

**ENVIRONMENTAL ASSESSMENT**

**Managing Damage to Resources and Threats to Human Health and Safety Caused by Mammals in  
the Commonwealth of Virginia**

Prepared by:

United States Department of Agriculture  
Animal and Plant Health Inspection Service  
Wildlife Services

In Cooperation with:

United States Department of Interior  
United States Fish and Wildlife Service

June 2017

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## ACRONYMS

AFWA	Association of Fish and Wildlife Agencies
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CDC	U.S. Department of Health and Human Services, Centers for Disease Control
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CSA	Cooperative Service Agreement
CWA	Clean Water Act
DEA	U.S. Department of Justice, Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FDA	U.S. Department of Health and Human Services, Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FR	Federal Register
FY	Fiscal Year
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NMFS	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NWRC	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center
USACE	U.S. Department of Defense, Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Department of the Interior, U.S. Fish and Wildlife Service
SOPs	Standard Operating Procedures
VDACS	Virginia Department of Agriculture and Consumer Services
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
WS-Virginia	U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Program in Virginia

## CHAPTER 1: NEED FOR ACTION AND SCOPE OF ANALYSIS

### 1.1 INTRODUCTION

Across the United States, habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with the needs of animals which increases the potential for conflicting human/animal interactions. This Environmental Assessment (EA) evaluates the potential environmental effects of alternatives for WS' involvement in mammal damage management in Virginia. The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program is the federal agency authorized to protect American resources from damage associated with wildlife (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)). Human/animal conflict issues are complicated by the wide range of public responses to animals and animal damage. What may be unacceptable damage to one person may be a normal cost of living with nature to someone else. The relationship in American culture of values and damage can be summarized in this way:

*Animals have either positive or negative values, depending on varying human perspectives and circumstances (Decker and Goff 1987). Animals are generally regarded as providing economic, recreational and aesthetic benefits, and the mere knowledge that animals exist is a positive benefit to many people. However, the activities of some animals may result in economic losses to agriculture and damage to property. Sensitivity to varying perspectives and values is required to manage the balance between human and animal needs. In addressing conflicts, managers must consider not only the needs of those directly affected by damage but a range of environmental, sociocultural and economic considerations as well.*

WS' activities are conducted to prevent or reduce animal damage to agricultural, industrial, and natural resources, and to property, livestock, and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, tribes, private organizations, and individuals. The WS program uses an integrated approach (WS Directive 2.105)<sup>1</sup> in which a combination of methods may be used or recommended to reduce damage. Program activities are not based on punishing offending animals but are conducted to reduce damage and risks to human and livestock health and safety, and are used as part of the WS Decision Model (Slate et al. 1992).

WS is a cooperatively funded, service-oriented program that receives requests for assistance with damage caused by animals from private and public entities, including tribes and other governmental agencies. As requested, WS cooperates with land and animal management agencies to reduce damage effectively and efficiently in accordance with applicable federal, state, and local laws and Memoranda of Understanding (MOUs) between WS and other agencies.

WS chose to prepare this EA to facilitate planning, interagency coordination and the streamlining of program management, and to clearly communicate with the public the analysis of direct, indirect, and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed damage management program. Pursuant to the NEPA and the Council on Environmental Quality (CEQ) regulations, WS is preparing this EA<sup>2</sup> to

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<sup>1</sup> WS Program Directives are available at [https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA\\_WS\\_Program\\_Directives](https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA_WS_Program_Directives)

<sup>2</sup> The CEQ defines an EA as documentation that "... (1) briefly provides sufficient evidence and analysis for determining whether to prepare an [Environmental Impact Statement]; (2) aids an agency's compliance with NEPA when no environmental impact statement is necessary; and (3) facilitates preparation of an Environmental Impact Statement when one is necessary" (Council on Environmental Quality 2007).

document the analyses associated with proposed federal actions and to inform decision-makers and the public of reasonable alternatives capable of avoiding or minimizing significant effects. This EA will also serve as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into the actions of the agency.

## 1.2 NEED FOR ACTION

WS continues to receive requests for assistance to resolve or prevent damage occurring to agricultural resources, natural resources, property, and reduce or prevent threats to human health and safety associated with mammal species, including Virginia opossum (*Didelphis virginiana*), bats (family *Vespertilionidae*), Eastern cottontail (*Sylvilagus floridanus*), Eastern chipmunk (*Tamias striatus*), woodchuck (*Marmota monax*), gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), beaver (*Castor canadensis*), nutria (*Myocastor coypus*), muskrat (*Ondatra zibethicus*), coyote (*Canis latrans*), dog (*Canis lupus familiaris*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), black bear (*Ursus americanus*), raccoon (*Procyon lotor*), mink (*Mustela vison*), striped skunk (*Mephitis mephitis*), river otter (*Lutra Canadensis*), bobcat (*Felis rufus*), cat (*Felis domesticus*), white-tailed deer (*Odocoileus virginianus*), feral swine (*Sus scrofa*), and small mammals, such as insectivores (shrews and moles)(order *Insectivora*) and rodents (mice, rats, and voles) (order *Rodentia*). This EA will assist in determining if the proposed management of mammal damage could have a significant impact on the human environment 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 program in accordance with plans and objectives developed to reduce damage, and because this goal and these objectives 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 are intended to apply to actions that may occur in any locale and at any time within Virginia as part of a coordinated program.

Changes in the need for action and the affected environment have prompted WS to initiate this new analysis to manage mammal 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.

Some species of animals have adapted to and have thrived in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between people and animals. Those conflicts often lead people to request assistance with reducing damage or threats. Animals can have either positive or negative values depending on the perspectives and circumstances of individual people. In general, people regard animals as providing economic, recreational, and aesthetic benefits. Knowing that animals exist in the natural environment provides a positive benefit to some people. However, activities associated with these animals may result in economic losses to agricultural resources, natural resources, property, and threaten human safety. Therefore, an awareness of the varying perspectives and values is required to balance the needs of people and animals. When addressing damage or threats of damage caused by animals, damage management professionals must consider not only the needs of those people directly affected by damage but a range of environmental, sociocultural, and economic considerations as well.

Both sociological and biological carrying capacities must be applied to resolve damage problems. The animal acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for animals or the maximum number of a given species that can coexist compatibly with local human populations. The biological carrying capacity is the ability of the land or habitat to support healthy populations of animals 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 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 animal acceptance capacity. The available habitat may have a biological carrying capacity to support higher populations; however, in many cases the animal acceptance capacity is lower or has been reached. Once the animal acceptance capacity is reached or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and safety.

The 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, forage) where they can find a niche. If their activities result in lost economic value of resources or threaten human safety, people characterize this as damage. When damage exceeds or threatens to exceed an economic threshold and/or poses a threat to human safety, people often seek assistance.

The threshold triggering a request for assistance is often unique to the individual person requesting assistance and can be based on many factors (e.g., economic, social, aesthetics). Therefore, how damage is defined can often be unique to an individual person, and damage occurring to one individual may not be considered damage by another individual. However, the term “damage” is consistently used to describe situations where an individual person has determined the losses associated with animals 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 include a loss in aesthetic value and other situations where the actions of animals are no longer tolerable to an individual person.

Managing damage caused by animals is often based on balancing animal populations and human perceptions in a struggle to preserve rare species, regulate species populations, oversee consumptive uses of animals, and conserve the environment that provides habitat. Animals are regarded as having aesthetic, ecological, economic, educational, nutritional, scientific and socio-cultural values (Chardonnet et al. 2002), and there is enjoyment in knowing species exist and contribute to natural ecosystems (Decker et al. 2001). However, when the presence of an adaptable and opportunistic species is combined with human expansion, land management conflicts often develop.

Mammals add an aesthetic component to the environment, provide essential ecological functions, sometimes provide opportunities for recreational hunting and trapping, and provide people with a connection with nature. Many people, even those experiencing damage, consider the mammals addressed in this EA to be a charismatic and valuable component of their environment. However, tolerance differs among individuals.

The need for action to manage damage and threats associated with mammals in Virginia arises from requests for assistance<sup>3</sup> received by WS to reduce and prevent damage. Table 1.1 lists the number of requests for assistance with managing mammal damage or threats of mammal damage in Virginia from the federal fiscal year (FY)<sup>4</sup> 2010 through FY 2014.

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<sup>3</sup> WS only conducts damage management after receiving a request for assistance. Before initiating damage activities, a Memorandum of Understanding, cooperative service agreement, or other comparable document must be signed between WS and the cooperating entity which lists all the methods the property owner or manager will allow to be used on property they own and/or manage.

<sup>4</sup> The federal fiscal year begins on October 1 and ends on September 30 the following year.

**Table 1.1 - Requests for assistance with managing mammal damage or threats of mammal damage received by WS in Virginia, FY 2010–2014<sup>1</sup>.**

<b>Species</b>	<b>Projects</b>
Virginia opossum	<b>232</b>
bats	<b>180</b>
Eastern cottontail	<b>117</b>
Eastern chipmunk	<b>12</b>
woodchuck	<b>501</b>
gray squirrel	<b>232</b>
fox squirrel	<b>0</b>
beaver	<b>417</b>
nutria	<b>47</b>
muskrat	<b>37</b>
coyote <sup>2</sup>	<b>1,008</b>
dog <sup>2</sup>	<b>154</b>
red fox <sup>2</sup>	<b>536</b>
gray fox	<b>59</b>
black bear	<b>1,495</b>
raccoon	<b>761</b>
mink	<b>4</b>
striped skunk	<b>615</b>
river otter	<b>18</b>
bobcat	<b>68</b>
cat	<b>53</b>
white-tailed deer	<b>1,285</b>
feral swine	<b>66</b>
insectivores & small rodents	<b>54</b>

<sup>1</sup>In some instances assistance was provided to a single person for multiple resources during multiple FYs

<sup>2</sup>Includes requests received with managing damage analyzed in another document pursuant to the NEPA

Two forms of assistance have been provided by WS to those people requesting assistance with resolving damage or the threat of damage. Technical assistance is the provision of information, recommendations, and demonstrations on available and appropriate methods that could 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 2 of this EA. Direct operational assistance is the direct application of methods by WS. Direct operational assistance can only commence after technical assistance has been provided (see WS Directive 2.101, WS Directive 2.201) and those persons requesting assistance have been informed of their options (see WS Directive 3.101). WS’ direct operational assistance activities will be discussed further in Chapter 2 of this EA. The numbers of requests for assistance are representative of the damage and threats that could be caused by mammals. Many of the requests for assistance involved multiple resources and multiple species.

Table 1.2 lists mammal species addressed in this EA and the resource types that these species can cause damage to in Virginia. Many of the mammal species addressed in this EA can cause damage to or pose threats to more than one resource. Chapter 3 lists specific small mammal species that WS could be requested to address infrequently. Those species would primarily be associated with threats of aircraft strikes at airports or damage to agriculture. Specific information regarding mammal damage to agricultural resources, natural resources, property, and reduce or prevent threats to human health and safety are discussed in the following subsections.

**Table 1.2 – Primary mammal species addressed in the EA and resources affected by these mammal species<sup>1</sup>.**

Species	Resource			
	A	N	P	H
Virginia opossum	X	X	X	X
bats			X	X
Eastern cottontail	X		X	X
Eastern chipmunk	X		X	
woodchuck	X		X	X
gray squirrel	X		X	
fox squirrel	X		X	
beaver	X	X	X	X
nutria	X	X	X	
muskrat	X	X	X	
coyote	X <sup>2</sup>	X	X	X
dog	X <sup>2</sup>	X	X	X
red fox	X <sup>2</sup>	X	X	X
gray fox	X	X	X	X
black bear	X		X	X
raccoon	X	X	X	X
mink	X	X		X
striped skunk	X	X	X	X
river otter	X	X		
bobcat	X		X	X
cat	X	X	X	X
white-tailed deer	X	X	X	X
feral swine	X	X	X	X
insectivores & small rodents	X		X	X

<sup>1</sup>A=Agriculture, N=Natural Resources, P=Property, H=Human Safety

<sup>2</sup>Damage to livestock is analyzed in a separate document pursuant to the NEPA

### **Need for Mammal Damage Management to Reduce or Prevent Threats to Human Health and Safety**

Requests received by WS for assistance in reducing or preventing threats to human health and safety from mammals fall into four categories.

