occur and begin to implement damage management activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of damage reduction requested by the cooperating entity.

Under this alternative, WS would 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) provide technical assistance and direct operational assistance to a property owner or manager experiencing damage. The take of many of the mammal species native to Virginia can only legally occur through regulated hunting and trapping seasons or through the issuance of a permit by the VDGIF and only at levels specified in the permit. Under the Virginia Administrative

Code (4 VAC 15-20-160), certain species are designated as "*nuisance species*" that may be killed at any time and in any manner allowed by Commonwealth and local laws. Those designated nuisance species that are addressed in this EA include the following mammals: house mice, feral swine, coyotes, woodchucks, and nutria. Under the Virginia Administrative Code (4 VAC 15-30-50), the "*...U.S. government agencies' employees whose responsibility includes fisheries and wildlife management...will be deemed to be permitted...to capture, temporarily hold or possess, transport, release, and when necessary humanely euthanize wildlife, provided that the methods of and documentation for the capture, possession, transport, release and euthanasia shall be in accordance with board policy*." Activities conducted under this alternative would occur in compliance with the Virginia Administrative Code and the MOU signed between the VDGIF and WS.

Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical non-lethal and/or lethal techniques under this alternative. 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 without consulting another private entity or governmental agency, or take no action.

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

Non-lethal methods that would be available for use by WS under this alternative include, but are not limited to minor habitat modification, behavior modification, visual deterrents, live traps, translocation, exclusionary devices, frightening devices, immobilizing drugs, reproductive inhibitors, and chemical repellents. Lethal methods that would be available to WS under this alternative include live-capture followed by euthanasia, body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, rodenticides, 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 had already attempted to alleviate damage using non-lethal methods, WS would not necessarily employ those same non-lethal methods since those methods were proven ineffective.

A complete list of chemical and non-chemical methods available for use under the identified alternatives, except the alternative with no damage management by WS (Alternative 3), can be found in Appendix B. Many of the methods available under this alternative would also be available under the other alternatives. As part of an integrated approach, WS may provide technical assistance and direct operational assistance to those people experiencing damage associated with mammals.

Technical Assistance Recommendations

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

in Alternative 2 of this EA. From FY 2006 through FY 2011, WS has conducted 2,455 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 were directly conducted by or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and there was a written MOU, cooperative service agreement, or other comparable document signed between WS and the entity requesting assistance. The initial investigation by WS personnel would define the nature, history, and extent of the problem; species responsible for the damage; and methods available to resolve the problem. The professional skills of WS' personnel could be required to effectively resolve problems, especially if chemicals were necessary or if the problems were complex.

Educational Efforts

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

Research and Development

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

WS' Decision Making Procedures

WS' personnel would use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model (WS Directive 2.201) and described by Slate et al. (1992). WS' personnel would assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed practical for the situation would be incorporated into a damage management strategy. After this strategy was implemented, monitoring would be conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy were effective, the need for further management would be ended. In terms of the WS Decision Model, most efforts to resolve wildlife damage consist of continuous feedback between receiving the request and monitoring the results of the

damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS.

Community-based Decision Making

WS could receive requests for assistance from community leaders and/or representatives. In those situations, the WS program in Virginia, under this alternative, would follow the "*co-managerial approach*" to solve wildlife damage or conflicts as described by Decker and Chase (1997) when receiving a request for assistance from a community leader or representative. Under a community based decision-making process, WS would provide information, demonstration, and discussion on available methods to the appropriate representatives of the community for which services were requested to ensure a community-based decision was made. By involving decision-makers in the process, damage management actions could be presented to allow decisions on damage management to involve those individuals that the decision-maker(s) represents. As addressed in this EA, WS would provide technical assistance to the appropriate decision-maker(s) to allow for information on damage management activities to be presented to those persons represented by the decision-maker(s), including demonstrations and presentation by WS at public meetings to allow for involvement of the community. Requests for assistance to manage damage caused by mammals often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives of the community, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on damage management activities. This process allows decisions on damage management activities to be made based on local input. The community leaders 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.

Community Decision-Makers

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

Private Property Decision-Makers

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

Public Property Decision-Makers

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

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

Under this alternative, WS would provide those cooperators requesting assistance with technical assistance only. Similar to Alternative 1, WS could receive requests for assistance from community representatives, private individuals/businesses, or from public entities. Technical assistance would provide those cooperators experiencing damage or threats associated with mammals with information, demonstrations, and recommendations on 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.

Under a technical assistance only alternative, WS would recommend an integrated approach similar to the proposed action alternative (Alternative 1) when receiving a request for assistance; however, WS would not provide direct operational assistance under this alternative. Preference would be given to non-lethal methods when practical and effective under this alternative (see WS Directive 2.101). Recommendation of methods and techniques by WS to resolve damage would be based on information provided by the individual seeking assistance using the WS Decision Model. Generally, several management strategies would be described to the requester for short and long-term solutions to managing damage; those strategies would be based on the level of risk, need, and the practicality of their application. 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.

In some instances, wildlife-related information provided to the requestor by WS would result in tolerance/acceptance of the situation. In other instances, damage management options would be discussed and recommended. Only those methods legally available for use by the appropriate individual would be recommend or loaned by WS. Similar to Alternative 1, those methods described in Appendix B would be available to those persons experiencing damage or threats associated with mammals in the Commonwealth except for Gonacon™, immobilizing drugs, and euthanasia drugs. Gonacon™ would only be available to WS and the VDGIF, while immobilizing drugs and euthanasia drugs would only be available to WS or appropriately licensed veterinarians.

The WS program in the Commonwealth regularly provides technical assistance to individuals, organizations, and other federal, Commonwealth, 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 2011, WS has conducted 2,455 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, Commonwealth, and local laws and regulations or those persons could take no action.

Alternative 3 – No Mammal Damage Management Conducted by WS

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

Despite no involvement by WS in resolving damage and threats associated with mammals in the Commonwealth, those persons experiencing damage caused by mammals could continue to resolve damage by employing those methods legally available since the take of mammals to alleviate damage or threats can occur despite the lack of involvement by WS. The take of mammals by other entities could occur through the issuance of permits by the VDGIF, when required, and during the hunting or trapping seasons. House mice, feral swine, coyotes, woodchucks, and nutria are considered nuisance species in the Commonwealth and can be lethally taken at any time and by any method that is legal under state and local laws (4 VAC 15-20-160). All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of Gonacon™, immobilizing drugs, and euthanasia chemicals. Gonacon™ is not registered for use in Virginia and if registered would only be available for use by WS and the VDGIF. Immobilizing drugs and euthanasia chemicals would 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 VDGIF and/or other entities, the requester could contact other entities for information and assistance with managing damage, could take actions to alleviate damage without contacting any entity, or could take no action.

3.2 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

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

Non-lethal Methods Implemented Before Lethal Methods

This alternative would require that non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce damage and threats to safety from mammals in the Commonwealth. If the use of non-lethal methods fails to resolve the damage situation or reduce threats to human safety at each damage situation, lethal methods would be employed to resolve the request. Non-lethal methods would be applied to every request for assistance regardless of severity or intensity of the damage or threat until deemed inadequate to resolve the request. This alternative would not prevent the use of lethal

methods by those persons experiencing mammal damage but would only prevent the use of those methods by WS until non-lethal methods had been employed.

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

Use of Non-lethal Methods Only by WS

Under this alternative, WS would be required to implement non-lethal methods only to resolve damage caused by mammals in the Commonwealth. 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 or by other entities. The non-lethal methods used or recommended by WS under this alternative would be identical to those non-lethal 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 VDGIF, local animal control agencies, or private businesses or organizations. Under this alternative, however, property owners/managers might be limited to using non-lethal methods only as they may have difficulty obtaining permits for lethal methods.

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

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

Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce threats and damage associated with mammals. However, non-lethal methods can be effective in preventing damage in certain instances. Under WS Directive 2.101, WS must consider the use of non-lethal methods before lethal methods. Non-lethal methods have been effective in alleviating mammal damage. For example, the use of one-way exclusion devices can be effective at allowing bats to exit a structure but prevent re-entry. Once bats have exited the structure, structural repairs could be completed to permanently prevent re-entry of bats. In those situations where damage could be alleviated using non-lethal methods deemed effective, those

methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Trap and Translocate Mammals Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Mammals would be live-captured using immobilizing drugs, live-traps, or nets (*e.g.* cannon nets, rocket nets, or drop 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 VDGIF and/or the property owner where the translocated mammals would be placed prior to live-capture and translocation. The translocation of mammals by WS could occur under any of the alternatives analyzed in detail, except Alternative 3. However, translocation by other entities could occur under Alternative 3.

The translocation of mammals that have caused damage to other areas following live-capture generally would not be effective or cost-effective. Translocation is generally ineffective because problem mammal species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in mammal damage problems at the new location. Also, hundreds of mammals would need to be captured and translocated to solve some damage problems (*e.g.*, deer confined within a perimeter fence); therefore, translocation would be unrealistic. Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988). There is also a concern of spreading wildlife diseases by moving wildlife from one location to another. For these reasons, this alternative was not considered in detail.

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

Under this alternative, the only method that would be available to resolve requests for assistance by WS would be the recommendation and the use of reproductive inhibitors to reduce or prevent reproduction in mammals responsible for causing damage. Reproductive inhibitors are often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et al. 1997). Use and effectiveness of reproductive control as a 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 through either sterilization (permanent) or contraception (reversible). Sterilization could be accomplished through: 1) surgical sterilization (vasectomy, castration, and tubal ligation), 2) chemosterilization, and 3) through gene therapy. Contraception could be accomplished through: 1) hormone implantation (synthetic steroids such as progestins), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily).

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

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

Compensation for Mammal Damage

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

Short Term Eradication and Long Term Population Suppression

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

Suppression would direct WS' program efforts toward managed reduction of certain problem populations or groups. In areas where damage can be attributed to localized populations of mammals, WS could decide to implement local population suppression using the WS' Decision Model. However, it is not realistic or practical to consider large-scale population suppression as the basis of the WS' program. Problems with the concept of suppression are similar to those described above for eradication. Typically, WS' activities in Virginia 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 Commonwealth agencies, such as VDGIF, as well as most wildlife professionals for many years (Latham 1960, Hoagland 1993). WS concurs with those agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties. Bounties are often ineffective at controlling damage over a wide area, such as the entire Commonwealth. The circumstances surrounding the take of animals are typically arbitrary and completely unregulated because it is difficult or impossible to assure animals claimed for bounty were not taken from outside the area where damage was occurring. In addition, WS does not have the authority to establish a bounty program.

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

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

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

In addition, the National Association of State Public Health Veterinarians and the AVMA oppose TNR programs based on health concerns and threats (AVMA 2003). Of major concern would be the potential for disease and parasite transmission to humans from direct contact during sterilization or the risk of exposure after the animal was released. Once live-captured, performing sterilization procedures during field operations on anesthetized feral animals 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 animals would need to be transported from the capture site to an appropriate facility, which increases the threat from handling and transporting. A mobile facility could be used; however, a mobile facility would still require additional handling and transporting of the live-captured feral animals to the facility. Once the surgical procedure was completed, the feral animal would have to be held to ensure recovery and transported back to the area 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 2004, Barrows 2004, Levy and Crawford 2004, Jessup 2004, Winter 2004, AVMA 2009). Feral animals subjected to TNR would continue to cause the same problems[9] they caused before the TNR program was initiated because of slow attrition. TNR programs can take a decade or longer to reduce target species populations (Barrows 2004, Winter 2004); especially, acute issues that 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).

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

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

Use of Regulated Hunting and Trapping as a Management Tool

Sport hunting and trapping by private individuals regulated by wildlife management agencies can be an effective population management tool and can be one of the most efficient and least expensive techniques for managing populations over broad areas. However, regulated hunting with firearms and trapping is often not allowed where safety is a concern and due to local ordinances. In agricultural areas, regulated hunting and trapping may not reduce the wildlife populations sufficiently to reduce damage or the regulated hunting or trapping season may not coincide with seasonal damage (*e.g.*, hunting normally occurs after the period when harvest of the agricultural crops occur). Additionally, airports are often not accessible to the public for hunting and trapping.

In urban and suburban areas where traditional hunting with firearms is not applicable because of public safety concerns, hunting laws, and local ordinances restricting the use of firearms, archery hunting may provide an alternative method for managing wildlife populations. Archery hunting may be used as an effective management tool to reduce urban deer populations (Kilpatrick and Walter 1999). However, it may be difficult to remove a sufficient number of deer using archery hunting alone. Ver Steeg et al. (1995) found that a controlled archery hunt did not sufficiently reduce the deer population in a suburban park in Illinois. Although some deer were removed by archery hunters, sharpshooting was used after the archery hunts were completed to ensure that the annual deer herd reduction goals were reached. Sharpshooting was nearly twice as efficient as archery hunting, with an overall removal rate of 3.76 deer per day for sharpshooting and 1.95 deer per day for archery hunting (Ver Steeg et al. 1995).
None of the alternatives analyzed in detail would prevent regulated hunting and trapping. WS could recommend, when appropriate, that hunting and/or trapping be allowed by the resource owner or manager on property they own or manage where damages were occurring or could occur under Alternative 1 and Alternative 2. However, allowing hunting and/or trapping would be the decision of the owner or manager of the property. Since WS does not have the ability to require hunting and/or trapping on properties to resolve damage, this alternative was not analyzed in detail.

Supplemental Feeding

Supplemental feeding would involve providing acceptable foods (*e.g.*, corn or a balanced ration diet) either during certain annual periods when damage is most severe, or on a year-round basis. This alternative was not considered because of the increased costs for supplemental feed and the potential for increasing the occurrence of damage to property, agricultural and natural resources, and threats to human health and safety by attracting wildlife to the area. Additionally, supplemental feeding may result in the spread of disease among mammal populations. The congregation of mammal at feeding locations and contact between other mammals at feeding sites may increase the transmission of diseases, such as tuberculosis in deer (Williamson 2000). In Virginia, feeding of deer is prohibited from September 1 through the first Saturday in January (4VAC15-40-285); however, the feeding of deer is prohibited throughout the year in Clarke, Frederick, Shenandoah, and Warren Counties and in the City of Winchester as part of the chronic wasting disease management plan developed by the VDGIF.

3.3 STANDARD OPERATING PROCEDURES FOR MAMMAL DAMAGE MANAGEMENT

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- Management actions would be directed toward localized populations or groups of target species and/or an individual of those species. Generalized population suppression across Virginia, or even across major portions of Virginia, would not be conducted.

- Non-target animals 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 VDGIF to evaluate population trends and the magnitude of WS' take of mammals in the Commonwealth.

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

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

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

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

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

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

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

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

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

- Personnel would be present during the use of live-capture methods or live-traps would be checked at least once a day or in accordance with Virginia laws and regulations. This would help ensure non-target species were released in a timely manner or were prevented from being captured.

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

- WS has consulted with the USFWS and the VDGIF to evaluate activities to resolve mammal damage and threats to ensure the protection of T&E species. WS would monitor the list of T&E species found in the Commonwealth through the USFWS' online project review system[10] to ensure that newly listed species would not be adversely affected by program activities.

- 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.

[10] At the time this EA was developed, the online project review system can be found at http://www.fws.gov/northeast/virginiafield/endspecies/Project_Reviews_Introduction.html

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. Most 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), if possible.

- Shooting would be conducted professionally and in the safest manner possible. When feasible, shooting would be conducted during times 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 VDACS, as appropriate.

- WS would adhere to all established withdrawal times for mammals when using immobilizing drugs for the capture of mammals that are agreed upon by WS, the VDGIF, 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 was 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 or mark the animal with ear tags labeled with a "*do not eat*" warning and appropriate contact information.

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

- House mice, feral cats, feral dogs, nutria, and feral swine are non-native, invasive species in the Commonwealth that can cause harm to native flora and fauna. Any reduction in those populations could be viewed as benefiting the aesthetic value of a more native ecosystem.

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

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

- WS' personnel would be present during the use of all live-capture methods or would check those methods at least once a day 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 (see WS Directive 2.505, WS Directive 2.430).

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

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

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

- Management actions to reduce or prevent damage caused by mammals in the Commonwealth 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 VDGIF.

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

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

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 Commonwealth 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. These resources will not be analyzed further.

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

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative in comparison to determine the extent of actual or potential impacts on the issues. Therefore, the proposed action/no action alternative

(Alternative 1) serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS and the VDGIF.

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 VDGIF to ensure activities are within management objectives for those species. WS would submit annual activity reports to the VDGIF. The VDGIF would monitor the total take of mammals from all sources and would factor in survival rates from predation, disease, and other mortality data. Ongoing contact with the VDGIF would assure local, Commonwealth, and regional knowledge of wildlife population trends would be considered.

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

Methods available to address mammal damage or threats of damage in the Commonwealth that would be available for use or recommendation under Alternative 1 (proposed action/no action alternative) and Alternative 2 (technical assistance only alternative) are either lethal methods or non-lethal methods. Many of the methods would also be available to other entities under Alternative 3 (no WS involvement alternative). The only methods that would not be available for use by other entities under Alternative 2 and Alternative 3 would be immobilizing drugs, euthanasia drugs, and Gonacon™. 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 that would be available to WS under Alternative 1 would include, but would not be limited to habitat/behavior modification, pyrotechnics, visual deterrents, live traps, translocation, cable restraints, exclusionary devices, frightening devices, nets, immobilizing drugs, and chemical repellents (see Appendix B for a complete list and description of potential methods).

The alternatives discussed in Chapter 3 were developed in response to the issues identified in Chapter 2 while meeting the need for action identified in Chapter 1. The issue of the potential impacts of conducting the alternatives on the populations of those mammal species addressed in this assessment is analyzed for each alternative below.

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

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

The issue of the effects on target mammal species arises from the use of non-lethal and lethal methods to address the need for reducing damage and threats. Methods employed in an integrated approach to reduce damage and threats are categorized into non-lethal and lethal methods. As part of an integrated approach

to managing damage and threats, WS could apply both lethal and non-lethal methods when requested by those persons experiencing damage.

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

Many non-lethal methods would be used to excluded, harass, and disperse target wildlife from areas where damage or threats were occurring. When effective, non-lethal methods would disperse mammals from the area resulting in a reduction in the presence of those mammals at the site where those methods were employed. However, mammals responsible for causing damage or threats would be dispersed to other areas with minimal impact on those species' populations. Non-lethal methods 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 Commonwealth under any of the alternatives.

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

In addition to non-lethal methods that could be used to disperse, exclude, or harass wildlife, another non-lethal method available could be the reproductive inhibitor Gonacon™. Scientists with the NWRC have developed GonaCon™, a new single dose immunocontraceptive vaccine. Recent studies have demonstrated the efficacy of this single-shot Gonadotropin-releasing hormone (GnRH) vaccine on California ground squirrels, Norway rats, feral cats and dogs, feral swine, wild horses, and white-tailed deer. Infertility among treated female swine and white-tailed deer lasted up to two years without requiring a booster vaccination (Miller et al. 2000). This vaccine overcomes one of the major obstacles of previous two dose vaccines which is the need to only capture an animal once for vaccination. A single-injection vaccine is much more practical as a field delivery system for use on free-ranging animals.

GonaCon™ was officially registered by the EPA in 2009 for use in reducing fertility in female white-tailed deer under EPA registration number 56228-40. GonaCon™ is registered as a restricted-use pesticide available for use by WS' personnel and personnel of a state wildlife management agency or persons under their authority. Additionally, in order for GonaCon™ to be used in any given state, the product must also be registered with the state and approved for use by the appropriate state agency responsible for managing wildlife. GonaCon™, when injected into the body, elicits an immune response that neutralizes the GnRH hormone being produced naturally by deer. The GnRH hormone in deer stimulates the production of other sexual hormones, which leads to the body reaching a reproductive state.

The vaccine neutralizes the GnRH hormone being produced which then prevents the production of other sexual hormones in the deer vaccinated; thereby, preventing the body of the deer from entering into a reproductive state (USDA 2010).

The reproductive inhibitor Gonacon™ is currently not registered for use in Virginia. However, it is discussed in this assessment to evaluate the potential use of the chemical if it becomes registered for use in the future. Gonacon™ has been classified as a restricted-use pesticide by the EPA. Restricted-use pesticides can only be purchased and/or applied by those persons who have successfully completed an applicators course to use restricted-use pesticides. The VDACS administers training and testing required for applicators to purchase and apply restricted-use pesticides in the Commonwealth. Except for federal, Commonwealth, or local government employees in the performance of their official wildlife management duties, written authorization is required from the VDGIF to administer drugs and/or chemical substances to wildlife (Code of Virginia, §29.1-508.1). Gonacon™ could be employed by WS and the VDGIF, if registered for use in the Commonwealth, under Alternative 1. Only the VDGIF could use Gonacon™ if Alternative 2 or Alternative 3 were selected.

In addition to non-lethal methods, lethal methods would also be available for use under all the alternatives by WS and/or by other entities. Lethal methods available to WS to address mammal damage under Alternative 1 would include live-capture followed by euthanasia, shooting, body-gripping traps, fumigants, toxicants, cable restraints, and the recommendation of hunting and/or trapping, where appropriate. Lethal methods would be employed by WS under Alternative 1 to resolve damage only after receiving a request for the use of those methods. Those same methods would also be available for WS to recommend and for other entities to use under Alternative 2. Under Alternative 3, those same lethal methods would continue to be available for use by other entities despite the lack of involvement by WS in damage management activities.

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 or recommended 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 by WS from the population using lethal methods under Alternative 1 would be dependent on the number of requests for assistance received, the number of mammals involved with the associated damage or threat, and the efficacy of methods employed. The number of mammals removed by other entities under Alternative 2 and Alternative 3 would be unknown but would likely be similar to the take that occurred pursuant to Alternative 1.

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

Often of concern with the use of lethal methods is that mammals that were lethally taken would only be replaced by other mammals either during the application of those methods (*e.g.*, mammals that relocate into the area) or by mammals the following year (*e.g.*, increase in reproduction and survivability that could result from less competition). As stated previously, WS would not use lethal methods during direct operational assistance as population management tools over broad areas. Lethal methods would be

employed under this alternative to reduce the number of mammals present at a location where damage was occurring by targeting those mammals causing damage or posing threats. Since the intent of lethal methods would be to manage those mammals causing damage and not to manage entire mammal populations, those methods are not ineffective because mammals return the following year.

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

WS may recommend that property owners or managers, that request assistance, allow mammals to be harvested during the regulated hunting and/or trapping season for those species in an attempt to reduce the number of mammals causing damage on their properties. Managing 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 VDGIF. WS does not have the authority to establish hunting or trapping seasons or to set allowed harvest numbers during those seasons. However, the harvest of those mammals during hunting and/or trapping seasons in the Commonwealth would be occurring in addition to any take that could occur by WS under the alternatives or recommended by WS.

WS would maintain ongoing contact with the VDGIF to ensure activities occur within management objectives for those species with hunting and/or trapping seasons. WS would submit annual activity reports to the VDGIF. The VDGIF would monitor the total take of mammals from all sources and factor in survival rates from predation, disease, and other mortality data. Ongoing contact with the VDGIF would assure local, Commonwealth, and regional knowledge of wildlife population trends were considered.

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

Virginia Opossum Population Information and Effects Analysis

Opossums are the only marsupials (*i.e*., animals that 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 4 to 20 ha (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 1 to 17 young born in an embryonic state which climb up the mothers belly to the marsupium (pouch), attach to teats, and begin to suckle (Gardner 1982, National Audubon Society 2000). Those young remain in the pouch for about two months. After two months, the young begin to explore and may be found traveling on their mother's back with their tails grasping hers (Whitaker, Jr., and Hamilton, Jr. 1998). Opossums live for only one to two years, with as few as 8% of a population of those animals surviving into the second year in a study in Virginia conducted by Seidensticker et al. (1987). In the five-year study conducted by Seidensticker et al. (1987), there was a wide variation in opossum numbers in what was considered excellent habitat for the species. Those variations were observed seasonally and in different years. However, the mean density during the study was 10.1 opossum per square mile with a range of 1.3 opossum per square mile to 20.2 opossum per square mile (Seidensticker et al. 1987). This was comparable to other opossum population densities in similar habitats in Virginia. Verts (1963) found a density estimate of 10.1 opossum per square mile in farmland areas in Illinois while Wiseman and Hendrickson (1950) found a density of 6.0 opossum per square mile in mixed pasture and woodlands in Iowa. However, VanDruff (1971) found opossum densities in waterfowl nesting habitat as high as 259 opossum per square mile.

Opossum are common throughout Virginia in appropriate habitat. Population estimates for opossum in the Commonwealth 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 Commonwealth of Virginia covers 42,775 square miles with 39,491 square miles being land area (United States Census Bureau 2012). If opossum were only found on 50% of the land area of the Commonwealth and using a mean density of 10.1 opossum per square mile found by Seidensticker et al. (1987) in Virginia, the population would be estimated at nearly 200,000 opossum. Using the range of opossum densities found by Seidensticker et al. (1987) of 1.3 opossum per square mile to 20.2 opossum per square mile and only 50% of the land area of the Commonwealth being occupied by opossum, the statewide population would range from a low of 26,000 opossum to a high of nearly 400,000 opossum. Under a separate analysis to evaluate activities to manage predation losses to native bird populations on the barrier and Chesapeake Bay islands and coastal areas of the Commonwealth of Virginia (USDA 2005*a*), WS estimated the statewide population at 427,493 opossum based on a mean density of 10.1 opossum per square mile and opossum occupying the entire land area of the Commonwealth. Therefore, for this analysis the opossum population in Virginia may range from a low of 26,000 to a high of 400,000 opossum.

Opossum can be found in a variety of habitats, including urban areas, so opossum occupying only 50% of the land area of the Commonwealth 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 furbearing species in the Commonwealth and can be harvested during annual hunting and trapping seasons (VDGIF 2012). During the development of the EA, opossum could be harvested during hunting and trapping seasons with no limit on the number that could be taken during those seasons. In addition, opossum can be lethally taken in the Commonwealth when causing damage or posing a threat of damage when permitted by the VDGIF. According to hunter survey data and fur dealer pelt transaction reports, a total of 6,008 opossum were harvested in Virginia from 2006 through 2010 (M.

Fies, VDGIF, pers. comm. 2011); however, the total number of opossum taken to reduce damage is unknown. The exact number of opossum harvested in the Commonwealth from 2006 through 2010 is unknown since the harvest total was based on pelt transactions and hunter survey data. Pelt transactions only reflect the number of opossum pelts sold in the Commonwealth and not all opossum taken during the hunting and/or trapping season are likely sold in the Commonwealth. In addition, harvest data only reflects information and data gathered from surveys and may not reflect the exact number of opossum harvested. Based on a total harvest of 6,008 opossum from 2006 through 2010, the annual harvest has averaged 1,202 opossum per year.

WS also provides assistance with reducing predation on native bird species on the barrier and Chesapeake Bay islands and coastal areas of Virginia. Those activities are covered under separate environmental analyses (USDA 2005*a*) but are discussed in this EA to evaluate the potential cumulative impacts from those activities and activities addressed under this alternative.

As part of damage management activities conducted by WS in the Commonwealth, including reducing threats to T&E species, 513 opossum have been lethally taken by WS from FY 2006 through FY 2011 (361 target take; 152 non-target take). On average, WS has lethally removed 86 opossum annually from FY 2006 through FY 2011 to alleviate damage and threats in the Commonwealth. In addition, WS has purposefully live-captured and released nine opossum from FY 2006 through FY 2011 with an additional 518 opossum live-captured unintentionally during other damage management activities and released unharmed. Based on previous requests for assistance received by WS and in anticipation of additional requests for assistance, WS could lethally remove up to 200 opossum annually in the Commonwealth as part of efforts to reduce or eliminate damage under the proposed action alternative. Based on a statewide population ranging from 26,000 opossum to 400,000 opossum, the lethal take of up to 200 opossum annually by WS under the proposed action alternative, would represent 0.1% to 0.8% of the estimated population.

The EA developed by WS analyzing activities to alleviate predation risks of T&E species estimated that WS could lethally remove up to 50 opossum annually in the Commonwealth to alleviate predation risks (USDA 2005*a*). Therefore, the cumulative take of opossum by WS could reach 250 opossum lethally removed annually. Using a population estimated at 200,000 opossum, the cumulative take of 250 opossum would represent 0.1% of the statewide population. Given the range of population estimates in the Commonwealth as stated above, the cumulative take of up to 250 opossum by WS annually would represent 0.1% to 1.0% of the estimated statewide population, if the overall population remains at least stable. If the total take by WS of 250 opossum were combined with the average number of opossum harvested in the Commonwealth from 2006 through 2010 estimated at 1,202 opossum, the combined take would represent 5.6% of a population estimated at 26,000 opossum and 0.4% of a population estimated at 400,000 opossum. If the statewide population were 200,000 opossum, the combined take would represent 0.7% of the population.

Although the total number of opossum lethally taken in the Commonwealth 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 250 opossum annually by WS, would be of a low magnitude when compared to the statewide population. The unlimited harvest allowed by the VDGIF during the harvest seasons provides an indication that population densities of opossum in the Commonwealth are sufficient that overharvest is not likely to occur, including lethal take to alleviate or prevent damage. In addition, the live-capture and subsequent release of opossum would not likely result in adverse effects to the statewide population since those animals would be released unharmed.

Black Bear Population Information and Effects Analysis

The American black bear is the smallest and most widely distributed of the three North American bear species (Pelton 1982). This species is a compact, heavily structured mammal with relatively massive legs and feet. Adult male black 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 frequently, a white V-shape across the throat or chest (Novak et al. 1987). Black bears mate in June and July and sow (female) bears produce litters that average between one and five, with the average number of cubs being two. Although black bears are primarily nocturnal, they may be seen at any time. They occupy ranges of 20 to 25 km^2 (8 to 10 mi^2), and sometimes up to 40 km^2 (15 mi^2). The home range of the male black bear is about double that of the female. Black bears are powerful swimmers and climb trees for protection or food. Although they are in the order Carnivora, their diet includes all types of vegetation including twigs, buds, leaves, nuts, roots, fruit, corn, berries, and newly sprouted plants. Black bears will rip open bee trees to feast on honey, honeycomb, bees, and larvae. They will also tear apart rotting logs for grubs, beetles, crickets, and ants. The black bear wades in streams or lakes, snagging fish with its jaws or pinning them with a paw. The black bear's diet also includes small to medium-size mammals or other vertebrates, and even livestock such as cattle, sheep, and goats. Bears are often a problem around open dumps, becoming dangerous as they lose their fear of humans. Occasionally, black bears kill people (National Audubon Society 2000, Herrero et al. 2011). It has been suggested that 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 1985, Kolenosky and Strathearn 1987). However, Herrero et al. (2011) found that most encounters with bears drawn into close contact with humans by food or garbage only result in threat displays and rarely lead to physical attacks.

In North America, black bear densities range from 0.1 to 1.3 bears per km^2 depending on region and habitat. Densities are greatest in highly diverse forests at a relatively early stage of development. In unhunted and lightly hunted populations, the annual survival rate of adult female black bears is about 80 to 90% with adult male survival slightly less. As hunting pressure increases, the number of males decreases more rapidly than that of females because of their greater vulnerability to hunting (Fraser et al. 1982). The VDGIF estimates the statewide population of black bears for Virginia to be between 16,000 and 18,000 bears (J. Sajecki, VDGIF, pers. comm. 2011).

Black bears are classified as a big game species in Virginia with seasons and harvest limits set annually by the VDGIF. Black bear harvests have been steadily increasing in Virginia over the past 10 years. The harvest has increased from just over 1,000 bears harvested in 2000 to 2,221 bears harvested during the 2010-2011 bear seasons (VDGIF 2011). The numbers of bears harvested in the Commonwealth from 1972 through 2010 are shown in Figure 4.1.

No black bears have been intentionally killed by WS in Virginia; although, three black bears were unintentionally taken during other damage management activities to protect livestock from FY 2006 through FY 2011. One black bear was dispersed by WS to alleviate damage during FY 2011. WS' personnel occasionally receive requests for assistance associated with black bears, but WS has provided primarily technical assistance for those requests in the past, and always refers complainants to the VDGIF for further action. Recently, WS has received increasing reports of bears on airports posing a threat to aviation safety. Any direct damage management actions by WS to address black bear damage in Virginia in future programs would be conducted as part of an informed wildlife management activity coordinated with the VDGIF for the purpose of meeting state wildlife resource management objectives. Such projects may involve live-capture and translocation of bears causing damage, or bears could be killed to protect human health and safety or agricultural resources.

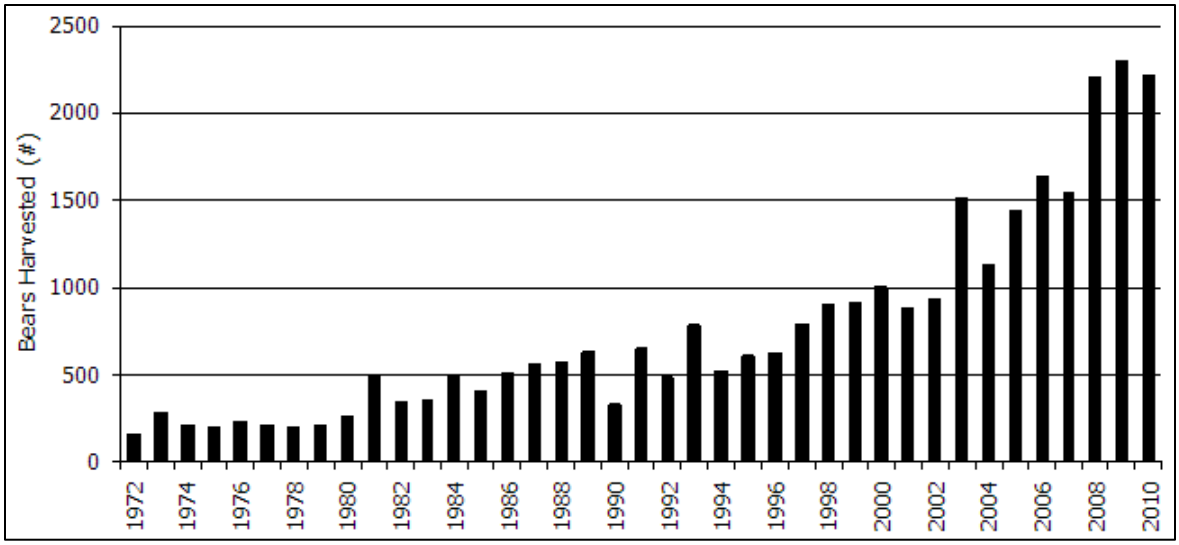


Figure 4.1: Black bear hunter harvest in Virginia, 1972-2010 (VDGIF 2011)

Under the proposed action, up to 25 black bears could be lethally removed by WS annually to prevent or reduce damage. Using the 2010-2011 harvest data, WS' proposed take of 25 black bears would account for 1.1% of the hunter harvest. Using the lowest population estimate of 16,000 bears statewide, WS' proposed take of 25 bears annually would account for 0.2% of the total population. Based on this information, WS' limited lethal take of black bears would have no adverse impacts on overall black bear populations in the Commonwealth.

Raccoon Population Information and Effects Analysis

The raccoon is a stocky mammal about 61 to 91 cm (2 to 3 feet) long, weighing 4.5 to 13.5 kg (10 to 30 lbs). It is distinctly marked, with a prominent black mask over the eyes and a heavily furred, ringed tail. The animal is a grizzled salt-and-pepper gray and black above, although some individuals are strongly washed with yellow (Boggess 1994).

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).

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

Absolute raccoon population densities are difficult to determine because of the uncertainty in knowing what percentage of the population had been counted or estimated along with 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 ha (101 acres) waterfowl refuge area, while Yeager and Rennels (1943) studied raccoons on 881 ha (2,177 acres) in Illinois and reported trapping 35 to 40 raccoons in 1938-1939, 170 in 1939-1940, and 60 in 1940-1941. Slate (1980) estimated one raccoon per 7.8 ha (19.3 acres) in New Jersey in predominantly agricultural land on the inner coastal plain. Raccoon densities of 100 per square mile (1 raccoon per 6.4 acres) have been attained around abundant food sources (Kern 2002). Riley et al. (1998) summarized rural raccoon densities based in published literature that ranged from 2 to 650 per square mile in rural habitats with an average of 10 to 80 raccoons per square mile.

Population estimates for raccoons in the Commonwealth are not available. Similar to the opossum analysis, a population estimate will be derived based on the best available information for raccoons to provide an indication of the magnitude of take proposed by WS to alleviate damage and threats of damage. The Commonwealth of Virginia covers 42,775 square miles with 39,491 square miles being land area (United States Census Bureau 2012). If raccoons were only found on 50% of the land area of the Commonwealth and using densities of 10 to 80 raccoons per square mile found by Riley et al. (1998), the population could range from a low of 197,500 raccoons to nearly 1.6 million raccoons. Under a separate analysis conducted in the EA evaluating the management of predation losses to native bird populations on the barrier and Chesapeake Bay islands and coastal areas of the Commonwealth (USDA 2005*b*), WS estimated the statewide population at approximately 2,116,300 raccoons based on a mean density of 50 raccoons per square mile and raccoons occupying the entire land area of the Commonwealth.

In Virginia, 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).

Raccoons also cause damage to natural resources through predation on species of concern or T&E species. Raccoon predation losses to native bird populations on the barrier and Chesapeake Bay islands have been analyzed in a separate EA (USDA 2005*b*). Additionally, WS has received reports of raccoon predation on T&E species of mussels in freshwater streams in western Virginia. The public are also concerned about health and safety issues associated with raccoons, primarily from threats 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 2006; see Table 1.3).

WS continues to provide assistance in efforts to contain the spread of raccoon rabies in Virginia. Those activities are part of the national rabies barrier program addressed under separate environmental analyses (USDA 2005*a*). Other rabies monitoring or control activities may occur as part of this program. Raccoons killed under the ORV program are addressed in a separate EA (USDA 2005*a*) but are included in this EA for cumulative impact analysis. Additionally, raccoons may be killed during activities to protect T&E species in Virginia, which were addressed in a separate EA (USDA 2005*b*) but are also included in this EA for cumulative impact analysis.

Raccoons are classified as furbearers in Virginia with a regulated annual hunting and trapping season with unlimited take allowed during the length of those seasons. At the time this EA was developed, up to two raccoons could be taken daily during the annual hunting season for raccoons, with no limit on the number that could be possessed during the length of the season. In addition, there were no limits on the number

of raccoons that could be trapped daily or in possession during the annual trapping season in the Commonwealth. The number of raccoons reported as harvested or trapped in the Commonwealth from 2006 through 2010 are shown in Table 4.1. Reported take of raccoons during the hunting and trapping seasons is based on a voluntary trapper survey and reported fur sales; therefore, take is considered as minimum take that likely occurred. As with other furbearing species, raccoons can also be lethally taken to alleviate damage or threats of damage when authorized by the VDGIF. The total number of raccoons taken annually in the Commonwealth to alleviate damage or threats of damage is currently unknown and Table 4.1 does not include take for other damage management purposes.