#### ***Threat of disease transmission***

Zoonotic diseases are animal diseases which are transmissible to people. Disease transmission can occur from direct interactions between people and mammals or from interactions with pets and livestock that have direct contact with wild mammals. Pets and livestock often encounter and interact with wild mammals, which can increase the possibility of transmission to people. With the exception of arthropod-borne (e.g., ticks) pathogens, disease transmission from wild and free ranging mammals to humans is uncommon. However, the infrequency of such transmissions does not diminish the concerns of those individuals requesting assistance because disease transmissions are documented and possible. Diseases which can be transmitted from wild or free ranging mammals to humans may be bacterial, spirochetal, rickettsial, viral, fungal, prions or parasites.

WS continues to receive requests for assistance from persons concerned about the potential risk of transmission of diseases to humans from wild and free ranging mammals. Many of these requests involve animals living near humans, animals acting out of character or animals showing no fear of humans.



Under the proposed action, WS could provide both technical assistance and direct operational assistance to these persons. WS could also conduct or assist with the monitoring or surveillance of diseases in wild and free ranging mammals addressed in this EA. Management of rabies is also addressed by a separate analysis pursuant to the NEPA (USDA 2009a). However, animals addressed as part of those damage management activities are also addressed in this EA to ensure a cumulative evaluation of potential effects under the proposed action / no action alternative. 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). WS may also sample mammals captured or lethally taken by private or other government entities or dying from other causes (e.g., collisions with vehicles). For example, WS may sample feral swine taken by private individuals for zoonotic or other diseases.

This section includes brief descriptions of examples of zoonotic diseases for which WS could provide surveillance or management assistance. Additional examples of zoonotic diseases, their animal host and how humans become exposed are displayed in Table 1.3. Hosts are organisms that harbor or carry other organisms either externally or internally (e.g., parasites). This discussion is intended to briefly address the more common known zoonotic diseases associated with those species addressed in this EA. It is not intended to be an exhaustive discussion of all potential zoonotics. The transmission of many zoonotic diseases from wildlife to humans is neither well documented nor well understood. 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. Consequently, this list is not all-inclusive and new diseases may be identified in the future or may be introduced from other geographic areas.

**Table 1.3 – Animal diseases that pose potential human health and safety risks through transmission to humans (Davidson 2006, Miller et al. 2013, Conover and Vail 2015).**

Disease (causative agent)	How humans contract	Hosts <sup>1</sup>
Anthrax ( <i>Bacillus anthracis</i> )	Direct contact, ingestion, inhalation	Mammals
Brucellosis, bovine ( <i>Brucella abortus</i> )	Direct contact, ingestion, inhalation	Feral swine, coyotes, others
Brucellosis, swine ( <i>Brucella suis</i> )	Direct contact, ingestion, inhalation	Feral swine, rodents, others
Dermatophilosis ( <i>Dermatophilus congolensis</i> )	Direct contact	Mammals
Echinococcosis/ hydatidosis ( <i>Echinococcus multilocularis</i> )	Ingestion	Canids <sup>2</sup> , felids <sup>3</sup> , cervids <sup>4</sup> , rodents, rabbits
Ehrlichiosis ( <i>Ehrlichia</i> species)	Bite of infected tick, possible direct contact or inhalation	Mammals
Giardiasis ( <i>Giardia</i> species)	Ingestion	Beavers, coyotes, dogs, cats, muskrats, rodents
Hantavirus (Hantaviruses)	Consumption, direct contact, inhalation	Rodents
Histoplasmosis ( <i>Histoplasma capsulatum</i> )	Inhalation	Bats
Leptospirosis ( <i>Leptospira interrogans</i> )	Direct contact, ingestion, inhalation	Rodents, raccoons, skunks, opossums, nutria
Lyme ( <i>Borelia burgdorferi</i> )	Bite of an infected tick	Mammals
Mange, demodetic ( <i>Demodex odoicoilei</i> )	Bite of infected mite	White tailed deer
Mange, scarpoptis ( <i>Scarpoptes scabiei</i> )	Bite of infected mite	Coyotes, foxes
Plague ( <i>Yersinia pestis</i> )	Bite of infected flea, inhalation	Chipmunks, carnivores, cats, rabbits, squirrels, others

Rabies ( <i>Rhabdovirus</i> )	Direct contact, inhalation	Mammals
Raccoon roundworm ( <i>Baylisascaris procyonis</i> )	Ingestion	Raccoons
Rocky Mountain Spotted Fever ( <i>Rickettsia rickettsii</i> )	Bite of infected tick	Mammals
Salmonellosis ( <i>Salmonella</i> species)	Ingestion	Cats, dogs, Feral swine, others
Toxoplasmosis ( <i>Toxoplasma gondii</i> )	Ingestion	Bobcats, cats
Trichinellosis, Trichinosis ( <i>Trichinella spiralis</i> )	Consumption	Carnivores, feral swine, raccoons, rodents, bears, others
Tularemia ( <i>Francisella tularensis</i> )	Bites of infected fleas and ticks, consumption, direct contact, inhalation	Beavers, rabbits, muskrats, rodents, others
Typhus, Epidemic ( <i>Rickettsia prowazekii</i> ), Murie typhus ( <i>Rickettsia typhi</i> )	Bite of infected lice or fleas, direct contact, inhalation	Rodents, others
Spirometra ( <i>spirometra mansonioides</i> )	Ingestion	Bobcats, cats, dogs, foxes, raccoons, others

<sup>1</sup>Host species listed here only include those animals addressed in this EA. The use of the general term “mammals” as the host species denotes zoonotic diseases that could infect a broad range of mammals.

<sup>2</sup>Canids include dogs, coyotes, and foxes

<sup>3</sup>Felids include cats, bobcats

<sup>4</sup>Cervids include deer and elk

Hantavirus Pulmonary Syndrome is caused by infection from certain species of hantaviruses. Infection in humans causes acute, severe respiratory disease (CDC 2013). Rodents are the natural hosts for all known hantaviruses, and the virus can be found in their urine, feces, and saliva (CDC 2012a). Once these substances have dried, humans can become infected by inhaling the dried materials as dust particles. This is the most common way the infection is acquired. As of April, 2014, the CDC had reported only one case of Hantavirus Pulmonary Syndrome in Virginia. Hantavirus has also been confirmed in other mid-Atlantic states, including North Carolina (1), Pennsylvania (4), and West Virginia (CDC 2016a). Nationally, 36% of human hantavirus infections result in death (CDC 2015a).

Tularemia, also known as “rabbit fever,” is a disease caused by the bacterium *Francisella tularensis* (CDC 2015b). Usually, people become infected through the bite of infected ticks or flies, by handling infected sick or dead animals, by eating or drinking contaminated food or water, or by inhaling airborne bacteria. An average of 142 human cases of tularemia were reported each year in the U.S. from 2005 to 2014 (CDC 2015c). Most cases occur in the south-central and western states; however, cases have been reported in every state except Hawaii. Without treatment with appropriate antibiotics, tularemia can be fatal (CDC 2015d). The causative agent of tularemia is one of the most infectious pathogenic bacteria known. The Working Group on Civilian Biodefense considers tularemia to be a dangerous potential biological weapon because of its extreme infectivity, ease of dissemination, and substantial capacity to cause illness and death (Dennis et al. 2001). Many wild animal species may be infected (hares, rabbits, squirrels, muskrats, beavers, deer), and occasionally certain domestic animals can also be infected (sheep and cats). However, rabbits are the species most often involved in disease outbreaks. The bacteria can also be found in ticks and flies. Tularemia in humans is relatively rare in Virginia, with 15 cases identified between 2005 and 2014 (VDH 2014). According to the Virginia Department of Health (VDH), most of these cases involved persons with known exposure to ticks, wildlife or performing landscaping work (VDH 2014).

Rabies is an acute, fatal viral disease of mammals most often transmitted through the bite of a rabid animal. Rabies is preventable, but it is fatal without prior vaccination or post-exposure treatment. All mammals, including man, are susceptible to rabies. Over the last 100 years, the way rabies in the U.S. is

transmitted to humans 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*b*). Before 1960, the majority of cases were reported in domestic animals. The principal rabies hosts today are wild omnivores 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 treatment, which involves a series of injections given to people who have been or potentially have been exposed, has proven nearly 100% successful in preventing mortality when administered promptly (CDC 2011*b*). 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 injections, and animal control programs (CDC 2011*b*). In 2013, 1,483 people in Virginia reportedly received rabies post-exposure injections (VDH 2013*a*). However, in 2013, Virginia health districts investigated over 18,000 incidents where a potential exposure to rabies occurred. As a result of these investigations, 3,988 animals were submitted for rabies testing; 968 were cats, 821 were bats, 600 were raccoons, 582 were dogs and 206 were skunks. Of the 488 animals that tested positive, the highest percentages of positive results were in wildlife (VDH 2013*a*). However, cats accounted for 7.6% of positive animals (VDH 2013*a*). A recent study in Pennsylvania found that the number of rabid cats and the number of human exposures to rabies because of an interaction with an unvaccinated rabid cat has steadily risen (Campagnolo et al. 2013). In the study, humans were more likely to come into contact with a rabid cat (29% of human exposure cases) than any other animal except raccoons (35% of human exposure cases) (Campagnolo et al. 2013). The WS program in Virginia (WS-Virginia) first became involved with the WS National Rabies Management Program in 2001, conducting raccoon density studies and collecting baseline data on the prevalence of rabies in the raccoon population. WS' involvement in rabies research and management is addressed in the WS nationwide EA on rabies management (USDA 2009*a*).

Numerous tick borne diseases have been documented in Virginia including Lyme disease, ehrlichiosis / anaplasmosis, Rocky Mountain spotted fever, Tidewater spotted fever, tularemia and Powassan virus (VDH 2013*a*). Lyme disease has been documented in all regions of the Commonwealth with an average of 1,043 cases per year between 2009 and 2013 (VDH 2013*a*). Blacklegged ticks (*Ixodes scapularis*) which transmit Lyme disease to humans infest a wide variety of animals, but are most commonly found on meadow voles, mice, and white-tailed deer. A total of 143 cases of ehrlichiosis / anaplasmosis including death were reported in Virginia in 2013, a 40% increase over the five year average (VDH 2013*a*). Both diseases are transmitted via the bite of a blacklegged or lone star (*Amblyomma americanum*) tick commonly found on white-tailed deer (VDH 2013*a*).

Raccoon roundworm is a roundworm commonly found in the small intestine of raccoons which causes severe or fatal encephalitis in a variety of mammals, including humans (CDC 2011*a*). It also causes eye and organ damage in humans. Humans become infected by ingesting soil or other materials (e.g., bark or wood chips) contaminated with raccoon feces and roundworm eggs. Young children are at particular risk for infection as a result of behaviors such as placing potentially contaminated fingers and objects like toys into their mouths (CDC 2012*b*). Raccoons are the primary host for the roundworm, but other animals can become infected. Cases are rare with fewer than 25 cases occurring in the U.S. (CDC 2012*b*). Although rare, infection can be serious. As of 2012, there were 16 reported human neurological cases of raccoon roundworm in the U.S.; six of these persons died (CDC 2012*b*).

Diseases and parasites affecting feral cats and dogs can have particularly serious implications for human health given the close association of these animals with humans and pets (companion animals). The topic of feral animals elicits a strong response in numerous professional and societal groups. 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 individuals or groups feed and care for individual feral animals. Of special concern are pet cats and dogs that are not confined at all times but are allowed to roam for extended periods of time. If these animals interact with feral animals of the same species (e.g., dogs with dogs, cats with cats) while they are roaming they risk exposure to a wide-range of diseases which could potentially be transmitted to their owners or other persons (e.g., family, friends, other household members) when they return home and before the diagnosis of a zoonosis occurs. Additionally, feral cats and dogs are more likely to be approached and handled by humans, increasing the potential for humans to be exposed to a zoonosis.