Table 4.1: Cumulative raccoon take from known sources in Virginia, 2006-2011

Year	Harvest Take[1,2]	WS' Take[3,4]	Total
2006	104,372	334	**104,706**
2007	126,574	370	**126,944**
2008	97,541	588	**98,129**
2009	42,750	629	**43,379**
2010	50,244[†]	588	**50,832**
2011	N/A[‡]	672	**N/A**
TOTAL	**421,481**	**3,181**	**424,662**

[1]Harvest take includes those raccoons reported during the hunting season and by fur dealer pelt transactions (M. Fies, VDGIF, pers. comm. 2011)
[2]Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since seasons often carry over from one calendar year to another with seasons generally beginning in the fall and ending in late-winter.
[3]WS' take is reported by federal fiscal year; includes intentional and unintentional take.
[4]WS' take also includes raccoons lethally taken during activities conducted to protect natural resources and to prevent the spread of raccoon rabies in the Commonwealth
[†] No hunter survey was completed for the 2010-2011 season (M. Fies, VDGIF, pers. comm. 2011); total take includes 11,698 in reported fur sales for 2010 and 2009 hunter harvest of 38,546 for comparative purposes.
[‡]N/A=Information is currently not available

WS live-captured and released 1,455 raccoons unharmed from FY 2006 through FY 2011. Most raccoons were intentionally live-captured, sampled, and released as part of surveillance activities for the ORV program (USDA 2005*a*). WS unintentionally live-captured but released 77 raccoons unharmed from FY 2006 through FY 2011 during other damage management activities. From FY 2006 through FY 2011, WS lethally removed 3,181 raccoons during all damage management activities in Virginia (2,809 target take; 372 non-target take). WS' annual take of raccoons during all projects from FY 2006 to FY 2010 (target and non-target) never exceeded 1.5% of the annual reported harvest for the corresponding year. Harvest information for FY 2011 is currently not available. The average number of raccoons reported harvested in the Commonwealth during the annual hunting and trapping seasons from 2006 through 2010 has been 84,296 raccoons per year. Although harvest figures are estimated for 2010, since no hunter survey was completed (M. Fies, VDGIF, pers. comm. 2011), WS' take of 588 raccoons in FY 2010 would represent 1.2% of the estimated harvest in 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 Commonwealth, especially given reported take is likely the minimum number of raccoons harvested.

Based on previous requests for assistance received by WS and in anticipation of receiving additional requests for assistance with managing raccoon damage, up to 500 raccoons could be lethally removed by WS annually when requested under the proposed action. Using the lowest population estimate of 197,500 raccoons, the take of 500 raccoons under the proposed action would represent 0.3% of the estimated population. Activities conducted to prevent the further spread of raccoon rabies in the Commonwealth 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 (USDA 2005*a*). However, if raccoons were visibly injured or exhibit signs of disease, those raccoons are often euthanized and processed for rabies testing. The number

of raccoons lethally taken in the Commonwealth during the post-baiting trapping varies, but is not likely to exceed 50 individuals annually. To alleviate predation of native bird populations on the barrier and Chesapeake Bay islands and coastal areas of the Commonwealth of Virginia, WS previously estimated that up to 500 raccoons could be killed annually to protect nesting shorebirds (USDA 2005*b*). Therefore, the statewide cumulative take of raccoons by WS in Virginia under all damage and disease management activities would not exceed 1,050 raccoons annually, which would represent 0.5% of the lowest population estimate of raccoons in the Commonwealth.

As stated previously, an average of 84,296 raccoons have been harvested in the Commonwealth from 2006 through 2010. When the average number of raccoons harvested in the Commonwealth is combined with the cumulative take that could occur by WS under all activities, the combined take would be 85,346 raccoons annually. Using the lowest population estimated for raccoons in the Commonwealth based on raccoons only inhabiting 50% of the land area, the cumulative take of 85,346 raccoons would represent 43.2% of the statewide population. Raccoon populations can remain relatively abundant if annual harvest levels are below 49% (Sanderson 1987). In addition, the statewide population is likely much higher than 197,500 raccoons. Using a statewide population estimated at 1.6 million raccoons, the cumulative take of 85,346 raccoons would represent 5.3% of the population. Using a population estimated at 2,116,300 raccoons (USDA 2005*b*), the cumulative take of raccoons would represent 4.0% of the statewide population. As with many of the other mammals species harvested for fur in the Commonwealth, the unlimited harvest levels allowed by the VDGIF provides an indication that overharvest of raccoons is not likely to occur during annual harvest seasons and from damage management activities. Although the statewide population of raccoons is unknown, the cumulative take of raccoons would be of low magnitude when compared to the actual statewide population and when compared to the annual harvest of raccoons in the Commonwealth. In addition, the live-capture and subsequent release of raccoons would not likely result in adverse effects to the statewide population since those animals would be released unharmed.

River Otter Population Information and Effects Analysis

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

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

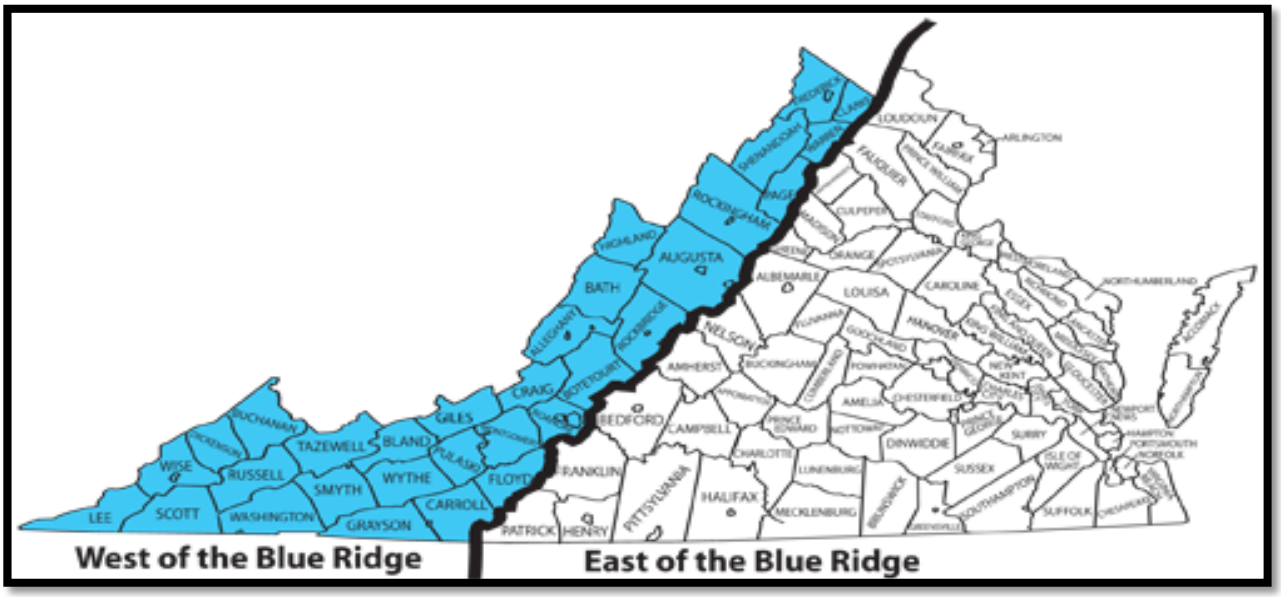
The statewide otter population is currently unknown. Densities of river otter in linear waterways have been reported ranging from one otter per 0.7 miles in southeast Alaska (Woolington 1984) to one otter per 10.6 miles (Reid 1984) in northeastern Alberta. Melquist and Dronkert (1987) summarized studies estimating river otter densities, which showed that densities were about 1 per 175 to 262 acres in Texas coastal marshes, and ranged from 1 per 1.8 miles to 1 per 3.6 miles of waterway (stream or river). The results of a Missouri study found 1 otter per 2.5 to 5.0 miles of linear waterways (Erickson et al. 1984). There are approximately 52,232 freshwater perennial river miles in Virginia (Virginia Department of Environmental Quality 2011). As was discussed previously, otter are closely associated with aquatic habitats where they forage and den along shorelines. Using 52,232 miles of perennial streams in Virginia and the range of 1 otter per 2.5 to 5.0 miles of waterway would result in a statewide population estimate ranging from 10,450 otter to 20,900 otter.

River otters are a regulated furbearer in Virginia with an annual trapping season. During the development of this EA, there were no harvest limits for otter east of the Blue Ridge. However, the harvest of otter was limited to two otter per person during the harvest season west of the Blue Ridge (see Figure 4.2).

From FY 2006 through FY 2011, WS has killed 56 river otters in the Commonwealth. Of those otters taken by WS from FY 2006 through FY 2011, 49 otter were taken as unintentional non-targets during aquatic rodent damage management activities (USDA 2000*a*), which is an average take of approximately eight otters per year. The highest unintentional take occurred during FY 2008 when 12 otters were unintentionally taken during other damage management activities. The seven otters that were intentionally taken by WS from FY 2006 through FY 2011 were a part of the data collection phase for a research project conducted by the USFWS in the Great Dismal Swamp National Wildlife Refuge. In addition, two otter were live-captured and were released unharmed by WS from FY 2006 through FY 2011. Non-target take of otters during aquatic rodent damage management activities are discussed and analyzed in WS' aquatic rodent EA for Virginia (USDA 2000*a*) but will be discussed in this assessment to evaluate cumulative take.

Since FY 2006, requests for assistance received by WS to manage damage caused by otter have been to alleviate damage occurring to agricultural resources, primarily from fish hatcheries in Virginia. Based on previous requests for assistance and anticipating future requests, WS reasonably expects the intentional take of otter would not exceed 10 otters annually in Virginia to resolve requests to manage damage to resources. As was discussed previously, river otters are also likely to be lethally removed by WS as unintentional non-targets during other activities to alleviate wildlife damage. To evaluate cumulative impacts on the river otter population from the activities proposed under this alternative, WS will evaluate cumulative take using the highest annual non-target take of otter that occurred during previous activities. As stated previously, the highest annual non-target take by WS occurred during FY 2008 when 12 otter were killed unintentionally.

Figure 4.2 – Map delineating the location of the Blue Ridge in Virginia



Trappers harvested 3,722 otters in Virginia from 2006 through 2010, an average of 744 per season (M. Fies, VDGIF, pers. comm. 2011). Under the proposed action, WS' take of up to 10 river otters would

account for 1.3% of the average annual harvest. Based upon the aforementioned population estimate, WS' limited lethal take of 10 river otters annually under the proposed action would represent 0.1% of the otter population in Virginia estimated at 10,450 otters and 0.05% of a statewide population estimated at 20,900 otters. When WS' average annual unintentional take is combined with the proposed take evaluated in this EA, the cumulative take by WS would represent 0.2% of a statewide population estimated at 10,450 otter and would represent 0.1% of a statewide population estimated at 20,900 otter. If the highest unintentional take by WS of 12 otters was combined with the proposed take under this proposed action of up to 10 otters, WS' cumulative take would represent 0.2% of a statewide population estimated at 10,450 otters and 0.1% of a statewide population estimated at 20,900 otters.

Using an average harvest level of 744 otter per year, the cumulative take by WS using the proposed take of up to 10 otters and the highest unintentional non-target take that has occurred from FY 2006 through FY 2011 of 12 otter, the combined cumulative take would represent 7.3% of a statewide population estimated at 10,450 otter and would represent 3.7% of a statewide population estimated at 20,900 otters.

The proposed take and the cumulative take of otters in the Commonwealth would be of low magnitude when compared to the statewide population estimates. The unlimited take allowed by the VDGIF in the area east of the Blue Ridge also provides an indication that harvest and damage management activities are not sufficient to cause the overharvest of otters.

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 striped skunk's diet also includes small mammals, the eggs of ground-nesting birds, and amphibians. Striped skunks are typically not aggressive and attempt to flee when approached by 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 7 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 besides those based on harvest numbers and trapper/hunter observations. During the breeding season, males may travel larger areas in search of females. Skunk densities vary widely according to season, food sources, and geographic area. Densities have been reported to range from one skunk per 77 acres to one skunk per 10 acres (Rosatte 1987).

Population estimates for striped skunks in Virginia are currently not available. Striped skunks can be found in a variety of habitats across the Commonwealth. If skunks only inhabit 50% of the land area of the Commonwealth and densities occur at one skunk per 77 acres, the statewide population could be conservatively estimated at nearly 164,100 skunks (based on the land area in the Commonwealth estimated at 39,491 square miles). Similar to other furbearing species, skunks can be found throughout the Commonwealth and the estimate is intended to evaluate the magnitude of take proposed under the proposed action. The statewide population of skunks is likely higher than 164,100 skunks.

Striped skunks can be lethally taken using hunting methods during a continuous open season on private property in the Commonwealth with no limit on the number that can be taken. In addition, skunks can be trapped during an annual season that places no limit on the number of skunks that can be harvested daily and no limit on the number of skunks that can be possessed throughout the trapping season. As such, the number of skunks lethally taken annually in the Commonwealth to alleviate damage or threats of damage is currently unknown. Hunter survey data and fur dealer report transactions indicate that 969 striped skunks were harvested in Virginia from 2006 through 2010 (M. Fies, VDGIF, pers. comm. 2011). From FY 2006 through FY 2011, WS lethally removed 243 striped skunks during all damage management activities in the Commonwealth. Of those 243 skunks lethally removed, 31 skunks were lethally removed unintentionally during other damage management activities. In addition, three skunks were live-captured unintentionally in cage traps but were released unharmed.

Based on previous requests for assistance received by WS and in anticipation of receiving additional requests for assistance with managing striped skunk damage in Virginia, up to 100 skunks could be lethally removed by WS annually under the proposed action, when requested. Using the lowest population estimate of 164,100 skunks, the take of 100 skunks would represent 0.06% of the estimated statewide population. Between 2006 and 2010, at least 969 skunks were harvested in the Commonwealth, which is an average of 194 skunks harvested annually. The actual harvest level is unknown since skunks can be lethally removed throughout the year in the Commonwealth.

If WS lethally removes up to 100 skunks annually and the average annual take of skunks in the Commonwealth is 194 skunks, the cumulative take would represent 0.2% of the statewide population estimated at 164,100 skunks. The unlimited take allowed by the VDGIF with no closed season provides an indication that skunk densities in the Commonwealth are sufficient to maintain a sustained harvest level and adverse effects from harvest and damage management purposes are not likely to cause overharvest of the species leading to population declines.

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). Coloration of the fur varies greatly in coyotes from nearly black to red or nearly white in some individuals and local populations. Most have dark or black guard hairs over their back and tail (Green et al. 1994). They sometimes breed with domestic dogs producing hybrids called "*coydogs*" (National Audubon Society 2000). The size of coyotes varies from 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 around 1900 to 1920. Now, all eastern states and Canadian provinces have at least a small population of coyotes (Voigt and Berg 1987).

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

Coyotes breed between January and March and are able to breed prior to reaching one year of age (Kennely and Johns 1976); however, 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, which causes large annual variations in the total number of coyotes breeding. In a Texas study, the percentage of females having litters varied from 48% to 81% (Knowlton 1972). Pups are born after a gestation period of 60 to 63 days, with litter sizes varying primarily with prey availability. Gier (1968) reported average litter sizes of 4.8 to 5.1 in years with low rodent numbers and 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 can 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 square kilometer (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) reported that density estimates of 0.5 to 1.0 coyotes per square mile would likely be applicable to coyote densities across much of their range. However, methods for estimating carnivore populations are crude and often produce estimates with broad confidence intervals (Crawford et al. 1993).

Actual population estimates for coyotes in Virginia are not well defined. Coyotes are common throughout the Commonwealth and inhabit a variety of habitats. 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 often prohibitive (Connolly 1992) and would not appear to be warranted given the coyote's overall relative abundance. The presence of unusual food concentrations and the assistance provided to a breeding pair by non-breeding coyotes at the den can influence coyote densities and complicate efforts to estimate abundance (Danner and Smith 1980). Coyote densities are lowest in late winter prior to whelping, highest immediately after whelping, followed by a continued decline to the next whelping season (Parker 1995).

Predator abundance indices suggest that densities of coyotes in North America increase from north to south (Knowlton and Stoddart 1985, Parker 1995). Coyote densities range from 0.2 per square mile when populations are low (pre-whelping) to 3.6 coyotes per square mile when populations are high (post-whelping) (Knowlton 1972, USDI 1979). Although coyote densities vary considerably between habitat types and vary based on numerous environmental variables, Knowlton (1972) concluded that coyote densities might approach a high of five to six coyotes per square mile under extremely favorable conditions with densities of 0.5 to 1.0 per square mile possible over the entire range of the coyote in the United States. Such an estimate is speculative but represents some the best available information for estimating coyote populations.

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). While removing animals from small areas at the appropriate time can reduce predation risks, immigration of coyotes from the surrounding area quickly replaces the animals removed (Stoddart 1984). Connolly and Longhurst (1975) determined that, "*...if 75% of the coyotes are killed each year, the population would be exterminated in slightly over 50 years.*" However, Connolly and Longhurst (1975) go on to explain that their "*...model suggests that coyotes, through compensatory reproduction, can withstand an annual population mortality of 70%*" and that coyote populations would regain pre-control densities (through recruitment, reproduction, and migration) by the end of the fifth year after control was terminated even though 75% mortality had occurred for 20 years. In addition, other researchers (Windberg and Knowlton 1988) recognized that immigration, (not considered in the Connolly and Longhurst (1975) model) could result in rapid occupancy of vacant territories, which helps to explain why coyotes have thrived in spite of intensive damage management activities (Connolly 1978).

In addition, Pitt et al. (2001) and Pitt et al. (2003) found that harvest of up to 60% of the population could occur for a sustained time because recruitment annually replaces breeders. A population model developed by Pitt et al. (2001) and Pitt et al. (2003) assessed the impact of removing a set proportion of a coyote population during one year and then allowing the population to recover. In the model, all populations recovered within one year when <60% of the population was removed. Recovery occurred within five years when 60 to 90% of the population was removed. Pitt et al. (2001) and Pitt et al. (2003) also evaluated the impact of removing a set proportion of the population every year for 50 years. When the removal rate was <60% of the population, the population size was the same as for an unexploited population. These findings were consistent with an earlier model developed by Connolly and Longhurst (1975), and revisited by Connolly (1995) which indicated that coyote populations could withstand an annual removal of up to 70% of their population and still maintain a viable population.

If coyotes only occupy 50% of the land area of Virginia and the density of coyotes in the Commonwealth ranges from 0.5 coyotes per square mile to five coyotes per mi^2, the statewide population could range from 9,900 coyotes to a high of 99,000 coyotes. Based on harvest data, approximately 18,500 coyotes are harvested annually in the Commonwealth and harvest data indicates that coyote populations in Virginia are at least stable (see Table 4.2). Therefore, coyote populations in Virginia are likely much higher than the lower estimate of 9,900, which is evident by the annual harvest of coyotes that exceeds the population estimate.

Coyotes are classified as a nuisance species in Virginia and may be taken throughout the year. Additionally, coyotes can be harvested during annual hunting and trapping seasons with no limit on the number of coyotes that can be harvested daily or possessed during the length of the seasons. The number of coyotes reported as harvested from 2006 through 2010 is shown in Table 4.2. As with other furbearing species, the reporting of coyote take is voluntary and represents a minimum number of coyotes harvested. Coyotes are also likely taken by other entities 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. Coyotes killed by WS during activities to protect livestock in Virginia are addressed in a separate EA (USDA 2002), but are also included in this EA for cumulative impact analysis.

From FY 2006 through FY 2011, WS in the Commonwealth killed 2,441 coyotes during all damage management activities, including activities to protect livestock from predation (USDA 2002). The highest level of take occurred in FY 2011 when 511 coyotes were killed to alleviate damage. WS' total take from FY 2006 through FY 2010 represents 2.0% of the total known take of coyotes in the Commonwealth from 2006 through 2010. The number of coyotes reported harvested during the 2011 season is currently unknown.

Based on the number of requests for assistance received previously and the number of coyotes killed by WS to resolve damage, and considering that coyote populations in Virginia seem to be stable based on

harvest data, WS could take up to 500 coyotes annually under the proposed action to alleviate damage. This take would be in addition to coyotes taken to reduce predation to livestock analyzed in a separate EA (USDA 2002). The total statewide lethal take of coyotes in Virginia by WS annually is not expected to exceed 1,000 animals. Although exact population estimates for coyotes in Virginia are not available, unlimited take allowed by the VDGIF for the species during hunting and trapping seasons and as a nuisance species indicates the species is not at risk of overharvesting.

Table 4.2: Known cumulative take of coyotes in Virginia, 2006-2011

Year	Harvest Take[1,2]	WS' Take[3]	Total
2006	19,442	388	**19,830**
2007	12,245	368	**12,613**
2008	24,928	457	**25,385**
2009	18,102	391	**18,493**
2010	18,802[†]	326	**19,128**
2011	N/A[‡]	511	**N/A**
TOTAL	**93,519**	**2,441**	**95,960**

[1] Harvest take includes coyotes reported during the hunting season and by fur dealer pelt transactions (M. Fies, VDGIF, pers. comm. 2011)
[2]Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since seasons often carry over from one calendar year to another with seasons generally beginning in the fall and ending in late-winter.
[3]WS' take is reported by federal fiscal year
[†] No hunter survey was completed for the 2010-2011 season (M. Fies, VDGIF, pers. comm. 2011); total take includes 913 in reported fur sales for 2010 and 2009 hunter harvest of 17,889 for comparative purposes.
[‡]N/A=Information is currently not available

Using a statewide coyote population ranging from 9,900 to 99,000 coyotes, take of up to 1,000 coyotes annually would represent from 1.0% to 10.1% of the estimated population. The highest reported take of coyotes in the Commonwealth during hunting and trapping seasons occurred in 2008 when 24,928 coyotes were reported harvested (which represents the minimum harvest since reporting of take is not required). Take of up to 1,000 coyotes by WS would have represented 4.0% of the highest total reported harvest of coyotes. When evaluated cumulatively, the combined take of 1,000 coyotes by WS and the highest harvest level reported at 24,928 coyotes would represent 26.2% of a coyote population estimated at 99,000 coyotes. Therefore, WS' cumulative take of coyotes, including take that could occur under the proposed action, 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, this secretive carnivore is seldom seen. This species is somewhat smaller in stature than the red fox, having shorter legs and extremities. Gray fox exhibit striking pelage that has grizzled upper parts resulting from individual guard hairs being banded with white, gray, and black. A predominance of black-tipped hairs in the middle of the back forms a dark longitudinal stripe that extends into a conspicuous black mane of coarse hair at the top of the black-tipped tail. Portions of the neck, sides, and limbs are cinnamon-colored. The ventral areas of a gray fox are buff colored. White shows on the ears, throat, chest, belly, and back legs, and the black, white, and reddish facial markings provide distinctive accents (Fritzell 1987).

Gray fox adults weigh about 3 to 7 kg (6.5 to 15 lbs), with males being slightly larger than females. Generally, adult gray fox measure 80 to 113 cm (31.5 to 44 inches) from the tip of the nose to the tip of the tail. They inhabit wooded, brushy, and rocky habitats from extreme southern Canada to northern Venezuela and Colombia, excluding portions of the mountainous northwestern United States, the Great

Plains, and eastern Central America. Gray fox occur over most of North America, north and east from southern California, Arizona, and central Texas (Fritzell 1987).

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

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

Accurate estimates of carnivore populations are rare and those for gray fox populations are no exception. Estimates based on knowledge of the species, experience, and intuition may be as accurate as those estimates based on recognized methods such as mark-recapture studies. Published estimates of gray fox density vary from 1.2 to 2.1 per square kilometer (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 square kilometer (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). 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). Although exceptions exist, eastern gray fox generally have larger home ranges than western animals (Fritzell 1987).

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 take refuge in them, especially in 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 can be found statewide in Virginia. If gray fox only occupied 50% of the land area of the Commonwealth and the density of gray fox in the Commonwealth were 3.1 gray fox per square mile, the statewide population could be estimated at nearly 61,200 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 Commonwealth is unlikely since fox can be found almost statewide. However, similar to the other furbearing species, gray fox occupying only 50% of the land area was used to provide a minimum population estimate to evaluate the magnitude of the proposed take by WS.

Gray fox can be harvested during annual hunting and trapping seasons in the Commonwealth. During the gray fox hunting and trapping seasons, there is no limit to the number of fox that can be harvested daily or

possessed during the length of the season. Between 2006 and 2010, a minimum of 88,684 gray fox were harvested in the Commonwealth during hunting and trapping seasons (see Table 4.3). The highest annual take occurred in 2006 when 32,322 gray fox were reported harvested. As with other furbearing species, the reporting of gray fox take by hunters and trappers is voluntary and represents a minimum number of gray fox harvested. Since the reporting of harvest is not required, the actual number of gray fox harvested is currently unknown. Gray fox are also likely 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.

From FY 2006 through FY 2011, WS killed 299 gray fox during damage management activities of which 78 were taken during activities directly targeting gray fox causing damage. The highest target take of gray fox by WS occurred during FY 2006 and FY 2007 when 18 fox were lethally taken each year. In addition, 221 gray fox have been lethally taken unintentionally during other damage management activities, primarily activities associated with alleviating predation risks to livestock. WS' cumulative take of 299 gray fox accounted for only 0.3% of the reported harvest of gray fox from 2006 through 2010. The highest annual non-target take of gray fox by WS occurred during FY 2008 when 50 gray fox were lethally taken unintentionally by WS. In addition, 11 gray fox were live-captured by WS and released unharmed from FY 2006 through FY 2011. On average, WS has lethally taken cumulatively nearly 50 gray fox annually during all damage management activities.

Based on previous requests received by WS to reduce damage and in anticipation of future requests, WS could intentionally remove up to 100 gray fox annually under the proposed action to address requests to alleviate damage and threats of damage. Using the lowest population estimate of 61,200 fox, the take of 100 gray fox by WS would represent 0.2% of the population. WS has also lethally taken unintentionally an average of 37 gray fox annually in the Commonwealth during other damage management activities with the highest annual non-target take of 50 fox occurring during FY 2008. If 100 target gray fox were taken by WS annually and 37 gray fox were taken annually as non-targets, the cumulative take would represent 0.2% of the lowest population estimate. If the highest non-target take by WS occurred annually, the cumulative take would continue to represent 0.2% of the estimated lowest population in the Commonwealth. The population of gray fox in the Commonwealth is likely greater than 61,200 fox since fox can be found statewide in suitable habitat.

Table 4.3: Known cumulative take of gray fox in Virginia, 2006-2011

Year	Harvest Take[1,2]	WS' Take[3]	Total
2006	32,322	64	**32,386**
2007	16,958	67	**17,025**
2008	21,475	63	**21,538**
2009	8,521	33	**8,554**
2010	9,408[†]	22	**9,430**
2011	N/A[‡]	50	**N/A**
TOTAL	**88,684**	**299**	**88,983**

[1] Harvest take includes gray fox reported during the hunting season and by fur dealer pelt transactions (M. Fies, VDGIF, pers. comm. 2011)
[2] Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since seasons often carry over from one calendar year to another with seasons generally beginning in the fall and ending in late-winter.
[3] WS' take is reported by federal fiscal year; includes intentional and unintentional take.
[†] No hunter survey was completed for the 2010-2011 season (M. Fies, VDGIF, pers. comm. 2011); total take includes 2,274 in reported fur sales for 2010 and 2009 hunter harvest of 7,134 for comparative purposes.
[‡] N/A=Information is currently not available

WS' cumulative take of gray fox would continue to be a small portion of the number of gray fox harvested in the Commonwealth annually. If WS had lethally removed 150 gray fox (100 under the proposed action plus the highest non-target take of 50) each year from FY 2006 through FY 2011, the

cumulative take would have presented 0.5% to 1.8% of the harvest of fox that occurred annually from 2006 through 2010. Like other mammal species addressed in this EA, the unlimited take allowed by the VDGIF during the hunting and trapping seasons and the permitting of take to alleviate damage by the VDGIF provides an indication that gray fox populations maintain sufficient densities within the Commonwealth to sustain unlimited harvest and that overharvest is unlikely.

Red Fox Population Information and Effects Analysis

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

In North America, the red fox weighs about 3.5 to 7 kg (7.7 to 15.4 lbs), with males averaging about 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 red fox may not have inhabited much of the United States; however, they were plentiful in many parts of Canada. Voigt (1987) has suggested that climatic factors, interbreeding with the introduced European red fox, extirpation of the gray and red wolf, and clearing of land for agriculture has possibly contributed to the present-day expansion and range of this species in North America.

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

Red fox mate from January through March and produce litters of 1 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 with 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. It is also an efficient scavenger, and in parts of the world, garbage and carrion are extremely important to its diet (Voigt 1987).

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

Population densities are difficult to determine because of the secretive and elusive nature of fox. Estimates are prone to error even in open areas with good visibility. Methods used to estimate numbers have included aerial surveys, questionnaires to rural residents and mail carriers, scent post surveys, intensive ground searches, and indices derived from hunting and trapping harvest (Voigt 1987). Home ranges for red fox in the eastern United States are usually from 500 to 2,000 ha (1,235 to 4,940 acres) in rural settings, such as farmland (Voigt and Tinline 1980), but such sizes may not apply among fox populations in urban settings. In Great Britain, where food is abundant in many urban areas, densities as high as 30 fox per square kilometer (78 per mi^2) have been reported (Harris 1977, MacDonald and Newdick 1982, Harris and Rayner 1986), while in southern Ontario, densities of about 1 fox per square kilometer (2.6 per mi^2) occur during spring. This includes both pups and adults. In small areas of the best habitat, three times as many fox have been observed (Voigt 1987). However, those densities rarely occur extensively because of the dispersion of unsuitable habitat, high mortality, or from competition with coyotes (Voigt and Earle 1983). Cyclical changes in fox numbers occur routinely and complicate density estimates as well as management. Those cycles can occur because of changes in prey availability, or disease outbreaks, especially rabies, among red fox. For fox populations to remain relatively stable, mortality and reproduction must balance approximately.

Red fox can be found statewide in Virginia. Based on an assumption that red fox only occupy 50% of the land area of the Commonwealth and the density of red fox in the Commonwealth is 2.6 red fox per square mile, the statewide population could be estimated at 51,300 red fox. Red fox can be harvested during annual hunting and trapping seasons. There is no limit to the number of fox that can be harvested daily and no possession limit during the length of the season for red fox. The number of red fox reported as harvested from 2006 through 2010 is shown in Table 4.4. As with other furbearing species, the reporting of red fox take is voluntary and represents a minimum number of red fox harvested. Red fox could also 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. In addition to the take of red fox addressed in this EA, the take of red fox to alleviate livestock predation (USDA 2002) and the take of red fox to alleviate predation losses to native bird populations on the barrier and Chesapeake Bay islands and coastal areas of the Commonwealth of Virginia (USDA 2005*b*) were analyzed in separate analyses but are also included in this EA for cumulative impact analysis.

Between 2006 and 2010, 74,369 red fox have been reported as lethally taken in the Commonwealth during hunting and trapping seasons (see Table 4.4). Harvest data for the 2011 season is currently unavailable. The highest level of take occurred in 2006 when 23,594 red fox were reported taken. As shown in Table 4.4, WS has lethally taken 1,070 red fox in the Commonwealth during all damage management activities from FY 2006 through FY 2011, with the highest level of take occurring in FY 2008 when 253 red fox were taken during damage management activities. Of those 1,070 red fox lethally removed by WS, 401 red fox were lethally removed as unintentional non-targets during other damage management activities, primarily associated with managing predation on livestock. Additionally, WS treated 41 red fox dens with gas cartridges from FY 2006 through FY 2011. WS also live-captured and released 12 red fox from FY 2006 through FY 2011 while 45 red fox were disperse to alleviate damage using non-lethal methods.

WS' take of 1,070 red fox from FY 2006 through FY 2011 would account for only 1.4% of the total reported harvest of 74,369 red fox from 2006 through 2010. 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 100 red fox annually under the proposed action. Cumulatively, take by WS statewide under all programs would not exceed 400 red fox annually under this alternative along with take to reduce livestock predation (USDA 2002) and to reduce nest predation (USDA 2005*b*).
WS could annually treat up to 20 red fox dens using gas cartridges. The cumulative take of red fox addressed in this EA would include the potential for take of red fox during the fumigation of dens with gas cartridges. Using a statewide population estimate of 51,300 red fox, take of up to 400 red fox annually would represent 0.8% of the estimated population.

Table 4.4: Known cumulative take of red fox in Virginia, 2006-2011

Year	Harvest Take[1,2]	WS' Take[3]	Total
2006	23,594	162	**23,756**
2007	13,469	160	**13,629**
2008	13,216	253	**13,469**
2009	11,561	154	**11,715**
2010	12,529[†]	146	**12,675**
2011	N/A[‡]	195	**N/A**
TOTAL	**74,369**	**1,070**	**75,439**

[1] Harvest take includes red fox reported during the hunting season and by fur dealer pelt transactions (M. Fies, VDGIF, pers. comm. 2011)
[2]Reported by season; for example, the 2006 entry covers the hunting and trapping season that began in 2006 and ended in 2007 since seasons often carry over from one calendar year to another with seasons generally beginning in the fall and ending in late-winter.
[3]WS' take is reported by federal fiscal year for all WS statewide damage management programs and includes intentional and unintentional take.
[†] No hunter survey was completed for the 2010-2011 season (M. Fies, VDGIF, pers. comm. 2011); total take includes 2,839 in reported fur sales for 2010 and 2009 hunter harvest of 9,690 for comparative purposes.
[‡]N/A=Information is currently not available

WS has also lethally taken unintentionally an average of 67 red fox annually in the Commonwealth during other damage management activities with the highest annual non-target take of 128 fox occurring during FY 2008. If 400 target red fox were taken by WS annually and 67 red fox were taken annually as non-targets, the cumulative take would represent 0.9% of the lowest population estimate. If the highest non-target take by WS occurred annually, the cumulative take would represent 1.0% of the estimated lowest population in the Commonwealth. The population of red fox in the Commonwealth is likely greater than 51,300 fox since fox can be found statewide in suitable habitat.

WS' cumulative take of red fox would continue to be a small portion of the number of red fox harvested in the Commonwealth annually. If WS had lethally removed 528 gray fox (400 cumulative annually plus the highest non-target take of 128) each year from FY 2006 through FY 2011, the cumulative take would have presented 2.2% to 4.6% of the harvest of fox that occurred annually from 2006 through 2010. Although exact population estimates for red fox in Virginia are not available, the unlimited take allowed by the VDGIF for the species during hunting and trapping seasons indicates the species is not at risk of overharvesting. The proposed take of red fox to alleviate damage would be a small component of the overall harvest of red fox in the Commonwealth. The overall take would be of low magnitude when compared to the statewide population and the number of fox harvested during the annual hunting and trapping seasons.

Woodchuck Population Information and Effects Analysis

The woodchuck, a member of the squirrel family, is also known as the "*groundhog*" or "*whistle pig*". It is closely related to other species of North American marmots. It is usually grizzled brownish gray, but white (albino) and black (melanistic) individuals can occasionally be found. Short strong legs support the woodchuck's compact, chunky body. Its forefeet have long, curved claws that are well adapted for digging burrows. Its tail is short, well furred, and dark brown. They dig large burrows, generally 8 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 because of burrowing; gnaw electrical cables, and damage hoses and other accessories on automobiles by gnawing (Bollengier 1994).

The breeding season for groundhogs 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 groundhogs 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 groundhogs through their lifetime. The range of the woodchuck in the United States extends throughout the East, northern Idaho, northeastern North Dakota, southeastern Nebraska, eastern Kansas, northeastern Oklahoma, and south to Virginia and Alabama.

Both sexes are similar in appearance, but the male is slightly larger, weighing an average of five to 10 pounds (2.2 to 4.5 kg). The total length of the head and body averages 16 to 20 inches (40 to 51 cm). The tail is usually four to seven inches (10 to 18 cm) long. Like other rodents, woodchucks have white or yellowish-white, chisel-like incisor teeth. Their eyes, ears, and nose are located toward the top of the head, which allows them to remain concealed in their burrows while they check for danger over the rim or edge. Although they are slow runners, woodchucks are alert and scurry quickly to their dens when they sense danger (Bollengier 1994).

Woodchucks are classified as a nuisance species in the Commonwealth and there is a continuous open season on private lands with no take limit. Hunter surveys indicate that hunters harvested 1,051,457 woodchucks in the Commonwealth from 2006 through 2009 (M. Fies, VDGIF, pers. comm. 2011), which is an annual harvest rate of 262,864 woodchucks. Between FY 2006 and FY 2011, WS killed 825 woodchucks in Virginia to alleviate damage or threats of damage, which is an average of 138 woodchucks per year. WS also killed 25 woodchucks unintentionally during other damage management activities in the Commonwealth, which is an average of four woodchucks per year. In addition, WS treated 2,181 woodchuck burrows with gas cartridges during the same period, averaging approximately 364 burrows treated per year. Based on previous requests for assistance and in anticipation of receiving additional requests in the future, it is estimated that up to 600 woodchucks could be lethally removed to alleviate damage by WS annually. This take would include woodchucks killed during the fumigation of up to 500 burrow entrances using gas cartridges.

Gas cartridges could be employed to fumigate woodchuck burrows in areas where damages were 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 would be placed inside active burrows at the entrance, the cartridge would be ignited, and the entrance to the burrow would be sealed with dirt, which allows the burrow to fill with carbon monoxide. 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). Based on the mean number of entrances per burrow system of approximately 3 entrances (Twichel 1939, Merriam 1971) and each burrow system occupied by a male and a female (Swihart 1992, Armitage 2003), the number woodchucks that could be lethally taken using gas cartridges could be estimated at approximately 334 woodchucks if 500 entrances were treated. 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 600 woodchucks. Take of up to 600 woodchucks annually by WS would represent 0.2% of the average number of woodchucks harvested annually in the Commonwealth from 2006 through 2009.

Damage management activities associated with woodchucks would target single animals or local populations of the species at sites where their presence was causing unacceptable damage to agriculture, human health or safety, natural resources, or property. Some local populations may be temporarily reduced because of damage management activities conducted under the proposed action alternative aimed at reducing damage at a local site. 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.

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 (1.25 to 1.75 lbs) (National Audubon Society 2000).

Gray squirrels are found throughout most of the eastern United States, including Virginia. They inhabit mixed hardwood forests, especially those containing nut trees such as oak and hickory. While gray squirrels 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 produce young 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 increase and decrease, 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. 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*).