In addition to rabies, feral cats carry other zoonotic diseases including cat scratch disease (*Bartonella henselae*), Salmonella (*Salmonella* spp.), murie typhus (*Rickettsia typhi*), plague (*Yersinia pestis*), tularemia (*Francisella tularensis*), toxoplasmosis (*Toxoplasma gondii*), hookworm (*Uncinaria stenocephala*, *Ancylostoma tubaeforme*, *Ancylostoma braziliense*, *Ancylostoma ceylanicum*), and raccoon roundworm (Gerhold 2011, Gerhold and Jessup 2013). Many zoonosis carried by cats are not life-threatening to humans if they are diagnosed and treated early. However, certain portions of the population are at higher risk including children under the age of five, pregnant women, adults over 65 and persons with weakened immune systems (e.g., cancer patients undergoing chemotherapy) (CDC 2016b). For example, in 1994, five children in Florida were hospitalized with encephalitis associated with cat scratch fever (Patronek 1998). In 2002, fleas from a feral cat colony which had grown from 100 to 1,000 cats, despite a trap, neuter and release effort, caused a daycare center at the University of Hawaii in Manoa to close for two weeks because of concerns about the potential transmission of murie typhus and flea (*Ctenocephalides felis*) infestations afflicting 84 children and faculty (Jessup 2004). In another example, in 2010, cats using Miami-Dade County beaches as a litter box were responsible for at least seven confirmed and eight unconfirmed human hookworm infections (Gerhold and Jessup 2013). A similar incident occurred in Miami in 2006 when 22 people were diagnosed with hookworm at a children's camp where feral cats were observed (Gerold and Jessup 2013).

Feral dogs can also carry zoonotic diseases. These include leptospirosis, salmonellosis, spirometra, and rabies and act as hosts for parasites that carry additional zoonotic diseases. For example, the primary way which people in Arizona are infected with Rocky Mountain spotted fever is feral dogs. From 2002 to 2004 an outbreak resulted in the hospitalization of 15 people and the death of two people (Demma et al. 2005).

Feral swine are potential reservoirs for a plethora of viral and bacterial diseases and parasites. Diseases that can infect humans include brucellosis, leptospirosis, salmonellosis, toxoplasmosis, trichinosis, trichostrongylosis, sarcoptic mange, (Seward et al. 2004), tuberculosis, tularemia (Hubálek 2002, Stevens 2010), anthrax, rabies (Luangtongkum et al. 1986) and plague (Beach 1993). Infection may occur from direct exposure to swine by handling live animals or carcasses (CDC 2009), through ingestion of undercooked pork, contaminated water or food crops (Jay et al. 2007). It can also occur when feral swine infect another host (e.g., domestic or wild animal) which then infects a person (West et al. 2009). Feral swine may also play a role in the emergence of new diseases, acting as re-assortment vessels for viruses such as the highly pathogenic H5N1 influenza virus. The reassortment of viruses could lead to new strains of influenza viruses that would become easily transferrable from other mammals to humans (Brown 2004). Feral swine can also be the location for the reassortment of the H5N1 virus into a virus that is easily transmitted from human to human. Although incidence of disease transmission from feral swine to humans is relatively uncommon, some diseases like brucellosis, tuberculosis, and tularemia can be fatal.

This section includes only some examples of zoonotic diseases for which WS could provide surveillance or management assistance. It is not intended to be an exhaustive discussion of all potential zoonotic diseases for which WS could provide assistance.

### ***Threat of Aircraft and Vehicles striking animals***

Collisions between aircraft or vehicles and animals are a concern throughout the world because of the hazards they pose to human health and safety. Mammals of all sizes can be involved in collisions. Injury or death can occur when vehicles strike mammals or when drivers or pilots try to avoid a collision with a mammal.

From 1990 to 2013, aircraft strikes with terrestrial mammals were reported 3,149 times in the U.S. (Dolbeer et al. 2014). A total of 1,028 (33 percent) of these were reported to have caused damage to the aircraft (Dolbeer et al. 2014). However, the number of mammal strikes actually occurring is likely to be much greater, since an estimated 80% of civil aviation wildlife strikes with wildlife go unreported (Cleary et al. 2000). These incidents can pose serious threats to human safety. For example, damage to the landing gear during landing or takeoff can cause a loss of control of the aircraft. Across the entire U.S. for the 24 year reporting period of injury-causing strikes, white-tailed deer were involved in 20 strikes that caused 27 injuries and one death, dogs were involved in one strike that injured two people and Eastern cottontail were involved in one strike that injured one person (Dolbeer et al. 2014).

In Virginia since 1990, aircraft have reported striking 61 white-tailed deer, 32 foxes, nine coyotes, eight skunks, seven woodchucks, six opossums, five raccoons, four muskrats, and a single mink, Eastern cottontail and domestic cat (FAA 2015). Fortunately, only one strike (with a white-tailed deer) resulted in the injury of one person and no strikes have caused a human fatality (FAA 2015). The infrequency of mammal strikes does not lessen the need to prevent threats to human safety.

In addition, some species addressed in this EA pose minimal strike hazards at airports but their presence on airport property can attract other species which pose higher risks of aircraft strikes. For example, a high density of insectivores, rodents and cottontail rabbits on airport property are a food source and therefore an attractant for many predator species. For example, raptors often pose a high risk to aircraft due to their relative size and their soaring and hovering behavior. Therefore, reducing rabbit densities at airports can reduce risks of strikes with raptors by reducing the availability of a food source.

Similar to strikes between mammals and aircraft, many strikes between vehicles and mammals are unreported (Romin and Bissonette 1996). The CDC estimated that 26,647 people were injured per year in collisions with animals (mostly deer) and an additional 10,000 people are injured annually when drivers take evasive action to avoid a collision (CDC 2004). Using a data set from Utah, Bissonette et al. (2008) found that 94.7% of collisions with deer resulted in no injury, 2.2% in possible injury, 1.8% in bruises and abrasions, 1.2% in broken bones or bleeding, and 0.04% in death. Of those people receiving injuries, 4.2% were treated at an emergency medical facility. Average cost of treatment to these people was \$2,237. More than 200 human fatalities occur as a result of deer-vehicle collisions every year (Conover 1997). Other mammals involved in fatalities include dogs, bears, cats and opossum (Williams and Wells 2005). The possibility exists for any collision with a mammal or any evasive action taken by a driver to avoid a collision with a mammal to result in human injury or death. However, the risk of injury or death increases with the size of the mammal. In general, animals with larger body sizes are a greater risk to human health and safety than those that are smaller (Williams and Wells 2005).

### ***Threat of Compromised Infrastructure***

Burrowing by beavers, muskrats, and woodchucks and damming by beavers can cause significant damage and or destruction to infrastructure, including foundations, roads, railways, dams, dikes, levees, storm water retention ponds, and bridges which in turn threatens human health and safety (Woodward 1984, Bollengier 1994, Miller 1994, Miller and Yarrow 1994). Damage caused by beavers often occurs when beavers plug culverts that allow water to pass beneath a roadway or when they impound water which washes out, undermines or floods roads or railroad beds. Culverts and the surrounding infrastructure which support the roadbed are not built to withstand the strong pressure and scouring action that occurs when water is forced into a narrow channel and cannot pass through culverts (because the beaver has erected a dam). This condition can lead to the washout or collapse of the road or railway bed which may not always be apparent until tested by the weight of a vehicle or train. In 1984, five people died and 26 were seriously injured when an Amtrak train derailed after beaver activity caused a flash flood that undermined the track (Associated Press 1985). Damming of culverts can also lead to flooding of the roadway which can cause cars to hydroplane and crash (Georgia Department of Transportation V. Miller et al.). Beavers, muskrats and woodchucks dig burrows or networks of burrows, which can weaken structures such as dams, dikes or levees which collapse when people or animals walk on them, when vehicles or heavy equipment (e.g., mowers, tractors) drive over them, or when tested by high water (Armitage 2003, Baker and Hill 2003, Bollengier 1994, Erb and Perry 2003, Miller 1994, Miller and Yarrow 1994). Such incidents can threaten the safety and lives of people on the dam or levee as well as those people downstream from the dam or protected by the levee.

### ***Additional human safety concerns***

Humans are increasingly living in close proximity to wildlife. This closeness coupled with a lack of harassing and threatening behavior by people toward wildlife has led to a decline in the fear wildlife have toward people. When wildlife species begin to habituate to the presence of people and human activity, a loss of apprehension occurs that can lead to threatening behavior toward people. This threatening behavior continues to increase as human populations expand and the populations of those species that adapt to human activity increase. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward people, or abnormal behavior. Although animals attacking people occurs rarely, the number of attacks appears to be on the increase.

From 1960–2006 a total of 159 people were bitten in 142 incidents by coyotes in the U.S. and Canada (White and Gehrt 2009). Of these, most (37%) were classified as predatory (“incidents in which a coyote directly and aggressively pursued and bit a victim”), followed by investigative (22%) (a habituated coyote bit people who were sleeping or resting), rabid (7%) (animal tested positive for rabies), pet related (6%) (a pet was present), and defensive (4%) (coyote was cornered or defending pups) (White and Gehrt 2009). A study conducted in the Denver Metropolitan Area classified not just incidents that resulted in bites but also any incident that resulted in physical contact between people and coyotes from 2003 to 2010 (Poessel et al. 2013). Of these, six (41.1%) involved situations in which pets were associated with the incident, four (30.8%) did not involve pets and three (23.1%) did not have any additional information (Poessel et al. 2013). Two deaths in the U.S. and Canada have been attributed to coyotes. A young child in California in 1981 (Howell 1982) and a 19-year old woman in Nova Scotia in 2009 (Canadian Broadcast Company 2009).

Black bears can also threaten human health and safety. There are two main types of bear attacks, defensive and predatory (Herrero 2002). Herrero (2002) documented 500 injuries to people resulting from encounters with black bears from 1960 to 1980 in the U.S. and Canada. Of those injuries, 90% were considered minor (e.g., minor bites, scratches, and bruises) by Herrero (2002). Most fatal attacks by

black bears are predatory (Herrero 2002). From 1900 to 2009, 14 fatal attacks occurred in the lower 48 states (Herrero et al. 2011).

A variety of other mammals addressed in this EA can also threaten human health and safety. For example feral swine have attacked hunters, dog walkers, golfers, picnickers and people recreating in urban and suburban environments (Mayer 2013). Four fatal feral swine attacks have been documented in the U.S. (Mayer 2013). Although attacks on people associated with those species addressed in this EA occur rarely, requests for assistance to lessen the threat of possible attacks could occur. Often, animals exhibiting threatening behavior or a loss of apprehension to the presence of people is a direct result and indication of an animal inflicted with a disease. Therefore, requests for assistance could occur from a desire to reduce the threat of disease transmission, from a fear of aggressive behavior from an animal that does not show a fear of people, or from a fear of aggressive behavior from an animal that is exhibiting aggressive behavior caused by disease (e.g., rabies).

### **Need for Mammal Damage Management to Resolve Damage to Agricultural Resources**

Requests received by WS for assistance in reducing or preventing damage or threats of damage from mammals to agriculture falls into three categories: crops, livestock and other resources. Farming is an important industry in Virginia with approximately 8.3 million acres devoted to agricultural production in Virginia in 2012 (NASS 2014). In the same year, agricultural products sold in the Commonwealth had a market value estimated at \$3.7 billion (NASS 2014).

#### ***Damage and Threats to Agricultural Crops***

In 2012, crops sold in the Commonwealth had a market value estimated at \$1.3 billion (NASS 2014). Sales of grains, oilseeds, dry beans and peas in 2012 totaled \$633 million, while sales of sod and plants raised for the nursery industry totaled \$251 million (NASS 2014). The sale of hay and other crops totaled \$139 million, while sale of tobacco totaled \$100 million (NASS 2014). Other important crops include vegetables, melons, potatoes and sweet potatoes, cotton, fruits, tree nuts and berries and Christmas trees (NASS 2014). All of these crops are vulnerable to wildlife damage.