Gray squirrel populations in Virginia are not well documented. Gray squirrel densities fluctuate based on available food sources but long-term densities tend to be stable (Gurnell 1987). Manski et al. (1981) found gray squirrel densities were typically less than 1.2 squirrels per acre in continuous areas of woodlands in North Carolina. Doebel and McGinnes (1974) found gray squirrel densities in small woodlots of less than 10 ha in area can be as high as 16 squirrels per ha. In urban parks, Manski et al. (1981) found gray squirrel densities can be more than 8.4 squirrels per acre. A three acre park in Washington, D.C. had a density of 50 squirrels per ha (20 per acre) (Hadidian et al. 1987). The Commonwealth of Virginia has 15.72 million acres of forestland (Virginia Department of Forestry 2011). If only 50% of the forested acres in Virginia were suitable habitat for gray squirrels, with a population density of 1.2 gray squirrels per acre, the gray squirrel population could be estimated to be approximately 9.4 million in Virginia.

Gray squirrels are considered a small game animal by the VDGIF and at the time this EA was developed, gray squirrels could be harvested during regulated hunting seasons in the spring and fall. The daily bag limit for hunters harvesting gray squirrels was six, regardless of species with no limit on the number of squirrels that could be possessed during the length of the season. During the squirrel season in the Commonwealth, fox squirrels (*Sciurus niger*), red squirrels (*Tamiasciurus hudsonicus*), and gray squirrels can be harvested and the daily take limits include the total of all squirrel species combined. The number of squirrels harvested annually in the Commonwealth during the regulated season is not currently available. Additionally, gray squirrels may be taken outside of the regulated hunting seasons by landowners when causing damage as outlined in the Code of Virginia (§ 29.1-516). However, the number of squirrels lethally removed to alleviate damage by other entities in the Commonwealth is currently unknown.

From FY 2006 through FY 2011, WS lethally removed 73 gray squirrels during activities to reduce squirrel damage to property, which is an average of 13 gray squirrels removed annually by WS to alleviate damage. Based upon an anticipated increase for requests for WS' assistance, it is possible that WS could kill as many as 100 squirrels each year in the Commonwealth under the proposed action alternative. Removing 100 squirrels would be of low magnitude when compared to the statewide population of gray squirrels. Although the number of squirrels harvested in the Commonwealth annually and the number removed to alleviate damage is unknown, the cumulative take is not likely to reach a level where adverse effects would occur to the statewide population, including take by WS. Some local populations may be temporarily reduced because of damage management activities aimed at reducing damage at a local project site; however, statewide populations would not be adversely affected by the cumulative take. The unlimited take allowed by the VDGIF during the length of the squirrel hunting season provides an indication that gray squirrel population densities are not subject to overharvest.

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. They usually have coarser and denser coats than their domestic counterparts and exhibit modified canine teeth called "*tusks*" which are usually 7.5 to 12.5 cm (3 to 5 inches) long, but may be up to 23 cm (9 inches) long. These tusks curl out and up along the sides of the mouth. Lower canines are also prominent but smaller. Young feral hogs have pale longitudinal stripes on the body until they are six weeks of age. Adults of the species average 90 cm (3 feet) in height and 1.32 to 1.82 m (4.5 feet to 6 feet). Males may attain a weight of 75 kg to 200 kg (165 lbs to 440 lbs) while females may weigh 35 kg to 150 kg (77 lbs to 330 lbs). These animals mate any time of year but peak breeding times usually occur in January and February through early summer. Litters sizes usually range from three to 12 piglets (National Audubon Society 2000). Feral swine are the most prolific wild mammal in North America. 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). Feral swine are found in variable habitat in much of the southern United States, as well as most of the United States. Populations are usually clustered around areas with ample food and water supplies. Evidence of the presence of feral swine may be rooted up earth, tree rubs at ground level to 900 cm (36 inches) high, with clinging hair or mud, and muddy wallows.

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 includes acorns, hickory nuts, pecans, beech nuts, and a wide variety of vegetation including roots, tubers, grasses, fruit, and berries, but feral hogs also eat crayfish, frogs, snakes, salamanders, mice, eggs and young of ground-nesting birds, young rabbits, and any other easy prey or carrion encountered. Feral swine have been known to kill and eat deer fawns (National Audubon Society 2000). They have also been reported to kill considerable numbers of domestic livestock, especially young animals, in some areas (Barrett and Birmingham 1994). Several diseases are also associated with feral swine populations (see Table 1.3).

In Virginia, feral swine are classified as a nuisance species (4VAC15-20-160) and may be taken at any time (except Sunday) on private lands and on some public lands during certain periods (VDGIF 2012). Feral swine have been reported in 22 Virginia counties, mostly in scattered populations (M. Dye, VDGIF, unpublished data 2011) and more commonly in the southwestern part of the Commonwealth. The total feral swine population in Virginia is unknown; however, reports of feral swine have been increasing. It is anticipated that feral swine populations in Virginia will continue to increase due to their prolific breeding behavior, adaptability, and additional swine being illegally released into the wild. Given the unregulated status of feral swine in the Commonwealth, the number of feral swine lethally removed annually is currently unknown.

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

From FY 2006 through FY 2011, WS removed a total of 114 feral swine to reduce damage and for disease surveillance in Virginia. Removal of a small number of feral swine or a single individual will sometimes reduce damage considerably where natural resources, agriculture, or property is affected (Barrett and Birmingham 1994). However, damage may increase dramatically in areas where this species has ample resources and opportunity to expand. WS anticipates increased requests to address damage in such locations in the future. It is possible that WS could kill up to 500 feral swine in Virginia each year for damage management and disease surveillance. However, such population reduction is not expected to affect overall statewide populations of the species because of the high reproductive rates exhibited by these animals (Barrett and Birmingham 1994). Damage management activities associated with feral swine would target single animals or local populations of the species at sites where their presence was causing unacceptable damage or threats to agriculture, human health and safety, natural resources, or property. Feral swine are not native to North America, including Virginia. Executive Order 13112 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, 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 on invasive species.

Based upon the above information, WS limited lethal take of feral swine would have no adverse impacts on overall feral swine populations in the Commonwealth. Any damage management activities involving lethal methods by WS would be restricted to isolated individual sites. Some local populations may be temporarily reduced because of damage management activities aimed at reducing damage at a local site. Since feral hogs are classified as a nuisance species in Virginia, in those cases where feral swine 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 natural environment since feral swine are not considered part of the native ecosystem.

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 these. 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 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, rabbits 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 their time available reproductively. Rabbits 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 Eastern cottontails in Virginia. There are over 25.2 million acres of land in the Commonwealth. If 25% of the land area of the Commonwealth has sufficient habitat to support rabbits, home ranges of rabbits do not overlap, and rabbit densities average one rabbit per acre (Craven 1994), a statewide rabbit population could be estimated at 6.3 million rabbits. The population of rabbits within the Commonwealth is likely higher than 6.3 million rabbits since rabbits can occur at higher densities and rabbits can be found statewide. Therefore, the population estimated at 6.3 million rabbits would be considered a minimum population estimate.

Eastern cottontails can be harvested in Virginia during annual regulated hunting seasons. From 2006 through 2009, hunters reported a harvest of 1,082,476 Eastern cottontails, averaging 270,619 per season (M. Fies, VDGIF, pers. comm. 2011). From FY 2006 through FY 2011, WS has lethally removed 425 Eastern cottontails in the Commonwealth. Of those rabbits lethally removed by WS, 35 rabbits were lethally removed as non-targets during other damage management activities. An additional 56 rabbits were live-captured unintentionally but were released unharmed, while 14 rabbits were dispersed by WS from FY 2006 through FY 2011. Most target take of Eastern cottontails has been 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 mammalian predators.

Based on the number of airports that have requested assistance from WS previously, WS could lethally take up to 200 cottontail rabbits annually in the Commonwealth to alleviate damage or threats of damage. If the population of cottontail rabbits remains at least stable in Virginia, WS' take of up 200 Eastern

cottontails annually would represent 0.003% of the minimum statewide population of 6.3 million rabbits. If WS' estimated annual take of up to 200 rabbits were included with the average annual harvest of rabbits estimated at 270,619 rabbits, the cumulative take would represent 4.3% of the minimum statewide population estimate. The highest rabbit harvest level that has occurred in Virginia between 2006 and 2009 occurred during the 2006 season when 349,859 rabbits were harvested. If WS had lethally taken 200 rabbits in 2006, the cumulative take of 350,059 rabbits would have represented 5.6% of the estimated minimum population of rabbits. Damages and threats of damages associated with Eastern cottontails most often occur in at airports within Virginia where hunting is restricted or not allowed. 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). Therefore, WS' proposed take would not adversely affect the ability to harvest rabbits during the annual regulated hunting season in the Commonwealth.

Nutria Population Information and Effects Analysis

Nutria are large, dark colored, semi-aquatic rodents that are native to South America. Nutria were introduced to the United States in the late 1930s (Whitaker, Jr. and Hamilton, Jr. 1998). The nutria is somewhat similar to the native muskrat in appearance. Nutria have small eyes and ears with a tail that is long, scaly, sparsely haired, and round (National Audubon Society 2000). Nutria weigh on average about 12 pounds (Whitaker, Jr. and Hamilton, Jr. 1998).

Nutria primarily inhabit brackish or freshwater marshes, but are also found in swamps, rivers, ponds, and lakes. They live in dense vegetation, in abandoned burrows, or in burrows they dig along stream banks or shorelines (Wade and Ramsey 1986). The burrowing activity of nutria can severely damage levees, dikes, earthen dams, and other structures. Nutria feed on terrestrial or aquatic green plants, but also feed on crops adjacent to their habitat. Nutria will consume approximately 25% of their own weight in food each day (Whitaker, Jr. and Hamilton, Jr. 1998).

Females begin breeding in their first year. Breeding can occur at any time during the year. In the right conditions, nutria can produce up to 15 young per year (Whitaker, Jr. and Hamilton, Jr. 1998). In the wild, the life expectancy of nutria is approximately two years. Home ranges for nutria are estimated to be from 12 to 445 acres, and densities range up to 10 nutria per acre (Whitaker, Jr. and Hamilton, Jr. 1998).

No population estimates are available for nutria in Virginia. Nutria have been documented at and in the vicinity of Back Bay National Wildlife Refuge in Southeastern Virginia (Virginia Invasive Species Council 2005), although their range and population have potentially expanded. Nutria are now considered established in an area bounded by the intersection of Route 13 and Interstate 264 south to the North Carolina border and east to the Atlantic Ocean (S. Barras, WS, pers. comm. 2011).

Nutria are classified as an invasive species in Virginia, and management objectives are to eradicate the species or keep the population at the lowest level possible (Virginia Invasive Species Council 2005). Executive Order 13112 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, 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 on invasive species.

WS lethally removed 48 nutria in the Commonwealth from FY 2006 through FY 2011. Based on the goal of limiting the expansion of nutria and to reduce the population in the Commonwealth, WS could remove up to 500 nutria annually. The management objectives of any activities conducted by WS would be coordinated with the VDGIF management goal of population suppression or eradication. Damage

management activities associated with nutria 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. In those cases where nutria are causing damage or are a nuisance and complete removal of the local population could be achieved, this would be considered as providing some benefit to the natural environment since nutria are not considered part of the native ecosystem.

White-tailed Deer Population Information and Effects Analysis

When compared to other land mammals in North America, the white-tailed deer currently occupies the largest geographic range of any other mammal (Pagel et al. 1991). Rural areas containing a matrix of forest and agricultural crops can contain the highest deer densities (Roseberry and Woolf 1998). Biologists and resource managers in Virginia have been challenged with managing escalating populations of deer in many urban/suburban areas and in some rural areas. As deer populations increase, there is an increasing occurrence of damage from white-tailed deer to agricultural crops (DeVault et al. 2007), increasing incidences of Lyme disease (Fernandez 2008), a rise in deer-vehicle collisions (Conover et al. 1995), and a disruption in forest health, regeneration, and forest dependent species (Tilghman 1989). Additionally, white-tailed deer are ranked as the second most hazardous species to aviation according to the percentage of strikes that caused damage from 1990 through 2010 (Dolbeer et al. 2012).

The authority for management of resident wildlife species is the responsibility of the VDGIF. The VDGIF collects and compiles information on white-tailed deer population trends and harvest and uses this information to manage deer populations. The primary tool for the management of deer populations in Virginia is through adjusting the allowed lethal take during the deer harvest season in the Commonwealth. Where deer damage to agricultural resources is severe, the VDGIF also issues kill permits for the take of deer outside of the regulated season to reduce damage (Code of Virginia § 29.1-529). Additionally, the VDGIF may issue permits under the Deer Population Reduction Program to allow take of deer outside of established seasons in areas with unique deer management needs, such as parks or airports (VDGIF 2007). Mortality can also occur from vehicle collisions, dogs, illegal take, tangling in fences, disease, and other causes (Crum 2003). Annual deer mortality in Virginia from other sources (*e.g.*, illegal take, disease, and predation) is currently unknown. From July 1, 2010 through June 30, 2011, State Farm Mutual Automobile Insurance Company (2011*b*) estimated 48,658 deer-vehicle collisions occurred in Virginia.

From FY 2006 through FY 2011, WS lethally removed 1,078 deer in Virginia to reduce damage to property and to protect human health and safety, primarily in suburban areas and at airports (see Table 4.5). Additionally, 47 deer were unintentionally taken by WS during other damage management activities (primarily associated with livestock protection) during this same period. All intentional take by WS occurred after receiving a request for assistance to address deer damage and after a kill permit was issued by the VDGIF to the resource manager. WS also live-captured and released five deer from FY 2006 through FY 2011, while dispersing 101 deer during the same period.

As shown in Table 4.5, the highest level of take by WS occurred in FY 2006 when 256 deer were removed using lethal methods, which accounted for 0.11% of the total take of deer in 2006 and 0.03% of the estimated population of deer in Virginia. WS' total take of 1,125 deer (intentional and unintentional) from FY 2006 through FY 2011 represents 0.1% of the total known take of deer in the Commonwealth. Based on this information, the magnitude of WS' take of deer to resolve damage or threats have been low in Virginia based on previous damage management activities. When take of deer has occurred by WS, the magnitude of take compared to the estimated population of 945,000 deer has ranged from 0.01% to 0.03% from FY 2006 through FY 2011. Based on this information, WS' previous damage management activities to resolve or prevent damage have not adversely affected the deer population.

Table 4.5: Comparison of WS' take of deer with take from other known sources in Virginia

	Year					
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Estimated Deer Population[1]	945,000	945,000	945,000	945,000	945,000	945,000
Take during Harvest Season[2]	223,775	242,792	256,382	259,147	219,747	N/A[†]
Take by WS[3,4]	256	126	127	182	236	198
Depredation Permit Take[5]	8,091	9,901	14,526	15,143	12,573	N/A
Total Deer Take	**232,122**	**252,819**	**271,035**	**274,472**	**232,556**	**N/A**
WS % Take of Total	0.11%	0.05%	0.05%	0.07%	0.10%	N/A
WS % Take of Population	0.03%	0.01%	0.01%	0.02%	0.03%	0.02%

[1]Deer population estimate reported by the VDGIF (2007)
[2]Hunter harvest reported by VDGIF (2011)
[3]Take by WS is reported by FY
[4]WS' take includes intentional and unintentional take
[5]data from M. Knox, VDGIF, pers. comm. (2011)
[†]N/A=Information is currently not available

When take of deer has occurred by WS, the magnitude of take compared to the total known take from hunting and depredation permits has ranged from 0.05% to 0.11% between 2006 and 2010. Based on previous requests for assistance, the magnitude of WS' take of deer to resolve damage or threats has been low in Virginia. The annual total known take of deer in the Commonwealth (*i.e.*, harvest take, WS' take, and take under depredation permits) has ranged from 24.6% to 29.1% of the estimated annual statewide deer population. As stated previously, State Farm Mutual Automobile Insurance Company (2011*a*) estimated that 48,658 deer-vehicle collisions occurred in the Commonwealth during a single year. If those collisions involved the death of only one deer and if the number of deer struck has remained relatively stable (although the actual trend is unknown), the total known annual mortality of deer in the Commonwealth would have ranged from 29.7% to 34.2% of the estimated deer population. For example, 274,472 deer were taken in the Commonwealth during the harvest season, by WS, and under depredation permits in 2009. If 48,658 deer were also struck and died during vehicle collisions in 2009 when the highest deer take occurred, the total mortality would have represented 34.2% of the statewide deer population estimated at 945,000 deer.

After review of the number of requests for assistance to resolve and prevent deer damage in Virginia received by WS since FY 2006, WS anticipates the number of requests for assistance to increase in the future. An increasing number of requests for assistance would likely result in the escalated lethal take of deer to resolve damage and threats. After review of previous activities conducted by WS and in anticipation of a gradual increase in requests for lethal take, WS anticipates that future lethal take would not exceed 1,000 deer annually. In addition, WS may be requested by the VDGIF and/or the VDACS to assist with sampling and managing the spread of diseases found in free-ranging and/or captive deer populations. If a disease outbreak occurred, WS could lethally take white-tailed deer for sampling and/or to prevent further spread of diseases. However, WS' total annual take would not exceed 1,000 deer annually under the proposed action.

If requested, WS could also assist with sampling and removing deer from captive facilities where deer are confined inside a perimeter fence. The detection of a disease at a captive facility often raises concerns of the potential spread of diseases to free-ranging herds. The spread of diseases among deer inside those facilities is often increased due to their close contact with one another. Often, once a disease is detected in a confined deer herd, the entire herd is destroyed to ensure the containment of the disease. Any involvement with the depopulation of deer confined inside a perimeter fence by WS would be at the request of the VDGIF and/or the VDACS. As proposed in this alternative, in those cases where WS was requested to assist with the removal of a captive deer herd in Virginia, the take would not exceed 1,000

deer for purposes of disease monitoring or surveillance. Deer confined inside perimeter fences for the purposes of non-traditional farming, including confined for hunting, are not included in statewide deer population estimates. However, since take of deer by WS for disease surveillance or monitoring could occur in free-ranging or captive herds, the potential take of up to 1,000 deer for disease surveillance and monitoring by WS would be considered as part of the impact analysis on the statewide free-ranging deer population.

In addition to WS' intentional take of deer to resolve or prevent damage, WS also conducts other damage management activities that pose a risk for the unintentional lethal take of deer, primarily projects that target coyotes, red fox, feral swine, and feral dogs. WS' unintentional take of deer during other damage management projects is included in WS' take shown in Table 4.5. From FY 2006 through FY 2011, 47 deer were unintentionally taken by WS during other damage management activities, primarily during activities to alleviate predation of livestock by carnivores (USDA 2002). On average, WS has lethally removed unintentionally eight deer per year from FY 2006 through FY 2011. SOPs discussed in USDA (2002) evaluating WS' activities to reduce and resolve livestock predation caused by coyotes, red fox, and dogs are designed to minimize non-target take, including deer (USDA 2002). Based on the limited unintentional take that occurred from FY 2006 through FY 2011 during other program activities in Virginia and after the review of program activities, the unintentional take of deer by WS during other activities is not expected to increase to any appreciable extent. The unintentional take of deer by WS would continue to be nominal when compared to the number of deer harvested annually. All take, including unintentional take, would be reported to the VDGIF annually and evaluated by WS to ensure WS' take, whether intentional or unintentional, would not adversely affect deer populations in the Commonwealth.

From 2006 through 2010, the highest deer harvest (259,147) in Virginia and the highest level of mortality from depredation permits (15,143) occurred in 2009 totaling 274,290 deer killed. If the number of deer killed from vehicle collisions is included, the total deer mortality of deer from human-induced causes was 322,948 deer. During the same period, the lowest deer harvest (219,747) in Virginia occurred in 2010. If WS' take reached 1,000 deer during the highest known mortality of deer in the Commonwealth that occurred in 2009, WS' take of 1,000 deer would represent 0.3% of the total known mortality in the Commonwealth. If WS' take reached 1,000 deer during the lowest harvest total of deer in the Commonwealth that occurred in 2010, WS' take of 1,000 deer would represent 0.4% of the total statewide mortality, including take under depredation permits and vehicle collisions.

The deer population in Virginia was determined to be stable over the past decade ranging from 850,000 deer to 1.05 million deer with a mean of 945,000 deer (VDGIF 2007). The total deer mortality in the Commonwealth in 2009 could be estimated at 322,948 deer, based on harvest, depredation take, WS' take, and vehicle collision data. If the deer population estimate provided by the VDGIF included recruitment of deer born that year, then the take of deer from all known sources in 2009 would represent 34.2% of the deer population. If WS had taken 1,000 deer in 2009, the total mortality of deer would have been estimated at 323,948 deer. WS' take of up to 1,000 when combined with the total known mortality in the Commonwealth during 2009, estimated at 323,948 deer, would have represented 34.3% of the population which is an increase of 0.1% when compared to the total mortality in 2009 if no take by WS had occurred (*i.e*., 34.2% without take by WS compared to 34.3% if WS' take had been 1,000 deer in 2009).

The take of deer unintentionally during other damage management activities conducted by WS would not be expected to increase the potential impacts on the deer population in Virginia. With oversight of the VDGIF, the magnitude of take of deer by WS annually to resolve damage and threats would be low. All take by WS would continue to be reported to the VDGIF to ensure WS' activities are incorporated into deer population objectives for the Commonwealth. Since deer can be taken to alleviate damage through

the issuance of depredation permits by the VDGIF, those deer taken by WS would likely be removed by those persons experiencing damage or threats since they could obtain permits for the lethal take of deer. WS' damage management activities associated with deer would be carried out under a depredation permit issued by the VDGIF to a property owner and/or manager or directly to WS to conducted deer damage management activities for a property owner and/or manager. Therefore, WS' activities would be removing deer that the property owner and/or manager could remove themselves under depredation permits but has chosen to request assistance from WS. Even in the event of a disease threat, those deer that would be taken by WS would likely be taken whether WS was directly involved or not. Therefore, WS' activities under the proposed action would not likely be additive to the mortality that already occurs under depredation permits and that could occur during disease threats. The potential impacts to the statewide deer population under the proposed action would likely be similar to the other alternatives given that WS' activities would not substantial increase the take that could occur in the absence of WS' direct involvement since take could occur when permitted by the VDGIF. The deer that could be taken by WS under the proposed action are likely those deer that would be taken by other entities when permitted by the VDGIF in the absence of WS' direct involvement in the activities.

GonaCon™ was officially registered by the EPA in 2009 for use in reducing fertility in female white-tailed deer under EPA registration number 56228-40. According to the label, only WS or state wildlife management agency personnel or individuals working under their authority can use the reproductive inhibitor. Additionally, in order for GonaCon™ to be used in any given state, the product must also be registered with the state and approved for use by the appropriate state agency responsible for managing wildlife. The reproductive inhibitor Gonacon™ is currently not registered for use in Virginia. Given this information and the costs associated with administering Gonacon™, WS does not anticipate the use of reproductive inhibitors for white-tailed deer in Virginia. However, if Gonacon™ becomes available to manage deer in the Commonwealth, 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.

The magnitude of WS' activities to alleviate damage and threats associated with deer in the Commonwealth would be low with the oversight and permitting of WS' activities occurring by the VDGIF. If take by WS had reached 1,000 deer during 2010 when the lowest known deer harvest occurred in the Commonwealth, WS' take would have represented 0.5% of the statewide harvest. In 2009, if WS' take had reached 1,000 deer, the total known mortality would have increased only 0.1% when compared to total known mortality if 1,000 deer had not be taken by WS. Based on the 2009 deer population estimate, take of up to 1,000 deer by WS would have represented 0.1% of the estimated population. WS would annually report to the VDGIF and monitor take to ensure WS' activities do not adversely affect deer. The permitting of all WS' take by the VDGIF would ensure WS' take would meet the objectives of the statewide deer management plan.

Feral Cat Population Information and Effects Analysis

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

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

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

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

Where it has been documented, the impact of feral cats on wildlife populations in suburban and rural areas, directly by predation, and indirectly by competition for food, has been enormous (Coleman and Temple 1989). In the United Kingdom, one study determined that house cats could kill 70 million animals and birds annually (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).

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

The number of feral cats in Virginia is unknown. Feral cats are considered by many wildlife biologists and ornithologists to be a detriment to native wildlife species. Feral cats prey upon native wildlife species and compete with native predators for prey. Thus, removing feral cats could be considered as providing some benefit to the natural environment by eliminating predation and competition from an introduced species.

Since feral cats are classified as companion animals under the Code of Virginia (§32.1-48.06) and may not be killed (§3.2-6570), control efforts by WS would be limited to live-trapping using cage traps with subsequent transport and transfer of custody to a local animal control officer. After relinquishing the feral cats to a local animal control officer, the care and the final disposition of the cat would be the responsibility of the animal control officer and local animal shelters. It is possible that WS could live capture as many as 100 feral cats each year in Virginia to alleviate damage and threats of damage. Feral cats would be removed in projects aimed at protecting human safety and wildlife.

Based upon the above information, WS' limited removal of feral cats would have minimal effects on local or statewide populations of this species in Virginia. Some local populations may be temporarily reduced because of live-capturing and removing feral cats at a local site. In those cases where feral cats were causing damage or were creating a nuisance and complete removal of the local population could be achieved, this would be considered as providing some benefit to the natural environment since feral cats are not considered part of the native ecosystem.

Feral Dog Population Information and Effects Analysis

Like domestic cats, 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 would be correspondingly varied, unlike the tracks of a group of coyotes (Green and Gipson 1994).

Feral dogs may occur wherever people are present and where people permit dogs to roam free or abandon unwanted dogs. Feral dogs probably occur in all of the 50 states, Canada, and Central and South America. They are also common in Europe, Australia, Africa, and on several remote ocean islands, such as the Galapagos. The home range of feral dogs can vary considerably in size with home ranges 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 near human habitation. Some people will not tolerate feral dogs in close proximity to human activity; thus, they take considerable effort to eliminate them in such areas. Feral dogs may be found on lands where human access is limited, such as military reservations and large airports. They may also live in remote sites, where they feed on wildlife and native fruits. The only areas that do not appear to be suitable for feral dogs are places where food and escape cover are not available, or where large native carnivores, particularly wolves, are common and prey on dogs (Green and Gipson 1994).

Like coyotes, feral dogs are best described as opportunistic feeders. They can be efficient predators, preying on small and large animals, including domestic livestock. Many rely on carrion, particularly

road-killed animals, crippled waterfowl, green vegetation, berries, and other fruits, and refuse at garbage dumps (Green and Gipson 1994).

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

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

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

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

From FY 2006 through FY 2011, WS lethally removed 59 feral dogs during all damage management activities in Virginia (51 target take; 8 non-target take), including those activities to protect livestock from predation. Feral dogs killed under the livestock protection program are addressed in a separate EA that evaluates the management of coyote, dog, and red fox predation on livestock in the Commonwealth of Virginia (USDA 2002), but are also included in this EA for cumulative impact analysis. WS has also live-captured and released 62 feral dogs during damage management activities from FY 2006 through FY 2011. It is possible that WS could kill as many as 50 feral dogs each year to alleviate damage in the Commonwealth. Many of those dogs would be removed in projects aimed at protecting human health and safety, valuable wildlife or other natural resources, or other agricultural resources.

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

Rodent and Insectivore Population Information and Effects Analysis

Rodents (mice, rats, and voles) and insectivores (shrews and moles) may be taken by WS during wildlife hazard management, assessment, and monitoring at airports and airbases. Although those species do not cause direct hazards to aviation safety, they serve as prey attractants to raptors and mammalian predators that may pose serious threats to aircraft safety. Typically, take is associated with small mammal trapping surveys at airports or with operational prey base management activities to reduce hazards created by avian or mammalian predators in the aircraft operations area. The level of WS' involvement in those activities may vary considerably from year to year depending on the number of airports requesting assistance from WS.

Rodent and insectivore species which may be the target of WS' surveillance and prey base management activities at airports include common white-footed mouse (*Peromyscus leucopus leucopus*), deer mouse (*Peromyscus maniculatus nubiterre*), eastern harvest mouse (*Reithrodontomys humulis virginianus*), eastern mole (*Scalopus aquaticus aquaticus*), hairy-tailed mole (*Parascolops breweri*), hispid cotton rat (*Sigmodon hispidus virginianus*), house mouse (*Mus musculus musculus*), Kirtland's short-tailed shrew (*Blarina brevicauda kirtlandi*), least shrew (*Cryptotis parva parva*), meadow jumping mouse (*Zapus hudsonius americanus*), meadow vole (*Microtus pennsylvanicus pennsylvanicus*), northern white-footed mouse (*Peromyscus leucopus noveboracensis*), northern short-tailed shrew (*Blarina brevicauda churchi*), pine vole (*Microtus pinetorum scalapsoides*), pygmy shrew (*Sorex hoyi winnemana*), and southeastern shrew (*Sorex longirostris longirostris*). Although population estimates are not available, those species are generally prolific breeders and are generally abundant throughout their range. Additionally, populations of those species fluctuate greatly over time.

Removal of those species by WS would be done primarily at airports by methods that may include trapping and the use of registered rodenticides (see Appendix B for a description of the rodenticides). Additionally, WS may use those same methods in removing voles to reduce damage at agricultural sites (*e.g*., orchards). Due to the species' relatively high reproductive rates and because management activities would be restricted to specific local sites, WS' activities under the proposed action would have minimal impacts on overall rodent and insectivore populations in the Commonwealth.

Bobcat Population Information and Effects Analysis

The bobcat is the most common wildcat in North America. Their fur is dense, soft, short and generally yellowish to reddish-brown in color with numerous black spots and black-tipped guard hairs on the back and white with black spots on the belly. Forelegs are tawny with black bars. The species gets its common name from its characteristic stubby or "*bobbed*" tail. The tail is generally only 9 to 20 cm (3.5 to 8 inches) in length with two or three black bars and a black tip above, while the underside is pale or white (Larivière and Walton 1997). Their upper legs have dark horizontal bands. The face has thin, black lines stretching onto broad cheek ruff and their ears are tufted. Males are generally larger than females. The length of bobcats ranges from 47.5 to 125 cm (19 to 49 inches), while their weight ranges between 4.1 and 18.3 kg (9 to 40 lbs) (Larivière and Walton 1997).

Bobcats are capable of hunting and killing prey that range from the size of a mouse to that of a deer. Rabbits, tree squirrels, ground squirrels, porcupines, and ground hogs comprise most of their diet. Opossums, raccoon, grouse, wild turkey, and other ground nesting birds are also eaten. Occasionally, insects and reptiles can be part of a bobcat's diet. They also resort to scavenging. They are opportunistic predators, and may feed on livestock and domestic animals such as poultry, sheep, goats, house cats, small dogs, exotic birds and game animals, and rarely, calves (Virchow and Hogeland 1994). McCord and Cardoza (1982) reported the cottontail rabbit to be the principal prey of bobcats throughout their range.

Bobcats can be found statewide in Virginia in suitable habitat. The statewide bobcat population is currently unknown. Ruell et al. (2009) reported bobcat densities ranged from 0.65 to 1.09 bobcats per square mile (0.25 to 0.42 bobcats per km^2) in coastal southern California in both large open habitat and in habitat surrounded by human developments. Lawhead (1984) reported bobcat densities of 0.66 per square mile (0.26 bobcats per km^2) in Arizona with a preference for riparian habitat. Bobcats in southern Illinois were reported to have a population density of 0.70 bobcats per square mile (0.27 bobcats per km^2) (Nielsen and Woolf 2001), while Anderson (1987) provided population density estimates of 0.13 to 0.26 bobcats per square mile (0.05 to 0.10 bobcats per km^2).

If bobcats only occupied 50% of the land area of the Commonwealth and the density of bobcat in the Commonwealth was estimated at a low of 0.13 bobcats per square mile to a high of 1.09 bobcats per square mile, the statewide population could be estimated at between approximately 2,600 and 21,500 individuals. Bobcats can be found in a variety of habitats, including developed areas, so bobcats occupying only 50% of the land area of the Commonwealth would be unlikely since bobcats can be found almost statewide. However, similar to the other furbearing species, bobcat 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.

Bobcats are classified as a furbearer in Virginia and may be taken during established hunting and trapping seasons, with a season limit of 12 bobcats per person. From FY 2006 through FY 2011, WS has intentionally removed two bobcats to reduce predation on livestock, while another seven bobcats were unintentionally killed during other damage management activities, mostly those implemented to reduce coyote predation to livestock. In addition, six bobcats were live-captured unintentionally during other damage management activities but were released unharmed. In anticipation of receiving requests for assistance, WS reasonably expects the total take of bobcats would not exceed 10 bobcats annually in Virginia to resolve requests to manage damage to resources and threats to human health and safety.

Based upon the aforementioned population estimate, WS' limited lethal take of 10 bobcats annually under the proposed action would represent 0.1% to 0.4% of a statewide population estimated to be between 2,600 and 21,500 individuals. The proposed take of bobcats by WS in the Commonwealth would be of low magnitude when compared to the actual statewide population estimates. WS' take of 10 bobcats would have no adverse effect on bobcat populations in Virginia since take of 10 bobcats is less than the limit of 12 per person that may be taken during regulated hunting and trapping seasons. The unintentional take of bobcats during activities targeting other wildlife species would not be expected to increase appreciably above the level of lethal unintentional take that has occurred previously. The combined intentional and unintentional take by WS would not be expected to reach a magnitude where adverse effects to the statewide population would occur based on the limited cumulative take that could occur by WS.

Bat Population Information and Effects Analysis

Bats are the only mammals that can truly fly. They are exceeded only by rodents as the most numerous mammals, both in number of species and number of individuals (Greenhall and Frantz 1994, National Audubon Society 2000). The bodies of bats are generally well furred with forelimbs that are enlarged. Bats have developed wings with membranes attached to four greatly elongated fingers, which spread when in flight and draw together when at rest. The "*thumb*" projects from the end of the "*forearm*" as a small but sharp claw that is used as the animal crawls about. Wing membranes are often naked and translucent (National Audubon Society 2000). The motion of bats in the air appears to be a swimming motion, in which they rotate their wings to catch air with the membrane, as opposed to birds, which flap their wings (National Audubon Society 2000). Although most North American bats have small eyes,

their visual acuity is good (Humphrey 1982). However, insectivorous bats locate food and avoid objects by means of echolocation, which is similar to radar or sonar (Humphrey 1982). While flying, the bat emits through its nose or mouth a continuous series of ultrasonic sounds. Those sounds bounce off objects and are picked up by the bats' complex ears (National Audubon Society 2000).

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

Among the 40 species of bats found north of Mexico, only a few species cause problems for people. Bats congregating in groups are called colonial bats, while those bats that live alone are known as solitary bats. Solitary bats typically roost in tree foliage or under bark, but occasionally can be in buildings, some only as transients during migration (Greenhall and Frantz 1994).

Seventeen species of bats are known to occur in Virginia. Three of the bat species, the Indiana bat (*Myotis sodalis*), gray bat (*Myotis grisescens*), and Virginia big-eared bat (*Corynorhinus townsendii virginianus*), are federally listed as endangered. The Rafinesque's big-eared bat (*Plecotus rafinesquei*) is a state listed species. Several bat species in Virginia are known to roost, raise young, or hibernate in various human structures. Such behavior sometimes causes human/bat conflicts, especially perceived or actual threats of rabies, by people who encounter bats in such locations, especially when bats enter the living space of a home. From FY 2006 to FY 2011, WS captured three bats from inside of human-occupied buildings and subsequently released the bats unharmed. No bats were lethally taken by WS in Virginia from FY 2006 through FY 2011.

WS anticipates receiving requests for assistance associated with bats inside of human-occupied buildings in the future. Bat species that may be removed include the big brown bat (*Eptesicus fuscus fuscus*), Eastern pipistrelle (*Pipistrellus subflavus subflavus*), evening bat (*Nycticeius humeralis humeralis*), and little brown bat (*Myotis lucifugus lucifugus*). Those species of bats can be found in buildings and other man-made structures. Bat species that are listed by the USFWS pursuant to the ESA and by the VDGIF are not generally associated with man-made structures and so it is unlikely that any federally or state listed bat species would be encountered by WS during activities to address bats.

In future program activities, bat damage would be handled by WS primarily through various technical assistance projects or referral to other entities. Most requests for WS' operational assistance would likely occur in relation to bats inhabiting human-occupied buildings. In most cases, a single bat found in a building would be live captured and released outside on site if there was no possibility of an exposure to people or pets. If the bat appeared sick, acted unusually or if there was a known bite or possible exposure to people or pets, the bat would be euthanized using AVMA approved methods and submitted for rabies testing. Those bats euthanized by WS for disease testing would likely be euthanized and submitted for testing by other entities in the absence of WS' involvement given the risk to human safety associated with exposure. Therefore, take by WS would not be additive to take that would likely occur in the absence of involvement by WS.

In future programs, WS could receive requests for assistance in reducing threats to people associated with bats in Virginia. Based upon an anticipated increase in the number of requests for WS' assistance, it is possible that WS could kill up to 10 bats each year statewide, of any species composition, consisting of big brown bats, Eastern pipistrelles, evening bats, and little brown bats. If the need arises, WS would consult with a qualified biologist to identify bats prior to removing them in order to eliminate any chance

of addressing a T&E species. If an Indiana bat, gray bat, or Virginia big-eared bat were identified, WS would contact the USFWS to determine the appropriate action. If a Rafinesque's big-eared bat were identified, WS would contact the VDGIF to determine the appropriate action. WS would continue to live-capture and release bats in those instances where no human or pet exposure can be assured.

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

Wildlife Disease Surveillance and Monitoring

The ability to efficiently conduct surveillance for and detect diseases would be dependent upon rapid detection of the pathogen if it were introduced. Effective implementation of a surveillance system would facilitate planning and execution at regional and state levels, and coordination of surveillance data for risk assessment. It would also facilitate partnerships between public and private interests, including efforts by federal, state, and local governments as well as non-governmental organizations, universities, and other interest groups.[11]

To provide the most useful information and a uniform structure for surveillance, strategies for collecting samples could be employed. Those strategies include:

Investigation of Illness/Death in Mammals: A systematic investigation of illness and death in mammals may be conducted to determine the cause of the illness or death. This strategy would offer the best and earliest probability of detection if a disease were introduced into the United States. Illness and death involving wildlife can often be detected by or reported to natural resource agencies and entities. This strategy capitalizes on existing situations of mammals without additional mammals being handled or killed.

Surveillance in Live Wild Mammals: This strategy would involve sampling live-captured, apparently healthy mammals to detect the presence of a disease. Mammal species that represent the highest risk of being exposed to, or infected with, the disease because of their movement patterns, or mammals that may be in contact with species from areas with reported outbreaks would be targeted. Where possible, this sampling effort would be coordinated with local projects that already plan on capturing and handling the desired mammal species. Coordinating sampling with ongoing projects currently being conducted by state and federal agencies, universities, and others would maximize use of resources and would minimize the need for additional mammal capture and handling.