Reports of wildlife damage to agricultural crops have increased over time (Conover and Decker 1991). In its most recent survey of agricultural losses to wildlife, conducted in 2002, the National Agricultural Statistics Service (NASS), reported that nationwide, field crop losses to wildlife totaled \$619 million and losses of vegetables, fruits and nut totaled \$146 million (NASS 2002). This damage is not evenly distributed among agricultural producers (Wywialowski 1994, Brown et al. 2004).

White-tailed deer damage to agricultural crops is widespread in Virginia (West and Parkhurst 2002). Surveys in other eastern states have indicated that anywhere from 32% to 71% of farmers experience deer damage (Brown et al. 1978, Decker and Brown 1982, Tanner and Dimmick 1984, Sayre et al. 1992, West and Parkhurst 2002). Nationwide white-tailed deer account for the majority of field crop, vegetable, fruit, and nut damage (Conover 1998, NASS 2002). Crops can account for as much as 78% (by mass) of a white-tailed deer's diet (Smith 1991). White-tailed deer cause damage to a variety of crops including but not limited to: corn, soybeans, forage crops (e.g., alfalfa, hay etc.), grain crops, vegetables (e.g., tomatoes, potatoes, pumpkins, melon), peanuts, nursery plants, orchards (e.g., fruit trees, nut trees, maple trees for syrup production), vineyards, berries, timber, and Christmas trees (de Calesta and Schwendeman 1978, Tanner and Dimmick 1984, Scott and Townsend 1985, Vecellio et al. 1994, Wywialowski 1996, ODNRDW 2001, Tzilkowski et al. 2002, Brown et al. 2004, MacGowan et al. 2004, DeVault et al. 2007, Colligan et al. 2011, Ober et al. 2014). Damage is caused not only when deer directly consume plant parts but also when deer trample or rub their antlers on small trees and which can kill plants outright or cause permanent disfigurement (Harder 1970, Scott and Townsend 1985, Craven and Hygnstrom 1994,

Lemieux et al. 2000). For example, deer will browse on the newly emerged growth of young conifers, especially the leader (ODNRDW 2001). When the leader (the vertical branch at the top of the tree) is consumed on young Christmas trees it often causes permanent disfigurement that renders the tree unmarketable.

After white-tailed deer, woodchucks caused the second-largest amount of damage in a 2002 New Jersey assessment (Drake and Grande 2002), but in contrast were only cited as causing damage by 9 to 20% of farmers surveyed across the Northeast and Mid-West (Wywialowski 1994). Woodchucks are responsible for damage to soybeans, corn, alfalfa, a variety of vegetables (e.g., beans, cabbage, squash, peas, watermelons), nursery plants and fruit trees (Bollengier 1994, Curtis and Sullivan 2001, ODNRDW 2001, Tzilkowski et al. 2002, DeVault et al. al. 2007). Damage is caused not only when plants are directly consumed but when plants such as fruit trees are stunted or killed by bark chewing or when the weight of the animal climbing the plant causes the structure of the plant to fail (e.g., corn stalks snap) (Curtis and Sullivan 2001, ODNRDW 2001).

Raccoons can cause significant damage to corn, turf grass / sod farms, and variety of vegetable and orchard crops (Craven and Hygnstrom 1994, DeVault et al. 2007). Humberg et al. (2007) found that raccoons were responsible for 87% of the damage to corn in Indiana. Raccoons cause crop damage when they consume developing seedlings, when they consume the harvestable crop (ears of corn, melons, tomatoes etc.), or when the weight of the animal climbing the plant causes the structure of the plant to fail (e.g., corn stalks snap) (Craven and Hygnstrom 1994, ODNRDW 2001).

Eastern cottontail can cause considerable damage to vegetables (e.g., peas, beans, beets, carrots etc.), nursery plants, orchards (e.g., fruit trees, nut trees), berries, timber, and Christmas trees (Craven 1994, Williams and Short 2014). In Nebraska, rabbits and hares caused an estimated \$2.2 million dollars in crop damage and destroyed approximately 500 acres of timber plantations annually (Williams and Short 2014). Damage is caused not only when plant parts are directly consumed but also when cottontails gnaw the bark off stunting or killing the plant (Craven 1994). Extensive damage can result when snow allows access to plant parts at a variety of heights above ground level (Craven 1994).

Feral swine accounted for an estimated \$18.5 million dollars in damages to field crops in 2002 (NASS 2002). Field crops damaged by feral swine include but are not limited to: corn, soybeans, forage crops (e.g., alfalfa, hay etc.), grain crops, vegetables (e.g., lettuce, spinach, melons, pumpkins, watermelons), peanuts, cotton, orchards, vineyards, berries, timber and Christmas trees (Schley and Roper 2003, Seward et al. 2004, West et al. 2009). Feral swine damage crops through direct consumption and other behaviors, such as rooting, trampling, and wallowing, which can destroy fields or reduce productivity. For example, rooting and trampling of seedlings impacts regeneration of timber plantations (Lipscomb 1989) and rooting and trampling in orchards can retard mature tree growth or cause a decline in harvest (Campbell and Long 2009).

Striped skunks can cause substantial damage to turf grass /sod farms. As skunks forage for insects and earthworms, they dig hundreds of holes (ODNRDW 2001). Skunks also consume seedlings and occasionally corn (Knight 1994, ODNRDW 2001). Virginia opossum can cause crop damage by consuming vegetables (e.g., tomato), fruits, nuts, and berries (Baldwin 2015).

Tree squirrels (gray and fox) can cause damage to orchards when they consume the flowers that will become fruit or nuts or when they consume or carry off the fruit or nut crop (Jackson 1994a). Tree squirrels may also damage orchard trees by chewing or stripping the bark (Jackson 1994a). Additionally, tree squirrels damage nursery plants, timber and Christmas trees when they clip the ends of branches or strip the bark off branches or the trunk (ICWDM 2015). Squirrels also cause damage when they consume corn seedlings, ripening, mature or stored corn (ODNRDW 2001).



Most beaver damage to crops, including field crops, nursery stock, orchards and timber occurs when beavers' dam building behavior results in flooding (Miller and Yarrow 1994). Beavers also cause damage when they consume the leaves, twigs and bark of plants or cut down trees (Miller and Yarrow 1994). Beavers will travel more than 100 yards to corn and other crops where they cut the plant off at ground level and drag it back to the water where they consume part of the plant and use the rest of it as dam construction material (Miller and Yarrow 1994). Muskrat and nutria will also consume field crops including corn, wheat, oats, grain sorghum (milo) etc. (LeBlanc 1994, Miller 1994).

Canids, including coyotes, like sweet substances (Mason and Bloom 1998). As a result coyotes can cause significant damage to sweet corn and watermelons (Green et al. 1994, Armstrong and Walters 1995).

Black bear can cause significant crop damage, particularly to corn, sunflowers and oats as well as orchards and timber (Hygnstrom 1994, Ditmer et al. 2015). Damage to corn can be easily identified by the large localized areas of broken, smashed stalks. Bears probably consume less than one third of what they destroy (Davenport 1953). Trees are damaged when bears break branches while consuming fruit, when they strip and feed on the inner bark of trees or when clawing the bark to make territorial marks (Hygnstrom 1994).

Rodents (mice, rats, and voles) (order *Rodentia*) can also cause significant damage to crops. Voles will girdle orchard trees or nursery stock and field crops may be damaged or completely destroyed (Anthony and Fisher 1977, O'Brien 1994). Rats consume the roots, stems, leaves and seeds of a variety of crops (Hawthorne 1994). Consumption of newly planted seed by both rats and mice can cause substantial damage.

### ***Damage and Threats to Livestock***

#### ***Disease***

Although the source of disease outbreaks can be difficult to identify, a risk of disease transmission exists wherever wild or free ranging mammals and livestock interact or use the same resources such as water or feed (Berentsen et al. 2014). Of the animal diseases that occur in the U.S., 72% (42) are presumed to require wildlife to transmit, maintain or complete the life cycle of the pathogen (Miller et al. 2013). Of these, six are so common in wildlife and their ability to infect domestic animals so common that it impedes their eradication (Miller et al. 2013). The role wildlife plays in livestock diseases is expected to increase (Siembieda et al. 2011). Diseases which can be transmitted from wild or free ranging mammals to livestock may be bacterial, spirochetal, rickettsial, viral, fungal, prions or parasites. Examples of diseases, the livestock they affect and the animal host are displayed in Table 1.4. Livestock diseases cause loss through morbidity, mortality, decreased production, decreased feed efficiency, lower reproductive success, and the costs associated with veterinary diagnostics and treatment.

Studies suggest that cattle in a five county area in Michigan became infected with *Mycobacterium bovis*, the mycobacterium that causes tuberculosis (TB) when they shared resources or interacted with white tailed deer (Berentsen et al. 2014). Infection can occur through inhalation of aerosolized bacteria or nose-to-nose contact but studies also suggest indirect contact which results when cows and deer share feed may be a mechanism which spread *Mycobacterium bovis* between individual deer and between deer and cattle. Transmission between farms is thought to occur via white-tail deer and not the transfer of cattle (Berensten et al. 2014). When Michigan cattle became infected, the state lost its TB accreditation status which has resulted in agricultural and livestock losses valued at \$12 million dollars a year (Horan and Wolf 2005).

Cats (*Felis domesticus*) can transmit the protozoan parasite, *Toxoplasma gondii* to both domestic and wild animal species. Cats have been found to be important reservoirs and the only species which allows for the parasite to complete its life cycle (Dubey 1973, Teutsch et al. 1979). Both feral and domiciled cats may be infected by this protozoan, but the infection is more common in feral cats. Fitzgerald et al. (1984) documented that feral cats transmitted *Toxoplasma gondii* to sheep in New Zealand, resulting in ewes aborting fetuses. Dubey et al. (1995) found that 68.3% of cats on swine farms in Illinois were positive for *T. gondii* and the major reservoir for this disease.

Coyotes, dogs, foxes and other canids host *Neospora caninum*, a protozoan parasite that is a frequent cause of calf abortions (Dubey 2003). Cattle can become infected by grazing on pasture or drinking water contaminated with infected predator feces (Dubey 2003). Barling et al. (2000) found statistically significant spatial associations between the density of cattle with the virus and the abundance of coyotes and grey foxes. Calf abortion caused by this parasite has been identified by a veterinarian and reported by the producer to WS in Virginia (C. Fox, USDA APHIS WS, personal communication, 2014).

Transmitted via a bite or saliva from an infected mammal, the rabies virus is fatal once symptoms appear (CDC 2012b). Rabies is a serious concern for livestock producers (Conover and Vail 2015). Infection of two cattle herds in Ohio and West Virginia resulted in cost to the public and the producer of \$44,000 and \$103,000, respectively (Chipman et al. 2011). In one of these cases, cows had been observed smelling and licking a skunk and in both cases the cattle tested positive for the raccoon rabies variant. Costs included market value of cattle that died or had to be euthanized (64 cattle in Ohio and 88 cattle in West Virginia), costs associated with government response, cost of vaccination to persons exposed to infected cattle, costs of carcass disposal and laboratory testing (Chipman et al. 2011). All mammals can be infected with rabies making most types of livestock susceptible (Conover 2002).

Ticks harbored by wildlife and free ranging mammals can carry both spirochetal and rickettsial diseases (Conover and Vail 2015) transferrable to livestock when wildlife and livestock interact or use the same resources (Miller et al. 2013). For example, Lyme disease caused by a spirochetal bacterium (*Borrelia burgdorferi*) can infect cattle, horses and other livestock via a bite from a black legged tick (Parker and White 1992). Problems include chronic weight loss, lameness, swollen joints, behavioral changes and decreased milk production in cows (Parker and White 1992). Anaplasmosis is caused by the rickettsial bacteria *Anaplasma phagocytophilum* and can similarly infect livestock via a bite from a black-legged tick (Conover and Vail 2015). The disease causes abortions, still births, decreased semen quality and impaired immune systems in infected sheep, goats and cattle (Conover and Vail 2015).