Surveillance in Harvested Mammals: Check stations for harvestable mammal species provide an opportunity to sample dead mammals to determine the presence of a disease, and could supplement data collected during surveillance of live mammals. Sampling of mammals harvested or taken as part of damage management activities would focus on species that are most likely to be exposed to a disease.

Under the disease sampling strategies listed above that could be implemented to detect or monitor mammalian diseases in the United States, WS' implementation of those sampling strategies would not

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

adversely affect mammal populations in the Commonwealth. Sampling strategies that could be employed involve sampling live-captured mammals that could be released on site after sampling occurs. The sampling (*e.g.*, drawing blood, hair 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 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 mammal species addressed in the EA and would not result in any take of mammals that would not have already occurred in the absence of disease sampling (*e.g.*, hunter harvest).

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

Mammal populations in the Commonwealth 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 to resolve mammal damage. Methods and techniques recommended would be based on WS' Decision Model using information provided from the requestor or from a site visit. Requestors may implement WS' recommendations, implement other actions, seek assistance from other entities, or take no action. However, those persons requesting assistance are likely people that would implement damage abatement methods in the absence of WS' recommendations.

Under a technical assistance only alternative, those persons experiencing threats or damage associated with mammals in the Commonwealth 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 VDGIF, during regulated hunting or trapping seasons, or without a permit as allowed by state laws and regulations. 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 VDGIF, 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 VDGIF, private entities, and/or municipal authorities. If direct operational assistance was not available from WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal take, which could lead to real but unknown effects on other wildlife populations. People have resorted to the illegal use of chemicals and methods to resolve wildlife damage issues (White et al. 1989, USFWS 2001, Food and Drug Administration 2003).

Alternative 3 – No Mammal Damage Management Conducted by WS

Under this alternative, WS would not conduct damage management activities in the Commonwealth. WS would have no direct involvement with any aspect of addressing damage caused by mammals and would provide no technical assistance. No take of mammals by WS would occur under this alternative. Mammals could continue to be lethally taken to resolve damage and/or threats occurring either through permits issued by the VDGIF, during the regulated hunting or trapping seasons, or without a permit as allowed in certain situations by state laws and regulations. Management actions taken by non-federal entities would be considered the *environmental status quo*.

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

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

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

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

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

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

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

Non-lethal methods that use auditory and visual stimuli to reduce or prevent damage are intended to elicit fright responses in wildlife. When employing those methods to disperse or harass target species, any non-targets near when those methods are employed would also likely be dispersed from the area. Similarly, any exclusionary device constructed to prevent access by target species also excludes access to non-target species. The persistent use of non-lethal methods would likely result in the dispersal or abandonment of areas by both target and non-target species in those areas where non-lethal methods were employed. Therefore, any use of non-lethal methods would have similar results on both non-target and target species. Although non-lethal methods would not result in lethal take of non-targets, the use of non-lethal methods could restrict or prevent access of non-targets to beneficial resources. Overall, potential impacts to non-targets from the use of non-lethal methods would not adversely affect populations since those methods are often temporary.

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

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

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

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

WS could also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage when those methods were deemed appropriate for use using the WS Decision Model. Lethal methods available for use to manage damage caused by mammals under this alternative would include live-capture followed by euthanasia, euthanasia chemicals, body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, rodenticides, 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 and dens would be observed for the presence of non-targets before the use of fumigants. If non-target activity (*e.g*., tracks, scat) were observed, the fumigation of those burrows or dens would not occur. Since non-targets are known to occur in burrows or dens, some risks of unintentional take of non-targets does exist from the use of fumigants. For example, burrows of woodchucks can be used by a variety of non-target species such as the Eastern cottontail, striped skunk, raccoon, red fox, coyote, white-footed mouse, house mouse, and short-tailed shrew (Hamilton 1934, Grizzell 1955, Dolbeer et al. 1991).

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

Zinc phosphide is a toxicant used to kill rodents, lagomorphs, and nutria. Zinc phosphide is two to 15 times more toxic to rodents than to carnivores (Hill and Carpenter 1982). Secondary risks appear to be minimal to predators and scavengers that scavenge carcasses of animals killed with zinc phosphide (Tietjen 1976, Hegdal and Gatz 1977, Hegdal et al. 1980, Hill and Carpenter 1982, Johnson and Fagerstone 1994). Risks would be minimal based on: 1) 90% of the zinc phosphide ingested by rodents is detoxified in the digestive tract (Hegdal et al. 1980), 2) 99% of the zinc phosphide residues occur in the digestive tracts, with none occurring in the muscle, 3) the amount of zinc phosphide required to kill target rodents is not enough to kill most other predatory animals that consume tissue (Johnson and Fagerstone 1994).

In addition, zinc phosphide has a strong emetic action (*i.e*., causes vomiting) and most non-target animals in research tests regurgitated bait or tissues contaminated with zinc phosphide without succumbing to the toxicant (Hegdal and Gatz 1977, Hegdal et al. 1980, Johnson and Fagerstone 1994). Furthermore, predators tend to eviscerate zinc phosphide-poisoned rodents before eating them or otherwise avoid the digestive tract and generally do not eat the stomach and intestines (Hegdal et al. 1980, Johnson and Fagerstone 1994). Although zinc phosphide baits have a strong, pungent, phosphorous-like odor (garlic-like), this characteristic seems to attract rodents, particularly rats, and apparently makes the bait unattractive to some other animals. Many birds appear capable of distinguishing treated from untreated baits and they prefer untreated grain when given a choice (Siegfried 1968, Johnson and Fagerstone 1994). Birds appear particularly susceptible to the emetic effects of zinc phosphide, which would tend to offer an extra degree of protection against bird species dying from the consumption of grain treated with zinc phosphide or, for scavenging bird species, from eating poisoned rodents. Use of rolled oats instead of

whole grain also appears to reduce bird acceptance of bait. Uresk et al. (1988) reported on the effects of zinc phosphide on six non-target rodent populations. Uresk et al. (1988) determined that no differences were observed from pretreatment until after treatment in populations of eastern cottontail rabbits and white-tailed jackrabbits (*Lepus townsendii*). However, primary consumption of bait by non-target wildlife could occur and potentially cause mortality. Uresk et al. (1988) reported a 79% reduction in deer mouse populations in areas treated with zinc phosphide; however, the effect was not statistically significant because of high variability in densities and the reduction was not long-term (Deisch et al. 1990).

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

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

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

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

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-target mammals during damage management activities conducted by WS from FY 2006 through FY 2011 is shown in Table 4.6. Table 4.6 also includes non-target mammals unintentionally lethally taken during the ORV program (USDA 2005*a*), during management of predation on livestock (USDA 2002), and activities to reduce nest predation on the barrier islands of the Commonwealth (USDA 2005*b*).

Table 4.6: Non-target mammals lethally taken by WS in Virginia, FY 2006 – FY 2011†

Species	Take	Species	Take
Black Bear	3	**Muskrat**	32
Bobcat	7	**Nutria**	2
Feral Cat	7	**Opossum**	152
White-tailed Deer	47	**River Otter**	49
Feral Dog	8	**Eastern Cottontail**	35
Gray Fox	221	**Raccoon**	372
Red Fox	401	**Striped Skunk**	31
Woodchuck	25	**Fox Squirrel**	1
Mice/Rats	5	**TOTAL**	**1,398**

†Includes non-target mammal take during other damage management activities conducted by the WS program in Virginia

The species with the highest level of take were red fox, which were primarily lethally taken during damage management activities targeting coyotes to alleviate livestock predation. WS has lethally removed 401 red fox as non-targets between FY 2006 and FY 2011, which is an average of 67 fox per year. All of the species lethally removed by WS as non-targets 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, except for fox squirrels. Although Table 4.6 lists mammal species lethally taken as non-targets by WS during previous damage management, other non-target species, including bird species, could be lethally removed unintentionally during damage management activities. However, the lethal take of those species would occur infrequently and would not occur at levels that adverse effects would occur to those species populations given the limited take that could occur. Table 4.6 reflects those species that are most likely to be lethally taken by WS during damage management activities as non-targets.

The capture and limited lethal take that could occur as part of other damage management activities are further addressed in the ORV program EA (USDA 2005*a*), the livestock protection EA (USDA 2002), and the EA addressing nest predation on the barrier islands of the Commonwealth (USDA 2005*b*). However, non-targets captured and lethally taken as part of those damage management activities are also 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 affect non-targets. Methods available to resolve and prevent mammal damage or threats when employed by trained, knowledgeable personnel would be selective for target species. WS would annually report to the VDGIF any non-target take to ensure take by WS would be considered as part of management objectives. Those methods available under the proposed action alternative would be available under the other alternatives except for Gonacon™, immobilizing drugs, and euthanasia drugs. Therefore, the potential impacts to non-targets are similar to the other alternatives and are considered minimal to non-existent.

As discussed previously, the use of non-lethal methods to address damage or threats are generally regarded as having 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 4.6, the lethal take of non-target mammals by WS during all damage management activities does not reach a magnitude where adverse effects would occur to the population of a species. 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, many of the species lethally taken or live-captured from FY 2006 through FY 2011 are also considered targets species in the EA and the level of take analyzed for each species under Issue 1 included an evaluation of non-target take during previous activities. Therefore, the take of those species would be evaluated cumulatively by WS, 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, feral dogs, coyotes, feral swine, nutria, woodchucks, and mice/rats can be harvested in the Commonwealth during annual harvest seasons. Mice, rats, coyotes, woodchucks, feral swine, and nutria can be lethally removed at any time to alleviate damage or threats of damage using legally available methods.

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 could result in the incidental take of unintended species. Those occurrences would be infrequent and should not affect the overall populations of any species under the proposed action. The proposed mammal damage management could benefit many other wildlife species that are adversely affected by predation or competition for resources. For example, fox often feed on the eggs, nestlings, and fledglings of ground nesting bird species, browsing damage from deer overabundance may affect species diversity, or raccoons may feed on T&E species of mussels in a stream. This alternative has the greatest possibility of successfully reducing mammal damage and conflicts to wildlife species since all available methods could possibly be implemented or recommended by WS.

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 Virginia 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 Commonwealth along with common and scientific names of the species listed.

Based on a review of those T&E species listed in the Commonwealth during the development of this EA, WS determined that activities conducted pursuant to the proposed action would not likely adversely affect

those species listed in the Commonwealth 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 Commonwealth or their critical habitats (S. Hoskin, USFWS, pers. comm. 2012).

Commonwealth Listed Species – The current list of Commonwealth listed species as determined by the VDGIF was obtained and reviewed during the development of the EA (see Appendix C). Based on the review of species listed in the Commonwealth, WS has determined that the proposed activities would not adversely affect those species currently listed by the Commonwealth. The VDGIF concurred with WS' determination that activities conducted pursuant to the proposed action would not likely adversely affect those species currently listed in the Commonwealth or their critical habitats (A. Ewing, VDGIF, pers. comm. 2012).

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

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

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

The potential impacts of harassment and exclusion methods on non-target species would be similar to those described under the proposed action. Harassment and exclusion methods 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 would likely be low under this alternative.

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

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

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

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

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

Alternative 3 – No Mammal Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with damage management activities in the Commonwealth. 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 VDGIF, take would continue to occur during the regulated harvest seasons, and certain nuisance 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 damage management activities on their own or through recommendations by the other federal, Commonwealth, 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 Mammal Damage Management Program (No Action/Proposed Action)

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

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

Lethal methods available under the proposed action would include the use of live-capture followed by euthanasia, body-gripping traps, cable restraints, the recommendation of take during hunting and/or trapping seasons, fumigants, rodenticides, 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 available would be restricted to use by WS only. Euthanasia chemicals would not be available to the public but those mammals live-captured could be killed using other methods.

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

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

warning of the use of those tools in the area would be posted for public view at access points to increase awareness that those devices were being used and to avoid the area, especially pet owners. Other live-capture devices, such as cannon nets, pose minor safety hazards to the public since activation of the device occurs by trained personnel after target species have been observed in the capture area of the net.

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

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

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

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

Drugs used in capturing, handling, and euthanizing wildlife include ketamine, a mixture of ketamine and xylazine, sodium pentobarbital, potassium chloride, and Beuthanasia-D. Meeting the requirements of the Animal Medicinal Drug Use Clarification Act would prevent any adverse impacts on human health with regard to this issue. SOPs that would be part of the activities conducted would include:

- All drugs used in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS.
- As determined on a state-level basis by those veterinary authorities (as allowed by Animal Medicinal Drug Use Clarification Act), wildlife hazard management programs may choose to

avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Ear tagging or other marking of animals drugged and released to alert hunters and trappers that they should contact state officials before consuming the animal.

- Most animals administered drugs would be released well before hunting/trapping seasons, which would give the drug time to completely metabolize out of the animals' systems before they might be taken and consumed by humans. In some instances, animals collected for control purposes would be euthanized when they are captured within a certain specified time period prior to the legal hunting or trapping season to avoid the chance that they would be consumed as food while still potentially having immobilizing drugs in their systems.

By following those procedures in accordance with Animal Medicinal Drug Use Clarification Act, wildlife management programs would avoid any adverse effects on human health with regard to this issue.

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

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

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

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

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

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

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

The recommendation by WS that mammals be harvested during the regulated hunting and/or trapping seasons that are established by the VDGIF 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 VDGIF 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 Commonwealth from FY 2006 through FY 2011. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, would be considered low.

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

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

who are experienced in their use. Risks to human safety associated with non-chemical methods such as resource management methods (*e.g*., crop selection, limited habitat modification, modification of human behavior), exclusion devices, frightening devices, and cage traps would be considered low based on their use profile for alleviating damage associated with wildlife. Although some risk of fire and bodily harm exists from the use of pyrotechnics and propane cannons, when used appropriately and in consideration of those risks, they can be used with a high degree of safety.

Under a technical assistance only alternative, the use of immobilizing drugs, euthanasia drugs, and Gonacon™ would not be available to the public. However, personnel with the VDGIF could use Gonacon™ under this alternative. Drugs used in capturing and handling wildlife could be administered under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and other entities, such as the VDGIF.

Chemical methods available would include repellents. There are few chemical repellents registered for use to manage damage caused by mammals in the Commonwealth. 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 would be established by the VDGIF, 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 local populations that could then reduce mammal damage or threats would not increase risks to human safety. Safety requirements established by the VDGIF for the regulated hunting and trapping season would further minimize risks associated with those activities. Although hunting and trapping accidents do occur, the recommendation of allowing hunting or trapping to reduce localized mammal populations would not increase those risks.

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

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

The cooperator requesting assistance would also be made aware of threats to human safety associated with the use of those methods. Risks to human safety from activities and methods recommended under this alternative would be similar to the other alternatives since the same methods would be available. If misused or applied inappropriately, any of the methods available to alleviate mammal damage could threaten human safety. However, when used appropriately, methods available to alleviate damage would not threaten human safety.

Alternative 3 – No Mammal Damage Management Conducted by WS

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

Similar to the technical assistance only alternative, reproductive inhibitors, immobilizing drugs, and euthanasia chemicals would not be available under this alternative to the public. However, fumigants, rodenticides, and repellents would continue to be available to those persons with the appropriate pesticide applicators license. Since most methods available to resolve or prevent mammal damage or threats would be available to anyone, the threats to human safety from the use of those methods would be similar between the alternatives. However, methods employed by those persons not experienced in the use of methods or 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 could have on the aesthetic value that people often regard for mammals. The effects of the alternatives on this issue are analyzed below by alternative.

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

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

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

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

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

Since those mammals removed by WS under this alternative could be removed with a permit issued by the VDGIF, without the need for a permit (*e.g.*, nuisance species, non-native species), or during the regulated hunting or trapping seasons, WS' involvement in taking those mammals would not likely be additive to the number of mammals that could be taken in the absence of WS' involvement.

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

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

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

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

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

Alternative 3 – No Mammal Damage Management Conducted by WS

Under the no mammal damage management by WS alternative, the actions of WS would have no impact on the aesthetic value of mammals in the Commonwealth. Those persons experiencing damage or threats from mammals would be responsible for researching, obtaining, and using all methods as permitted by federal, Commonwealth, and local laws and regulations. Mammals could continue to be dispersed and lethally taken under this alternative in the Commonwealth. Lethal take could continue to occur when permitted by the VDGIF through the issuance of permits, take could occur during the regulated harvest season, and in the case of nuisance 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 Commonwealth. The VDGIF with management authority over mammals could continue to adjust all take levels based on population objectives for those mammal species in the Commonwealth. Therefore, the number of mammals lethally taken annually through hunting and under permits would be regulated and adjusted by the VDGIF.

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

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

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

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

Under the proposed action, WS would integrate methods using WS' Decision Model as part of technical assistance and direct operational assistance. Methods available under the proposed action could include non-lethal and lethal methods integrated into direct operational assistance conducted by WS. Under this alternative, non-lethal methods would be used by WS that were generally regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, crop selection, limited habitat modification, modification of human behavior), translocation, 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 would be to use methods as humanely as possible to effectively resolve requests for assistance to reduce damage and threats to human safety. WS would continue to evaluate methods and activities to minimize the pain and suffering of methods addressed when attempting to resolve requests for assistance.

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

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

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

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

Under the proposed action, lethal methods could also be employed to resolve requests for assistance to resolve or prevent mammal damage and threats. Lethal methods would include shooting, euthanasia after mammals were live-captured, fumigants, rodenticides, and body-gripping traps. WS' use of euthanasia methods under the proposed action would follow those required by WS' directives (see WS Directive 2.505, WS Directive 2.430).

Research and development by WS has improved the selectivity and humaneness of management techniques. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods were used in situations where non-lethal damage management methods were not practical or

effective. Personnel from WS would be experienced and professional in their use of management methods. Consequently, management methods would be implemented in the most humane manner possible. Many of the methods discussed in Appendix B to alleviate mammal damage and/or threats in the Commonwealth, could be used under any of the alternatives by those persons experiencing damage regardless of WS' direct involvement. The only methods that would not be available to those persons experiencing damage associated with mammals would be reproductive inhibitors, immobilizing drugs, and euthanasia drugs. Therefore, the issue of humanness associated with methods would be similar across any of the alternatives since those methods could be employed by other entities in the absence of WS' involvement. Those persons who view a particular method as humane or inhumane would likely continue to view those methods as humane or inhumane under any of the alternatives. SOPs that would be incorporated into WS' activities to ensure methods were used by WS as humanely as possible are listed in Chapter 3.

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

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

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

Alternative 3 – No Mammal Damage Management Conducted by WS

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

The humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the public to use to resolve damage and threats caused by mammals. Under Alternative 3, euthanasia or killing of live-captured animals would also be determined by those persons employing methods to live-captured wildlife.

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

The populations of several of the mammal species addressed in this assessment are sufficient to allow for annual harvest seasons that typically occur during the fall. Hunting and trapping seasons are established by the VDGIF. Those species addressed in this EA that have established harvest seasons include black bear, bobcat, coyote, Eastern cottontail, gray fox, gray squirrel, red fox, raccoon, river otter, striped skunk, Virginia opossum, and white-tailed deer. For many mammal species considered harvestable during hunting and/or trapping seasons, the number of mammals harvested during the season is reported by the VDGIF online or in published reports.

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

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

With oversight of mammal populations by the VDGIF, the number of mammals permitted by the VDGIF 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 VDGIF annually to ensure take by WS was incorporated into population management objectives established for mammal populations. Based on the limited take proposed by WS and the oversight by the VDGIF, WS' take of mammals annually would have no effect on the ability of those persons interested to harvest mammals during the regulated harvest season.

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

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

Alternative 3 – No Mammal Damage Management Conducted by WS

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

4.2 CUMULATIVE IMPACTS OF THE PROPOSED ACTION BY ISSUE

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

Under Alternative 1 and Alternative 2, WS would address damage associated with mammals either by providing technical assistance (Alternative 2) or by providing technical assistance and direct operational assistance (Alternative 1) in the Commonwealth. WS would be the primary federal agency conducting direct operational damage management activities in the Commonwealth under Alternative 1 and Alternative 2. However, other federal, Commonwealth, and private entities could also conduct damage management activities associated with mammals. The take of native mammal species requires a permit from the VDGIF, except for those species considered nuisance species. Several species of mammals addressed in this assessment can also be harvested during the annual regulated harvest season.

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

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

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

- Natural mortality of mammals
- Mortality through vehicle strikes, aircraft strikes, and illegal harvest
- Human-induced mortality from annual hunting and/or trapping seasons for mammal species
- Human-induced mortality of mammals through private damage management activities
- Human and naturally induced alterations of wildlife habitat
- Annual and perennial cycles in wildlife population densities

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

This process allows WS to take into consideration other influences in the environment, such as those listed above, in order to avoid cumulative adverse impacts on target species.

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

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

Historical outcomes of WS' damage management activities on wildlife

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

Strategies built into the WS program

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

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

Potential effects on non-target species from conducting mammal damage management arise from the use of non-lethal and lethal methods to alleviate or prevent those damages. The use of non-lethal methods during activities to reduce or prevent damage caused by mammals has the potential to exclude, disperse, or capture non-target wildlife. However, the effects of non-lethal methods are often temporary and often do not involve the take (killing) of non-target wildlife species. When using exclusion devices and/or repellents, both target and non-target wildlife can be prevented from accessing the resource being damaged. Since exclusion and repellents do not involve lethal take, cumulative impacts on non-target species from the use of exclusionary or repellent methods would not occur but would likely disperse those individuals to other areas. Exclusionary methods are often expensive and require constant maintenance to ensure effectiveness. Similarly, repellents can also be expensive to apply and require constant re-application to ensure effectiveness. Therefore, the use of exclusionary devices and repellents would be

somewhat limited to small, high-value areas and not used to the extent that non-targets would be excluded from large areas that would cumulatively impact populations from the inability to access a resource, such as potential food sources, denning, or fawning sites. The use of visual and auditory harassment and dispersion methods would generally be temporary with non-target species returning after the cessation of those activities. Dispersal and harassment do not involve the take (killing) of non-target species and similar to exclusionary methods would not be used to the extent or at a constant level that would prevent non-targets from accessing critical resources that would threaten survival of a population.

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

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

All chemical methods would be tracked and recorded to ensure proper accounting of used and unused chemicals occurs. All chemicals would be stored and transported according with WS' Directives and relevant federal, state, and local regulations. Chemical methods available for use under the proposed action would include repellents, acute toxicants, anti-coagulants, fumigants, and gas cartridges, which are described in Appendix B. Except for repellents that are applied directly to the affected resource, all chemical methods would be employed using baits that are highly attractive to target species, used in known burrow/den sites and/or used in areas where exposure to non-targets would be minimal. The use of those methods requires an acclimation period and monitoring of potential bait sites for non-target activity. All chemicals would be used according to product label, which ensure that proper use would minimize non-target threats. WS' adherence to Directives and SOPs governing the use of chemicals would also ensure non-target hazards would be minimal.

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

Repellents may be used or recommended by the WS program in Virginia to manage mammal damage. The active ingredients in numerous commercial repellents are capsaicin, pepper oil, and carnivore urine. Characteristics of these chemicals and potential use patterns indicate that no cumulative impacts related to environmental fate would be expected from their use in WS' programs in Virginia when used according to label requirements.

When using acute toxicants, as required by WS' SOPs and applicable pesticide labels, all potential bait sites would be pre-baited and monitored for non-target use as outlined in the pre-treatment observations section of the label. If non-targets were observed feeding on the pre-bait, the areas would be abandoned

and no baiting would occur at those locations. Once sites were baited, sites would be monitored to further observe for non-target feeding activity. If non-targets were observed feeding on bait, those sites would be abandoned. WS would retrieve all dead target species to the extent possible following treatment to minimize any secondary hazards associated with or perceived to be associated with scavengers feeding on target species carcasses. When using anti-coagulants, appropriate bait stations would be utilized and inspected as required by the applicable label.

The methods described in Appendix B all have a high level of selectivity and could be employed using SOPs to ensure minimal impacts to non-target species. Most of the species lethally taken by WS as unintentional non-targets can be harvested in the Commonwealth during annual hunting and/or trapping seasons. In addition, several species are not native to the Commonwealth and are considered invasive species that often compete with native wildlife for resources. Also, potential impacts to a species' population from WS' previous non-target take were analyzed cumulatively in Chapter 4 of this EA when evaluating overall take to alleviate damage when those species would be considered a target species. 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 of non-targets would not cumulatively affect non-target species. WS' has reviewed the T&E species listed by the VDGIF, the USFWS, and the National Marine Fisheries Service and has determined that damage management activities proposed by WS would not likely adversely affect T&E species. Cumulative impacts would be minimal on non-targets from any of the alternatives discussed**.**

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

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

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

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

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

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 plant species that may be suppressed or killed by high mammal densities.

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

Mammal population objectives are established and enforced by the VDGIF through the regulating of take during the statewide hunting/trapping seasons after consideration of other known mortality factors. Therefore, WS has no direct impact on the status of mammal populations since all take by WS occurs at the discretion of the VDGIF. Since those persons seeking assistance could remove mammals from areas where damage was occurring without assistance from WS, WS' involvement would have no effect on the aesthetic value of mammals in the area where damage was occurring. When damage caused by mammals has occurred, any removal of mammals by the property or resource owner would likely occur whether WS was involved with taking the mammals or not.

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

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

Issue 5 - Humaneness and Animal Welfare Concerns of Methods

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

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

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

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

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

The populations of several mammal species are sufficient to allow for annual harvest seasons that typically occur during the fall. Hunting and trapping seasons are established by the VDGIF. Those species addressed in this EA that have established hunting and/or trapping seasons include: black bear, bobcat, coyote, Eastern cottontail, gray fox, gray squirrel, red fox, raccoon, river otter, striped skunk, Virginia opossum, and white-tailed deer.

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

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

5.1 LIST OF PREPARERS

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Michael Fies	VDGIF – Furbearer Project Leader
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APPENDIX A
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APPENDIX B

METHODS AVAILABLE FOR RESOLVING OR PREVENTING MAMMAL DAMAGE IN THE COMMONWEALTH OF VIRGINIA

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

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

A variety of methods would potentially be available to the WS program in Virginia relative to the management or reduction of damage from mammals. Various federal, Commonwealth, and local statutes and regulations and WS directives govern WS' use of damage management tools and substances. WS develops and recommends or implements strategies based on resource management, physical exclusion, and wildlife management approaches. Within each approach there may be available a number of specific methods or tactics. The following methods would be available to alleviate damage and threats of damage associated with mammals.

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 to target individuals of local wildlife population to alleviate damage and conflicts. Methods may be non-lethal (*e.g*., fencing, frightening devices,) or lethal (*e.g*., firearms, body gripping traps, snares). If WS personnel apply these methods on private lands, a cooperative service agreement must be signed by the landowner or administrator authorizing the use of each damage management method. Non-chemical methods that would be available to WS would include:

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

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

Some mammals that cause damage are attracted to homes by the presence of garbage or pet food left outside and unprotected. Removal or sealing of garbage in tight trash receptacles, and elimination of all pet foods from outside areas can reduce the presence of unwanted mammals. If raccoons were 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 would usually be 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
- harassment / shooting into groups

Live Capture and Relocation can be accomplished using cage traps, snares, nets, and foothold traps to capture some species of mammals to translocate them for release to suitable habitat away from areas where they were causing damage or posing a threat of damage. Unless specifically requested by the VDGIF, WS does not use or recommend this method to resolve mammal damage in Virginia.

Trapping can utilize a number of devices, including footholds, cage-type traps, body gripping (Conibear) traps, foot snares, and neck/body snares. These techniques could be 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 would be placed either 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 would be 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.

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

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

Fumigants such as the large gas cartridge (EPA Reg. No. 56228-1) and gas cartridge (EPA Reg. No. 56228-2) are registered by WS with VDACS and are often used to treat dens or burrows of coyotes, fox, or woodchucks. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the burrow or den. Sodium nitrate is the principle active chemical in gas cartridges and is a naturally occurring substance. Although stable under dry conditions, it is readily soluble in water and likely to be highly mobile in

soils. In addition, dissolved nitrate is very mobile, moving quickly through the vadose zone to the underlying water table (Bouwer 1989). 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*a*, EPA 1986*b*). 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).

Carbon Dioxide (CO_2) is sometimes used to euthanize mammals that were live-captured. Live mammals would be placed in a sealed chamber. CO_2 gas would be released into the chamber and the animal quickly dies after inhaling the gas. This method is approved as a euthanizing agent by the AVMA. CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

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

Chemical Immobilization Drugs

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

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.

Chemical Euthanasia Drugs

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 would be 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. 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.

Fatal-Plus® combines pentobarbital with other substances to hasten cardiac arrest. Intravenous (IV) is the preferred route of injection; however, IC is acceptable as part of the two-step procedure used by WS. Animals would first be anesthetized and sedated using a combination of ketamine/xylazine and once completely unresponsive to stimuli and thoroughly sedated, Fatal-Plus® is administered. Like Beuthanasia®-D, it is a Schedule III drug requiring a DEA registration for purchase and is subject to the security and record-keeping requirements of Schedule II drugs.

Rodenticides

Zinc phosphide is an inorganic compound used to control rats, mice, voles, ground squirrels, prairie dogs, nutria, muskrats, feral rabbits, and gophers. Zinc phosphide is a heavy, finely ground gray-black powder that is partially insoluble in water and alcohol. When exposed to moisture, it decomposes slowly and releases phosphine gas (PH_3). When zinc phosphide comes into contact with dilute acids in the stomach, phosphate (PH3) is released, which may account in a large part for observed toxicity. Animals that ingest lethal amounts of bait usually succumb overnight with terminal symptoms of convulsions, paralysis, coma, and death from asphyxia. If death is prolonged for several days, intoxication that occurs is similar to intoxication with yellow phosphorous, in which the liver is heavily damaged. Prolonged exposure to phosphine can produce chronic phosphorous poisoning.

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

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

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

APPENDIX C

Federally and State Listed Threatened and Endangered Species in the Commonwealth of Virginia

Federally Endangered, Threatened, Proposed, and Candidate Species in Virginia

SCIENTIFIC NAME	COMMON NAME	STATUS
AMPHIBIANS		
Plethodon shenandoah	Shenandoah salamander	LE
BIRDS		
Calidris canutus rufa	Red knot	C
Charadrius melodus	Piping plover	LT
Picoides borealis	Red-cockaded woodpecker	LE
Sterna dougallii dougallii	Roseate tern	LE
CRUSTACEANS		
Antrolana lira	Madison cave isopod	LT
Lirceus usdagalun	Lee County cave isopod	LE
FISHES		
Acipenser brevirostrum[1]	Shortnose sturgeon	LE
Erimonax monachus	Spotfin chub	LT
Erimystax cahni	Slender chub	LT
Etheostoma percnurum	Duskytail darter	LE
Noturus flavipinnis	Yellowfin madtom	LT
Percina rex	Roanoke logperch	LE
Phoxinus cumberlandensis	Blackside dace	LT
INSECTS		
Cicindela dorsalis dorsalis	Northeastern beach tiger beetle	LT
Neonympha mitchelli mitchelli	Mitchell's satyr	LE
Nicrophorus americanus	American burying beetle	LE-EX
MAMMALS		
Corynorhinus townsendii virginianus	Virginia big-eared bat	LE
Felis concolor couguar	Eastern cougar	LE-EX
Glaucomys sabrinus coloratus	Carolina northern flying squirrel	LE
Glaucomys sabrinus fuscus	Virginia northern flying squirrel	LE
Myotis grisescens	Gray bat	LE
Myotis sodalis	Indiana bat	LE
Sciurus niger cinereus	Delmarva Peninsula fox squirrel	LE

SCIENTIFIC NAME	COMMON NAME	STATUS
MUSSELS		
Alasmidonta heterodon	Dwarf wedgemussel	LE
Cumberlandia monodonta	Spectaclecase	PE
Cyprogenia stegaria	Fanshell	LE
Dromus dromas	Dromedary pearlymussel	LE
Epioblasma brevidens	Cumberlandian combshell	LE
Epioblasma capsaeformis	Oyster mussel	LE
Epioblasma torulosa gubernaculum	Green-blossom pearlymussel	LE-EX
Epioblasma florentina walkeri	Tan riffleshell	LE
Epioblasma triquetra	Snuffbox	PE
Fusconaia cor	Shiny pigtoe	LE
Fusconaia cuneolus	Fine-rayed pigtoe	LE
Hemistena lata	Cracking pearlymussel	LE
Lampsilis abrupta	Pink mucket pearlymussel	LE-EX
Lemiox rimosus (=Conradilla caelata)	Birdwing pearlymussel	LE
Lexingtonia dolabelloides	Slabside pearlymussel	C
Pegias fabula	Little-wing pearlymussel	LE
Plethobasus cyphyus	Sheepnose	PE
Pleurobema collina	James spinymussel	LE
Pleurobema plenum	Rough pigtoe	LE
Ptychobranchus subtentum	Fluted kidneyshell	C
Quadrula cylindrica strigillata	Rough rabbitsfoot	LE
Quadrula intermedia	Cumberland monkeyface pearlymussel	LE
Quadrula sparsa	Appalachian monkeyface pearlymussel	LE
Villosa fabalis	Rayed bean	PE-EX
Villosa perpurpurea	Purple bean	LE
Villosa trabalis	Cumberland bean pearlymussel	LE-EX
REPTILES		
Caretta caretta[1]	Loggerhead sea turtle	LT
Chelonia mydas[1]	Green sea turtle	LT
Dermochelys coriacea[1]	Leatherback sea turtle	LE
Eretmochelys imbricata[1]	Hawksbill sea turtle	LE
Lepidochelys kempii[1]	Kemp's ridley sea turtle	LE
Clemmys muhlenbergii	Bog turtle	LT(S/A)
SNAILS		
Polygyriscus virginianus	Virginia fringed mountain snail	LE

SCIENTIFIC NAME	COMMON NAME	STATUS
SPIDERS		
Microhexura montivaga	Spruce-fir moss spider	LE
LICHENS		
Gymnoderma lineare	Rock gnome lichen	LE
PLANTS		
Aeschynomene virginica	Sensitive joint-vetch	LT
Amaranthus pumilus	Seabeach amaranth	LT
Arabis serotina	Shale barren rock cress	LE
Betula uber	Virginia round-leaf birch	LT
Cardamine micranthera	Small-anthered bittercress	LE
Echinacea laevigata	Smooth coneflower	LE
Helenium virginicum	Virginia sneezeweed	LT
Helianthus schweinitzii[1]	Schweinitz's sunflower	LE
Helonias bullata	Swamp pink	LT
Iliamna corei	Peter's Mountain mallow	LE
Isotria medeoloides	Small whorled pogonia	LT
Platanthera integrilabia	White fringeless orchid	C-EX
Platanthera leucophaea	Eastern prairie fringed orchid	LT
Ptilimnium nodosum	Harperella	LE
Rhus michauxii	Michaux's sumac	LE
Schwalbea americana	American chaffseed	LE-EX
Scirpus ancistrochaetus	Northeastern bulrush	LE
Spiraea virginiana	Virginia spiraea	LT

KEY

LE	Listed endangered.
LT	Listed threatened.
PE	Proposed endangered.
PT	Proposed threatened.

EX	Believed to be extirpated in Virginia.
LT(S/A)	Endangered due to similarity of appearance to another listed species.
C	Candidate (The Service has enough information to list the species as threatened or endangered, but this action is precluded by other listing activities).

[1]Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Oceanic and
Atmospheric Administration's Fisheries Service.

Last Updated: February 6, 2012
Prepared by U.S. Fish and Wildlife Service, Virginia Field Office

State listed Threatened and Endangered Species in the Commonwealth of Virginia[1]

Common Name	Scientific Name	State status
Kemp's ridley sea turtle	Lepidochelys kempii	SE
Leatherback sea turtle	Dermochelys coriacea	SE
Loggerhead sea turtle	Caretta caretta	ST
Wood turtle	Glyptemys insculpta	ST
BIRDS		
Bachman's sparrow	Aimophila aestivalis	ST
Bachman's warbler (=wood)	Vermivora bachmanii	SE
Bald eagle	Haliaeetus leucocephalus	ST
Bewick's wren	Thryomanes bewickii	SE
Gull-billed tern	Sterna nilotica	ST
Henslow's sparrow	Ammodramus henslowii	ST
Kirtland's warbler (=wood)	Dendroica kirtlandii	SE
Loggerhead shrike	Lanius ludovicianus	ST
Peregrine falcon	Falco peregrinus	ST
Piping plover	Charadrius melodus	ST
Red-cockaded woodpecker	Picoides borealis	SE
Roseate tern	Sterna dougallii dougallii	SE
Upland sandpiper	Bartramia longicauda	ST
Wilson's plover	Charadrius wilsonia	SE
MAMMALS		
American water shrew	Sorex palustris	SE
Carolina northern flying squirrel	Glaucomys sabrinus coloratus	SE
Delmarva Peninsula fox squirrel	Sciurus niger cinereus	SE
Dismal Swamp southeastern shrew	Sorex longirostris fisheri	ST
Eastern puma (=cougar)	Puma (=Felis) concolor cougar	SE
Gray bat	Myotis grisescens	SE
Gray wolf	Canis lupus	SE
Indiana bat	Myotis sodalis	SE
Rafinesque's eastern big-eared bat	Corynorhinus rafinesquii macrotis	SE
Rock vole	Microtus chrotorrhinus	SE
Snowshoe hare	Lepus americanus	SE
Virginia big-eared bat	Corynorhinus (= Plecotus) townsendii virginianus	SE
Virginia northern flying squirrel	Glaucomys sabrinus fuscus	SE

MOLLUSKS		
	Freshwater Mollusks	
Appalachian monkeyface (pearlymussel)	Quadrula sparsa	SE
Atlantic pigtoe	Fusconaia masoni	ST
Birdwing pearlymussel	Conradilla caelata (= Lemiox rimosus)	SE
Black sandshell	Ligumia recta	ST
Brook floater	Alasmidonta varicosa	SE
Cracking pearlymussel	Hemistena lata	SE
Cumberland bean (pearlymussel)	Villosa trabalis	SE
Cumberland monkeyface (pearlymussel)	Quadrula intermedia	SE
Cumberlandian combshell	Epioblasma brevidens	SE
Deertoe	Truncilla truncata	SE

S/A=Similarity of Appearance; SOC=Federal Species of Concern (not a legal status; list maintained by USFWS Virginia Field Office); SE=State Endangered; ST=State Threatened; SSC=State Special Concern (not a legal status).

[1] Information obtained from http://www.dgif.virginia.gov/wildlife/virginiatescspecies.pdf, October 4, 2011.