Feral swine can carry at least 30 viral and bacterial diseases, and nearly 40 parasites that may affect domestic livestock, humans, and wildlife species (Ruiz-Fons et al. 2008, Meng et al. 2009). For example, porcine reproductive and respiratory syndrome is a highly infectious virus that causes reproductive failure and respiratory disease in swine (USDA 2009b). The total cost of productivity losses due to porcine reproductive and respiratory syndrome in the domestic swine herd in the United States was estimated at \$664 million annually during 2011 (Holtkamp et al. 2013). Another example, pseudorabies is a viral disease associated with an extremely contagious herpes virus that can have negative effects on reproduction in domestic swine. An economic analysis estimated that the annual cost of pseudorabies to pork producers in the United States at more than \$30 million annually in lost production as well as testing and vaccination costs (USDA 2008).

**Table 1.4: Additional wildlife diseases with mammalian hosts that pose threats to livestock in the United States (modified from Miller et al. 2013)**

Disease	Affected livestock	Hosts*
Anthrax	Cattle, sheep, goats, horses, swine	All mammals
Aujeszky's disease	Swine, cattle, sheep, goats, horses	Feral swine, other mammals
Blue tongue	Sheep, goats, cattle	Cervids <sup>1</sup> , others
Bovine anaplasmosis	Cattle	Cervids <sup>1</sup>
Bovine genital campylobacteriosis	Cattle	Numerous
Bovine viral diarrhea	Cattle, bison, camelids <sup>2</sup>	White-tailed deer, others
Brucellosis ( <i>Brucella abortus</i> )	Cattle, sheep, horses	Feral swine, others
Brucellosis ( <i>Brucella suis</i> )	Swine, horses	Feral swine, rodents, others
Echinococcosis/ hydatidosis	Sheep, cattle	Canids <sup>3</sup> , felids <sup>4</sup> , cervids <sup>1</sup> , rodents, rabbits
Epizootic hemorrhagic disease	Cattle, sheep	White-tailed deer, others
Equine encephalomyelitis (eastern and western)	Equids <sup>5</sup> , reptiles of cattle, sheep, camelids and pigs	Rodents, white-tailed deer, others
Infectious bovine rhinotracheitis/infectious pustular vulvovaginitis	Cattle	Several implicated
Leptospirosis	Cattle, sheep, goats, pigs, horses, others	Rodents, raccoon, skunk, opossum, nutria
Maedi-visna	Sheep, goats	Ruminants <sup>6</sup>
Myxomatosis	Rabbits	Rabbits
Paratuberculosis	Cattle, sheep, goats	Ruminants <sup>6</sup> , rabbits, others
Q fever	Cattle, sheep, goats	Numerous
Rabbit hemorrhagic disease	Rabbits	Rabbits
Transmissible gastroenteritis	Swine	Feral swine
Trichinellosis (trichinosis)	Swine	Carnivores, feral swine, rodents, bears, others
Tularemia	Sheep, horses, pigs	Rabbits, muskrats, rodents, others
Vesicular stomatitis	Cattle, swine, equids, camelids, sheep, goats	Numerous
Chronic wasting disease	Domestic cervids <sup>1</sup>	Wild cervids <sup>1</sup>
Malignant catarrhal fever	Cattle, bison, swine, sheep, goats	Cervids <sup>1</sup> , wild ovine species
Plague	Numerous	Chipmunks, carnivores, others

\*Host species listed here only include those animals addressed in this EA.

<sup>1</sup>Cervids include deer and elk

<sup>2</sup>Camelids include llamas and alpacas

<sup>3</sup>Canids include dogs, coyotes, and foxes

<sup>4</sup>Felids include cats, bobcats

<sup>5</sup>Equids include horses, donkeys, and mules

<sup>6</sup>Ruminants include cattle, sheep, goats and deer

### Predation

The sale of animals grown by the aquaculture industry (fish, crustaceans and mollusks) in Virginia totaled \$43.2 million in 2012 (NASS 2014). Additionally, there were 14,334 colonies of bees and sale of honey totaled more than \$1 million in the Commonwealth in 2012 (NASS 2014). Although sheep and cattle industries are more likely to incur losses, livestock producers in Virginia have reported losses and damage to other livestock including alpaca, donkey, horse, llama, pig, rabbit, and various species of fowl (C. Fox, USDA APHIS WS, personal communication, 2014).

Bears predate both cattle and sheep in Virginia (NASS 1991, 1995, 2000, 2010). In 2010, an estimated five cows and 259 calves, valued at \$89,380 dollars were preyed upon by bears (NASS 2011). Multiple sheep kills in a single attack are fairly common. Cattle and sheep are also likely to be injured or killed when they are run into or through fences or over cliffs while trying to escape bears (Wade and Bowns 1982). Similarly, sheep are vulnerable to bear predation because they drown trying to swim to safety, or die from suffocation when they are crowded against each other after being driven into the corner of a pasture, a gully, barn or other confined space (Wade and Bowns 1982). Black bear damage to apiaries (beehive operations) can result in economically substantial losses (McKinley et al. 2014). Bear damage to beehives is characterized by broken and scattered hives and combs. Bears will return night after night until all the larvae (immature bees), comb and honey are eaten (Hygnstrom 1994). Hives are typically predated by bears in the spring when the number of immature bees is highest and the amount of stored honey is lowest (McKinley et al. 2014).

Bobcats are known predators of lambs (NASS 1991, 1995, 2000, 2005). Although rare, bobcats can and do kill calves, and calf predation has been reported in Virginia (NASS 2001). Bobcats are known predators of animals up to eight times their weight (Labisky and Boulay 1998).

Grey fox predation occurs to both sheep and lambs although predation of lambs is more common (Wade and Bowns 1982). Often only small lambs are killed but under some circumstances foxes may kill large lambs and adult sheep (Wade and Bowns 1982).

Raccoons (Acorn and Dorrance 1990, Boggess 1994a), minks (Acorn and Dorrance 1990, Boggess 1994b), opossums, skunks (Acorn and Dorrance 1990, Knight 1994), and other mammals are also predators of livestock, especially fowl and their eggs. Skunks also damage beehives when they attempt to feed on bees (Knight 1994). Raccoons, minks, otters, muskrats and, to a lesser extent, rats, foxes, bobcats, bears, and other mammals may prey on fish and other cultured species at aquaculture (freshwater and marine) facilities (Parkhurst et al. 1987, Goldberg et al. 2001).

Feral swine can kill calves, goat kids, lambs, and poultry (West et al. 2009, Stevens 2010, USDA 2015a). Predation primarily occurs to young livestock but feral swine will also kill adult animals (Wade and Bowns 1982). Frequently, even when predation is considered, feral swine often escape suspicion because people generally underestimate their capabilities as a predator (Beach 1993).

Management of livestock predation by coyotes, dogs and red foxes in the Commonwealth is covered by separate analyses pursuant to the NEPA (USDA 2015b).

### ***Damage and Threats to Other Agricultural Resources***

Mammals cause damage to other agricultural resources besides crops and livestock. For instance many species can cause agricultural damage when they consume, contaminate or destroy stored grain, feed, or seed (Wywiałowski 1994). Feral swine damage pasture and soil structure through rooting, trampling, wallowing and compaction (Seward et al. 2004, West et al. 2009). These changes in soil properties and water infiltration rates can lead to flooding of crop or pasture land or erosion and damage to water sources (West et al. 2009). Feral swine consume and contaminate livestock feed and mineral sources and also damage farm infrastructure such as fences, irrigation ditches, and other structures (Seward et al. 2004, West et al. 2009). Additionally, rooting and wallowing creates holes that if unnoticed can damage farming equipment (West et al. 2009).

Damming by beavers can cause significant damage to crops and agricultural infrastructure (Miller and Yarrow 1994). In some instances, thousands of acres of crop land have been flooded by beavers (Miller

and Yarrow 1994). Additionally, beavers, muskrats, nutria and woodchucks dig burrows or networks of burrows, which can weaken structures such as dams, dikes or levees or similar agricultural infrastructure and cause damage when they collapse injuring livestock, damaging farming equipment or flooding crops or property used for agriculture (Armitage 2003, Baker and Hill 2003, Leblanc 1994). Eastern chipmunks and gray squirrels can cause considerable damage to maple sugar tubing systems by gnawing on the tubes and consume the sugar water (May et al. 1992, Williams and Corrigan 1994). Woodchucks and coyotes cause similar damage to rubber hoses used in irrigation (Connolly 1992, Bollengier 1994).

### **Need for Mammal Damage Management to Resolve Damage to Natural Resources**

Mammals can negatively affect natural resources through habitat degradation, competition with other wildlife, direct depredation, and other factors. Habitat degradation occurs when large concentrations of animals in a localized area negatively affect characteristics of the surrounding habitat, which can then adversely affect other wildlife species. Competition occurs when species compete for available resources, such as food or habitat. Direct depredation occurs when predatory mammal species feed on other wildlife species, which can negatively influence those species' populations, especially when depredation occurs on threatened and endangered species. Examples of these types of damage and threats which occur or could occur in Virginia include but are not limited to the following examples.

#### ***Damage and Threats Caused by Predation***

Virginia's coastal areas provide critically important habitat for nesting colonial waterbirds and shorebirds including the piping plover (*Charadrius melodus*) and roseate tern (*Sterna dougallii*), which are listed and protected under the Endangered Species Act (ESA) (Watts and Paxton 2014, Wilke et al. 2005). However, threats including habitat loss and degradation, sea level rise, severe weather events, human disturbance, competition with other species and predation jeopardize these populations (Davis et al. 2001, Erwin et al. 2011). Managing variables that are controllable (predator and competitor species, human disturbance) helps offset variables that are not within our control (weather, sea level rise). Predation continues to be a significant and manageable factor limiting recovery of many species of birds nesting on the barrier islands of Virginia.

The presence of even a single predator at a nest site can result in the direct mortality of adult birds, chicks and eggs or cause birds to abandon active nests and the nesting site entirely (Erwin et al. 2011, Kress and Hall 2004). Virginia opossum, coyote, dog, fox, raccoon, mink, striped skunk, cat, rodents (i.e., rats) and other mammals are known or suspected to reduce breeding success of piping plovers (Patterson et al. 1991, Boettcher et al. 2007, Daisey 2009, Wilke 2011, Wilke 2012, USFWS 2014), American oystercatchers (*Haematopus palliatus*) (Nol 1989, Erwin et al. 2001, Wilke et al. 2007, Daisey 2009, Schulte et al. 2010, Denmon and Tarwater 2011, Wilke 2011, Denmon and Chapman 2012, Wilke 2012, Denmon et al. 2013), black skimmers (*Rynchops niger*) (Daisey 2009), terns (*Sterna* spp.) (Erwin et al. 2001, Kress and Hall 2004, Daisey 2009, Erwin et al. 2011, USFWS 2014) and other seabirds (Burger and Gochfeld 1991, Brinker et al. 2007, Daisey 2009, Wilke 2012) in Virginia or regionally. Predation is a primary threat facing the recovery of the piping plover and the American oystercatcher in Virginia (Boettcher et al. 2007, Wilke et al. 2007). Mammalian predation can be solely or primarily responsible for the failure (100% of nests lost) of a colony of nesting colonial waterbirds or localized population of shorebirds during a given year (Patterson et al. 1991, McGowan et al. 2005, Ellis et al. 2007). The distribution of raccoons and red fox on islands used by nesting colonial waterbirds and shorebirds in Virginia has increased overtime, contributing to the problem (Keišs 2001, Erwin et al. 2001, Wilke et al. 2005). There is a general inverse relationship between the number of predators removed and the productivity of beach nesting birds in any given year (USFWS 2014). Management efforts in Virginia have been credited with reducing populations of predators that are reducing breeding success; and are believed responsible for increases in piping plover (Boettcher et al. 2007), American oystercatcher (Wilke

2011) and tern (Erwin et al. 2011) breeding success. Therefore, reducing predation is an important action identified for the recovery of species which are threatened, endangered or otherwise imperiled (USFWS 1996).

Freshwater mussels are the most imperiled group of animals in the U.S. (Carey et al. 2015). In Virginia, there are 26 freshwater mussel species listed and protected under the ESA (Appendix C). A combination of habitat destruction and alteration, damming and impoundment, loss of host fish (needed to complete their reproductive cycle), pollution, water quality degradation and the introduction of invasive species has compromised freshwater mussel populations' ability to sustain themselves when faced with competition, disease and predation (Edelman et al. 2015, Strayer et al. 2004). Predation is a significant factor which may limit the recovery of freshwater mussel species (Haag 2012, Hoggarth et al. 1995, Kopij 2011, Neves and Odom 1989). Mink, raccoon, skunk, river otter, and muskrat will all predate freshwater shellfish (Tyrrell and Hornbach 1998, Williams et al. 2008). However muskrat are the species most documented as causing extensive predation to freshwater mussels including threatened and endangered species (Hanson et al. 1989, Neves and Odom 1989, Tyrrell and Hornbach 1998, Diggins and Stewart 2000, Owen et al. 2011, Hersey et al. 2013). Often, scientists are unable to find live rare mussels but find their remains present in muskrat middens (piles of shells created over time by muskrats discarding the shells of predated mussels) (Neves and Odom 1989, Owen et al. 2011). Reducing predation has been identified as an action to aid in mussel recovery (Neves and Odom 1989, Owen et al. 2011, Hersey et al. 2013, Edelman et al. 2015).

Feral swine are known predators of small mammals, white-tailed deer fawns, birds, snakes, turtles, salamanders, frogs, fish and a variety of invertebrates (West et al. 2009, Ballari and Barrios-Garcia 2014). In locations where species are struggling (e.g., threatened or endangered species), additional predation pressure by feral swine can threaten populations (Jolley et al. 2010). For example, Engeman et al. (2014) observed that once feral swine identify sea turtle and shorebird nests as a food source, all remaining nests are quickly predated. Managing this predation can dramatically improve nesting success (Engeman et al. 2014).

In Virginia, cats kill a variety of wildlife species including birds, mammals, reptiles and amphibians (Mitchell and Beck 1992). An estimated 1.3–4 billion birds, 6.3–22.3 billion mammals, 228–871 million reptiles and 86–320 million amphibians are killed by cats each year in the U.S. (Loss et al. 2013). Un-owned cats are the cause of an estimated 69% of the birds killed by cats and 89% of the mammals killed by cats (Loss et al. 2013). The estimated number for birds killed by cats exceeds the number of birds killed by any human cause including collisions with windows, buildings, communication towers, vehicles or poisonings by pesticides (Loss et al. 2013). Native species make up the majority of these birds (Loss et al. 2013). Cats can prey on birds as large as mallards (*Anas platyrhynchos*) (Figley and VanDruff 1982) and young brown pelicans (*Pelecanus occidentalis*) (Anderson et al. 1989).

Hawkins et al. (1999) conducted a two-year study in two parks. One park had no cats while the other park had more than 25 cats which were being fed daily. Almost twice as many birds were observed in the park with no cats than in the park with cats. Two species of ground-nesting birds, which were observed in the park without cats were never seen in the park with cats. Additionally, more than 85% of the native deer mice (*Peromyscus* spp.) and harvest mice (*Reithrodontomys megalotis*) trapped were in the park without cats; whereas, 79% of the house mice (*Mus musculus*), a non-native exotic species, were trapped in the park with cats. 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).

In contrast to claims that well-fed cats pose little threat to wildlife, hunting and hunger are not linked in domestic cats (Adamec 1976) and well-fed cats still hunt and kill wildlife (Liberg 1984, Castillo and

Clarke 2003, Hutchings 2003). Their sheer abundance makes them an unnatural element of the environment (Longcore et al. 2009). Feral cats are found at densities 10–100 times higher than similarly sized native predators (Liberg et al. 2000).

Cats are a significant threat to threatened and endangered species as well as biodiversity. Threatened, endangered or species of concern are of particular risk from cats because for these species, even a small number of fatalities can cause significant population declines (Medina et al. 2011). For example, cats are responsible for at least 14% of bird, mammal and reptile extinctions on islands worldwide and are the primary threat to 8% of bird, mammal and reptile species which are critically endangered on islands worldwide (Medina et al. 2011). However, the impact of cats on threatened, endangered or species of concern is not limited to islands. For example, Houghton (2005) found that predation was the most common cause of nest loss for piping plovers (listed as threatened under the ESA in Virginia) and that cats were responsible for 13% of this predation.

Even if cats don't kill wildlife, infection from inflicted wounds or the stress of capture can result in mortality. Just the presence of cats can reduce reproductive success (Bonnington et al. 2013). For example in a 2013 study, blackbird parents reduced the rate at which they delivered food to their young after being exposed to a cat (Bonnington et al. 2013). Observations continued for 90 minutes after the cat was removed but feeding rates did not return to normal during this period of time (Bonnington et al. 2013). Reduced food delivery, even for short periods of time can have adverse impacts on chicks and the reproductive success of the adults (Dunn et al. 2010, Martin et al. 2011). Alternatively, the presence of cats may cause behavior in wildlife that makes them more vulnerable to predation by other predators (Charnov et al. 1976).

### ***Damage and Threats to Habitat***

Feral swine have a negative effect on “almost all aspects of ecosystem structure and function” (Jolley et al. 2010). The greatest damage occurs in areas that are environmentally sensitive or which provide critically important habitat for species which are listed under the ESA or are otherwise imperiled (Campbell and Long 2009). Much of this damage occurs through feral swine's rooting behavior (digging for food with their snout) which disturbs both the structure and properties of soil (Campbell and Long 2009). Rooting in conjunction with trampling and compaction, leads to the leaching of important minerals, changes in decomposition rates and nutrient cycling as well as increased rates of erosion (Campbell and Long 2009). This disturbance, along with the consumption of seeds and young plants by feral swine also changes the composition of vegetation on the landscape, the rate of plant regeneration and encourages exotic invasive plants (Singer et al. 1984, Campbell and Long 2009). Howe et al. (1981) found that feral swine rooting activities in the forest of Tennessee and North Carolina had occurred to the extent that recovery would take three or more years, while Bratton (1975) found that feral swine damage was so extensive that the forest understory was unlikely to ever recover. These changes in vegetation can be so extensive that they nearly wipe out local populations of native wildlife for which this vegetation provides critical habitat (Singer et al. 1984). This damage is most pronounced in areas that are more sensitive to disturbance such as aquatic environments (Seward et al. 2004, Kaller and Kelso 2006, Engeman et al. 2007, Kaller et al. 2007). Where feral swine cause erosion, increased turbidity, increased sedimentation, fecal contamination, nutrient mobilization, surface water enrichment as well as direct and indirect effects on aquatic biota and communities occurs (Zengel and Conner 2008).

Because white-tailed deer can occupy a variety of habitats and reproduce rapidly especially in the absence of native predators, their populations have increased sharply and in some areas have reached very high densities (Rooney and Waller 2003). Even in managed populations, deer densities regularly exceed those which existed at the time of European settlement (Rooney and Waller 2003). White-tailed deer are selective about what types of plants they consume (Strole and Anderson 1992). Therefore when deer

populations are overabundant they can have substantial effects on individual plants, plant populations and communities (e.g., plant diversity and density) (Russel et al. 2001). These changes can lead to adverse effects on other species and natural ecosystems through food web interactions or habitat modification (Rooney and Waller 2003). For example, changes in plant diversity caused by overabundant deer can affect the diversity of insects (Murdoch et al. 1972, Haddad et al. 2001) which leads to a decrease in the number of insect predators (e.g., insect eating birds)(Nuttle et al. 2001). Changes in plant density can affect the structure and composition of the forest in the long term (de Calesta 1994, McShea and Rappole, 2000, Fuller 2001) which reduces the abundance, diversity and density of birds (de Calesta 1994, McShea and Rappole 2000) and nutrient cycling (Rooney and Waller 2003). Nuttle et al. (2001) concluded that even when deer are over abundant for a relatively short period of time they can cause disruptions to the structure and function of ecosystems for a century.

Nutria can have detrimental negative impacts on native aquatic environments through their consumption of vegetation, construction of elevated platforms from vegetation as well as their foraging and burrowing activity (Witmer et al. 2012). In the Chesapeake Bay, nutria are considered a primary factor in the decline of marshes (Witmer et al. 2012). Marshes provide many ecological services, including the recharge and discharge of ground water, stabilization of sediments, flood control and storm buffering, erosion control and habitat for many species of plants and animals (Witmer et al. 2012). Nutria can consume up to 25% of their body weight in vegetation per day and preferentially consume the stems and roots of plants discarding as much as 90% of the plant (Witmer et al. 2012). In the Chesapeake Bay's Blackwater National Wildlife Refuge, nutria destroyed more than half (~7,000 acres) of the original marsh (Kendrot 2011). To consume the roots of plants, nutria dig and chew down into the mat or fabric of roots that holds the marsh together (Bounds et al. 2003, Witmer et al. 2012). This accelerates erosion by tidal currents and wave action and causes the vegetative mats to sink. Sinking of these vegetative mats effectively kills the plants and areas of marsh become areas of open water (Witmer et al. 2012). Nutria construct burrow systems for cover, runs or slides to get to and from the water and vegetative platforms for feeding, resting or grooming (Bounds et al. 2003, Witmer et al. 2012). The creation of these structures also accelerates the erosion of wetlands or waterways resulting in the loss of habitat for other species (Witmer et al. 2012). A 2004 economic analysis found that nutria in the Chesapeake Bay cost Maryland's commercial and sport fisheries, hunting, and wildlife watching industry about \$2.8 million dollars per year (Southwick Associates 2004).

Beavers have a tremendous influence on ecosystem structure and function. For example, beaver dams slow water which increases the deposit of sediments and reduces the availability of invertebrates for fish to eat (Niles et al. 2013). Dams also lead to an increase in water temperature and a decrease in dissolved oxygen which can be detrimental to some species of fish (Niles et al. 2013). Furthermore, dams can also restrict the movement of fish and isolate populations (Watters 1996). In order to reproduce, the life cycle of freshwater mussels requires that specific species of fish be present to act as hosts for parasitic immature mussels (different species of mussels require different species of fish) (VDGIF 2016). If the correct species of fish is not present, the freshwater mussel cannot reproduce. Additionally, the abundance and diversity of freshwater mussels is directly related to stream geomorphology and hydraulic conditions (Johnson and Brown 2000, Gangloff and Feminella 2007) which can be drastically altered by beavers (Rosell et al. 2005). Freshwater mussels are the most imperiled group of animals in the U.S., with 25 species listed and protected under the ESA in Virginia (Carey et al. 2015, Appendix C). Beavers not only change aquatic environments but also the surrounding environment including habitat and the number and species of both plants and animals present (Rosell et al. 2005). This may occur both as a result of their construction of dams, burrows, canals and lodges as well as their harvest of or consumption of plant material (Rosell et al. 2005). For example, populations of swamp pink (*Helonias bullata*) a species of plant listed as threatened under the ESA are highly vulnerable to the effects of beaver activity at U.S. Army Garrison, Fort A.P. Hill, in Virginia (Applegate et al. 2015).



### ***Damage and Threats Caused by Competition***

Feral swine negatively impact species of native wildlife by competing for resources (Seward et al. 2004, West et al. 2009). Many of the species listed under the ESA are at risk primarily because of competition or predation from exotic invasive species such as feral swine (Seward et al. 2004). Feral swine also compete with non-listed species of native wildlife such as white-tailed deer, black bears, wild turkeys (*Meleagris gallopavo*), raccoons and gray squirrels for acorns and other tree nuts (Henry and Conley 1972, Elston and Hewitt 2010). In some years this competition may be insignificant but in years in which resources are limited competition may be acute (Henry and Conley 1972). This is because feral swine not only have the ability to intake more food per unit of time and a wider diversity of food than species of native wildlife, but also because feral swine displace native wildlife from feeding sites and may comparatively be more efficient at digesting food (Elston and Hewitt 2010).

Competition between deer and other animals most often occurs when they share a common food resource (Rooney and Waller 2003). Authors have found that overabundant deer may compete with invertebrates to consume leaves and stems (Alverson and Waller 1997, Augustine et al. 1998, Rooney and Waller 2001), and with insects and various fruit and seed eating animals to consume flowers, fruits, seeds and nuts (Balgooyen and Waller 1995, McShea and Rappole 1992, Sargent 1990, Rooney 1997).

Muskrats and nutria co-exist in many areas and it is believed that the larger exotic invasive nutria can out-compete native muskrats (Witmer et al. 2012). Specifically, nutria and muskrats may compete for food, resting and den sites (Witmer et al. 2012).

Cats can outnumber and compete with a variety of native predators for food (Hoffmann and Gottschang 1977, Erlinge et al. 1984, Liberg et al. 2000). George (1974) speculated that the large number of animals killed by cats could reduce the amount of prey available to carnivores and predatory birds. Because cats are often fed and vaccinated against disease they may have additional advantages which allow them to compete with wild predators.

### ***Threats Caused by Disease***

Finally, mammals can negatively affect other wildlife through the transmission of disease. For example, Gehrt et al. (2013) concluded that the prevalence of *T. gondii* in the local skunk, raccoon and coyote population is likely a result of the presence of infected cats which act as hosts. Additional examples of diseases which occur or could occur in Virginia and cause damage or threaten wildlife populations include but are not limited to some of the same diseases that threaten human and livestock health (see ***Damage and Threats to Livestock, Disease***).

### **Need for Mammal Damage Management to Resolve Damage to Property**

Mammals have the ability to cause substantial damage to property. Examples of these types of damage and threats which occur or could occur include but are not limited to the following examples.

#### ***Damage Caused by Aircraft and Vehicles Striking Animals***

Collisions between aircraft or vehicles and animals can result in significant damage. Mammals of all sizes can be involved in collisions. Damage can occur when vehicles strike mammals or when drivers or pilots try to avoid a collision with a mammal.

From 1990 to 2013, aircraft strikes with terrestrial mammals were reported 3,149 times in the U.S. (Dolbeer et al. 2014). A total of 1,028 (33 percent) of these were reported to have caused damage to the

aircraft (Dolbeer et al. 2014). However, the number of mammal strikes actually occurring is likely to be much greater, since an estimated 80% of civil animal strikes go unreported (Cleary et al. 2000). These incidents can result in significant costs related not only to damage to the aircraft but also negative effects on flight. For example, strikes or near collisions can result in precautionary or emergency landings, evasive maneuvers, jettisoned fuel, and delayed or cancelled flights (Dolbeer et al. 2014). From 1990 to 2013, strikes with white-tailed deer in the U.S. caused \$43.8 million dollars in total damages (Dolbeer et al. 2014).

In Virginia since 1990, aircraft have reported striking 61 white-tailed deer, 32 foxes, nine coyotes, eight skunks, seven woodchucks, six opossums, five raccoons, four muskrats, and a single mink, Eastern cottontail and domestic cat (FAA 2015). In one of these strikes, the airplane was destroyed; in 22 strikes substantial damage was reported; in 22 strikes minor damage was reported, and in 22 no damage was reported (FAA 2015). However, for 48.8% (64) of the reported strikes, damage to the plane was either unknown or not reported (FAA 2015). Reported negative effects on flight include precautionary and emergency landings, evasive maneuvers, altered flights, delayed flights and canceled flights all of which result in economic losses (FAA 2015). The infrequency of mammal strikes does not lessen the need to prevent damage to aircraft. In addition, some species addressed in this EA pose minimal strike hazards at airports but their presence on airport property can attract other species which pose higher risks of aircraft strikes.

Similar to strikes between mammals and aircraft, many strikes between vehicles and mammals are unreported (Romin and Bissonette 1996). Using a data set from Utah, Bissonette et al. (2008) found that an average deer-vehicle collision resulted in \$1,320 dollars in vehicle damages. Nationwide, it is estimated that more than 1 million deer-vehicle collisions occur in the U.S., resulting in vehicle damage costs that exceed \$1.1 billion dollars (Conover et al. 1995, Conover 1997). The possibility exists for any collision with a mammal or any evasive action taken by a driver to avoid a collision with a mammal to result in a collision with something else (e.g., another vehicle, a tree). Because these collisions are not classified as deer-vehicle collisions, the cost associated with this type of collision is unknown. Mammals commonly involved in collisions include deer, bears, cats, coyote, dogs, foxes, opossums, raccoon, skunks, squirrels and woodchucks (Williams and Wells 2005, Smith-Patten and Patten 2008). However, the risk of damage increases with the size of the mammal.

### ***Damage and Threats to Pets***

Damage to property also includes attacks on cats, dogs and other pets. For example, coyotes will attack and kill cats and dogs (Grubbs and Krausman 2010, Poessel et al. 2013). Feral swine will also attack and kill domestic dogs (Mayer 2013). Attacks on pets are not limited to these examples. Pets may be attacked by a variety of species addressed in this EA.

Additionally, mammals can transmit diseases to pets. For example, dogs, particularly hunting dogs, may become infected with pseudorabies after coming into contact with infected feral swine. Once a dog is infected, there is no treatment, and death typically occurs soon after symptoms appear (Cramer et al. 2011). Diseases and parasites affecting pets are many of the same diseases that can infect livestock (***Damage and Threats to Livestock, Disease***) and humans (***Threat of Disease Transmission***). At particular risk are pets that are not confined at all times but are allowed to roam for extended periods of time and could interact with feral animals of the same species (e.g., dogs with dogs, cats with cats, potbellied pigs with feral swine) while they are roaming, risking exposure to a wide-range of diseases.

### ***Damage to Infrastructure and Other Property***

Mammals can cause damage to many different types of infrastructure and property. Examples include but are not limited to the following.

Beavers, muskrats, nutria and woodchucks dig burrows or networks of burrows, which can weaken or cause damage to foundations, roads, railways, dams, dikes, levees, storm water retention ponds and bridges (Woodward 1984, Bollengier 1994, Miller 1994, Miller and Yarrow 1994). Additionally, beavers cause damage to infrastructure when they plug culverts that allow water to pass beneath a roadway or when they impound water which washes out, undermines or floods roads, railroad beds, homes or other property. Nutria dig and chew down into the mat or fabric of roots that hold wetlands together (Bounds et al. 2003, Witmer et al. 2012). This accelerates erosion which can cost homeowners living adjacent to these areas thousands of dollars to repair (Witmer et al. 2012).

Other damage to infrastructure occurs when animals attempt to gain or succeed in gaining entry to buildings by chewing or gnawing holes, ripping of siding or vents or simply by slipping in through small holes (Greenhall and Franz 1994, Jackson 1994a, Jackson 1994b, Timm 1994a, Timm and Howard 1994, Baldwin 2014). Once access to buildings is achieved these animals can shred or displace insulation, chew wiring or deposit large amounts of urine and feces which can be absorbed by building materials (Greenhall and Frantz 1994, Baldwin 2014). Items in interior spaces can also be damaged when animals consume them, shred them for nesting material (e.g., upholstered furniture) or contaminate them with urine or feces.

Many species of wildlife have the ability to cause substantial damage to turf, landscaping plants and backyard gardens. Damage occurs when they consume plants or plant parts or when they root, dig, borrow, trample or wallow in parks, golf courses, residential areas or similar locations. For example, the rooting behavior that feral swine use to forage can have detrimental effects on golf courses and other recreational areas because of their ability to cause large scale damage in a short period of time.

### **1.3 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) AND WS DECISION-MAKING:**

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

Pursuant to the NEPA and the CEQ regulations, this EA documents the analyses of potential federal actions, informs decision-makers and the public of reasonable alternatives capable of avoiding or minimizing significant effects, 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 alternatives. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

## **1.4 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. Management of most mammals is the responsibility of the Virginia Department of Game and Inland Fisheries (VDGIF). Therefore, the lethal removal of mammals by WS to alleviate damage or reduce threats of damage as described in this EA could only occur within the parameters established by the VDGIF. Cooperation between VDGIF and WS ensures WS' actions are incorporated into population objectives established by the VDGIF. Dogs and cats are classified as companion animals in the Commonwealth of Virginia and are managed by local law enforcement and animal control authorities.

Based on the scope of this EA, the decisions to be made are:

How can WS best respond to the need to address damage caused by mammals in Virginia?

Do the alternatives have significant impacts meriting an Environmental Impact Statement (EIS)?

## **1.5 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT**

### **Affected Environment**

Mammals can be found across the Commonwealth throughout the year. Therefore, damage or threats of damage associated with mammals could occur wherever mammals occur as would requests for assistance to manage damage or threats of damage. Assistance would only be provided by WS when requested by a landowner or manager and WS would only provide direct operational assistance on properties where a MOU, Cooperative Service Agreement (CSA), or other comparable document had been signed between WS and the cooperating entity.

Upon receiving a request for assistance, the proposed action alternative, or those actions described in the other alternatives could be conducted on private, federal, Commonwealth, tribal, and municipal lands in Virginia to reduce damage and threats associated with mammals. The analyses in this EA are intended to apply to actions taken under the selected alternative that could occur in any locale and at any time within the analysis area. This EA analyzes the potential impacts of mammal damage management and addresses activities in Virginia that are currently being conducted under a MOU, CSA, or other comparable document with WS. This EA also addresses the potential impacts of mammal damage management in the Commonwealth where additional agreements may be signed in the future.

### **Federal, Commonwealth, County, City, and Private Lands**

Under two of the alternatives analyzed in detail, WS could continue to provide assistance on federal, state, county, municipal, and private land when a request was received for such services by the appropriate resource owner or manager. Actions taken on federal lands have been analyzed in the scope of this EA.

### **Native American Lands**

The WS program 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 CSA 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 and threats associated with mammals on federal, Commonwealth, county, municipal, and private properties under the alternatives analyzed in this EA would be available for use to alleviate damage on Tribal properties when the use of those methods had been approved for use by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would include those activities that could be employed on Native American lands, when requested and agreed upon between the Tribe and WS.

### **Site Specificity**

This EA analyzes the potential impacts of alternative approaches to managing damage and threats associated with mammals that could be conducted on private and public lands in Virginia where WS and the appropriate entities have entered into an agreement through the signing of a MOU, cooperative service agreement (CSA), or other comparable document. WS would only conduct damage management activities when requested by the appropriate resource owner or manager. This EA also addresses the potential impacts of conducting damage management activities in areas where additional MOUs, CSAs or other comparable documents may be signed in the future. Because the need for action is to reduce damage and because the goals and directives of WS are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional efforts could occur. Thus, this EA anticipates those additional efforts and analyzes the impacts of such efforts as part of the alternatives.

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

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

## **1.6 AUTHORITY OF FEDERAL AND STATE AGENCIES**

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

### **Wildlife Services (WS):**

The primary statutory authorities for the WS program are 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 managing animal damage and threats.

### **United States Fish and Wildlife Service (USFWS):**

The USFWS is the primary federal agency responsible for conserving, protecting, and enhancing the nation's fish and wildlife resources and their habitat. The USFWS has specific responsibilities for the protection of migratory birds, threatened and endangered species, inter-jurisdictional fish, and certain marine mammals, as well as for lands and waters managed by the agency in the National Wildlife Refuge System. The USFWS has statutory authority for enforcing the Fish and Wildlife Improvement Act of 1978 (16 USC 7.12), the Fish and Wildlife Act of 1956 (16 USC 742 a-j), and the Migratory Bird Treaty Act (16 USC 703-711).

### **United States Environmental Protection Agency (EPA):**

The U.S. Environmental Protection Agency (EPA) is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which regulates the registration and use of pesticides, including repellents and pesticides available for use to manage damage associated with mammals. The EPA is also responsible for administering and enforcing Section 404 of the Clean Water Act (CWA) along with the U.S. Army Corps of Engineers.

### **United States Food and Drug Administration (FDA):**

The U.S. Food and Drug Administration (FDA) is responsible for protecting the public health by assuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation. The FDA is also responsible for advancing the public health by helping to speed innovations that make medicines and foods more effective, safer, and more affordable; and helping the public get the accurate, science-based information they need to use medicines and foods to improve their health.

### **United States Drug Enforcement Administration (DEA):**

The U.S. Drug Enforcement Administration (DEA) is responsible for enforcing the Controlled Substance Act (1970). The DEA prevents the abuse and illegal use of controlled substances by regulating their production, distribution and storage.

### **United States Army Corps of Engineers (USACE):**

The U.S. Army Corps of Engineers (USACE) is responsible for regulating all waters of the U.S. under the Clean Water Act (CWA).

### **Virginia Department of Game and Inland Fisheries (VDGIF):**

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.

The VDGIF is responsible for classifying mammals as game animals or nuisance species and establishing and enforcing hunting and trapping seasons and licensing fur dealers. Additionally, the Board of Directors is responsible for the classification and protection of endangered and threatened species.

VDGIF has a MOU with WS 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 threatened and endangered 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.

### **Virginia Department of Agriculture and Consumer Services (VDACS):**

Under Title 3.2, Chapter 1, Section 102A, the Commissioner of Agriculture and Consumer Services is charged with regulating pesticides. The VDACS has the authority to classify restricted pesticides, certify and register pesticide applicators, license pesticide dealers, businesses and consultants, and conduct investigations and enforce these measures. Chapter 39 under Title 3.2 of the Code of Virginia is known as the Virginia Pesticide Control Act.

VDACS has a MOU with WS which establishes a cooperative relationship between WS and VDACS, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving wildlife conflicts in Virginia.

### **Virginia Department of Environmental Quality (VDEQ):**

The Virginia Department of Environmental Quality (VDEQ) is the Commonwealth's primary environmental regulatory agency.

## **1.7 DOCUMENTS RELATED TO THIS EA**

### **WS' Environmental Assessments Re-Evaluated Under this EA:**

WS has previously developed EAs that identified the need to manage damage associated with mammals (USDA 2012), aquatic rodents (USDA 2000), and to manage predation losses to native bird populations on the barrier and Chesapeake Bay islands and coastal areas (USDA 2005). Those EAs identified the issues associated with managing damage in the Commonwealth and analyzed alternative approaches to meet the specific need identified in those EAs while addressing the identified issues. Since activities conducted under the previous EAs will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EAs will be superseded by this analysis and the outcome of the Decision issued based on the analyses in this EA.

### **WS' Environmental Assessment – Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Fox, and Coyotes in the United States:**

WS previously prepared an EA that identified the need to fund and participate in oral rabies vaccine (ORV) 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 2009*a*). This EA identified the issues associated with funding and participating in the ORV and analyzed alternative approaches to meet the specific need identified while addressing the identified issues.

### **WS' Final Environmental Impact Statement – Feral Swine Damage Management:**

APHIS and cooperating agencies previously prepared an EIS that addressed feral swine damage management in the United States, American Samoa, Mariana Islands, United States Virgin Islands, Guam, and Puerto Rico (USDA 2015*c*). The Record of Decision selected the preferred alternative in the EIS to implement a nationally coordinated program that integrates methods to address feral swine damage. In accordance with the Record of Decision, WS developed this EA to be consistent with the EIS and the Record of Decision.

### **WS' Environmental Assessment – Managing Livestock Predation by Coyotes, Dogs and Red Foxes in the Commonwealth of Virginia:**

WSs previously developed an EA that identified the need to manage damage to livestock associated with coyote, dog and red fox predation in Virginia (USDA 2015*b*). The EA identified the issues associated with managing damage to livestock in the Commonwealth and analyzed alternative approaches to meet the specific need to reduce predation damage to livestock while addressing the identified issues.

### **Virginia Deer Management Plan 2015–2024:**

The VDGIF has developed a multi-year plan to guide the management of white-tailed deer in the Commonwealth of Virginia (VDGIF 2015). The plan includes goals that specify the general directions for deer populations, deer habitat, deer damage and deer-related recreation in Virginia.

### **Virginia Bear Management Plan 2012–2021:**

The VDGIF has developed a multi-year plan to guide the management of black bears in the Commonwealth of Virginia (VDGIF 2012*a*). The plan includes goals that specify the general direction for bear populations, bear habitat, bear-related recreation, and human-bear problems in Virginia.



## **Proposal to Permit Take as provided under the Bald and Golden Eagle Protection Act Final Environmental Assessment:**

Developed by the USFWS, this EA evaluated the issues and alternatives associated with the promulgation of new regulations to authorize the “take” of bald eagles and golden eagles as defined under the Bald and Golden Eagle Protection Act. The preferred alternative in the EA evaluated the authorization of disturbance take of eagles, the removal of eagle nests where necessary to reduce threats to human safety, and the issuance of permits authorizing the lethal take of eagles in limited circumstances, including authorizing take that is associated with, but is not the purpose of, an action (USFWS 2009). A Decision and Finding of No Significant Impact (FONSI) was made for the preferred alternative in the EA. The selected alternative in the EA established new permit regulations for the “take” of eagles (see 50 CFR 22.26) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27). The USFWS published a Final Rule on September 11, 2009 (74 FR 46836-46879).

### **1.8 PUBLIC INVOLVEMENT**

Issues related to the management of damage and threats associated with mammals and the alternatives to address those issues were initially developed by WS. 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. This EA will be noticed to the public through legal notices published in local print media, through the APHIS stakeholder registry, and by posting the EA on the APHIS website at <http://www.aphis.usda.gov/wildlifedamage/nepa>.

WS will make the EA available for a minimum of 30 days 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 identified after publication of notices announcing the availability of the EA will be fully considered to determine whether the EA should be revisited and, if appropriate, revised prior to issuance of a Decision.

### **1.9 RATIONALE FOR PREPARING AN EA RATHER THAN AN EIS**

WS has the discretion to determine the geographic scope of their analyses under the NEPA. The intent in developing this EA is 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 or a finding of no significant impact (FONSI). In terms of considering cumulative effects, one EA analyzing impacts for the entire state will provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. As most mammals are regulated by the VDGIF, the best available data for analysis is often based on statewide population dynamics. For example, an EA on county level may not have sufficient data for that area and would have to rely on statewide analysis anyway. If a determination is 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.

### **1.10 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 agency analyzes its potential impacts on the “*human environment,*” it is reasonable for that agency to compare not only the effects of the proposed federal action, but also the potential impacts that could or would occur from a non-federal entity

conducting the action in the absence of the federal action. This concept is applicable to situations involving federal assistance in managing damage associated with resident wildlife species managed by the state natural resources agency, invasive species, or unprotected species.

Most wildlife species are protected under Commonwealth and/or federal law. To address damage associated with these species, a permit must be obtained from the appropriate Commonwealth agency. However, in some situations, species can be managed without the need for a permit. In Virginia, animals classified as nuisance species (e.g., nutria, coyotes, feral swine and woodchucks) and those species not designated as endangered or threatened or classified as game or fur-bearing animals which are causing damage, a health hazard or nuisance can be lethally removed throughout the year (§ 29.1-100, § 29.1-511, § 29.1-530, 4 VAC 15-20-160). Beaver, bobcat, fox, mink, muskrat, opossum, otter, raccoon and skunk maybe lethally removed when they are causing damage or a nuisance or posing a threat to human health or safety (§ 29.1-100, § 29.1-516, § 29.1-517). Beaver may also be lethally removed when causing damage under § 29.1-518 and both foxes (4 VAC 15-110-80) and skunks (4 VAC 15-220-10) can also be lethally removed at any time. Additionally, rabbits and squirrels can be lethally removed when causing “*substantial damage to fruit trees, gardens crops or other property*” (§ 29.1-516). However, method restrictions apply in all instances (e.g., firearms restrictions, trapping restrictions, pesticide regulations).

When a non-federal entity (e.g., agricultural producers, individuals, or any other non-federal entity) takes an action involving mammals, the action is not subject to compliance with the NEPA due to the lack of federal involvement<sup>5</sup> in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed.

Therefore, in those situations in which a non-federal entity has decided that a management action directed towards mammals should occur and even the particular methods that should be used, WS’ involvement in the action would not affect the environmental status quo because 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.

## **1.11 LAWS AND STATUTES RELATED TO THIS EA**

Several laws or statutes authorize, regulate, or otherwise would affect WS’ activities. WS complies with all applicable federal, Commonwealth, and local laws and regulations in accordance with WS Directive 2.210. Those laws and regulations relevant to managing damage in the Commonwealth are addressed below:

### **Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-711; 40 Stat. 755), as amended:**

The Migratory Bird Treaty Act (MBTA) makes it unlawful to, “to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase” some migratory bird species, or their parts, nests, or eggs (16 USC 703-711). A list of bird species protected under the MBTA can be found in 50 CFR 10.13. All actions conducted in this EA comply with the regulations of the MBTA, as amended.

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<sup>5</sup> If a federal permit were required to conduct damage management activities, the issuing federal agency would be responsible for compliance with the NEPA for issuing the permit.

### **Bald and Golden Eagle Protection Act (16 USC 668-668c), as amended:**

Populations of bald eagles showed periods of steep declines in the lower United States during the early 1900s attributed to the loss of nesting habitat, hunting, poisoning, and pesticide contamination. To curtail declining trends in bald eagles, Congress passed the Bald Eagle Protection Act (16 USC 668) in 1940 prohibiting the take or possession of bald eagles or their parts. The Bald Eagle Protection Act was amended in 1962 to include the golden eagle and is now referred to as the Bald and Golden Eagle Protection Act. Certain populations of bald eagles were listed as “endangered” under the Endangered Species Preservation Act of 1966, which was extended when the modern Endangered Species Act (ESA) was passed in 1973. The “endangered” status was extended to all populations of bald eagles in the lower 48 states, except populations of bald eagles in Minnesota, Wisconsin, Michigan, Washington, and Oregon, which were listed as “threatened” in 1978. As recovery goals for bald eagle populations began to be reached in 1995, all populations of eagles in the lower 48 States were reclassified as “threatened”. In 1999, the recovery goals for populations of eagles had been reached or exceeded and the eagle was proposed for removal from the ESA. The bald eagle was officially de-listed from the ESA on June 28, 2007 with the exception of the Sonora Desert bald eagle population. Although officially removed from the protection of the ESA across most of its range, the bald eagle is still afforded protection under the Bald and Golden Eagle Protection Act.

Under the Bald and Golden Eagle Protection Act (16 USC 668-668c), the take of bald eagles is prohibited without a permit from the USFWS. Under the Act, the definition of “take” includes actions that “*pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb*” eagles. The regulations authorize the USFWS to issue permits for the take of bald eagles and golden eagles on a limited basis (see 74 FR 46836-46837, 50 CFR 22.26, 50 CFR 22.27). As necessary, WS would apply for the appropriate permits as required by the Bald and Golden Eagle Protection Act.

### **Endangered Species Act (ESA) (16 USC 1531-1544):**

The Endangered Species Act (ESA) recognizes that our natural heritage is of “*esthetic, ecological, educational, recreational, and scientific value to our Nation and its people.*” The purpose of the Act is to protect and recover species that are in danger of becoming extinct. It is administered by the USFWS and the Department of National Marine Fisheries Service (NMFS). The USFWS has primary responsibility for terrestrial and freshwater species while the NMFS is primarily responsible for marine organisms. Under the ESA, species may be listed as endangered or threatened. Endangered is defined as a species that is in danger of becoming extinct throughout all or a significant portion of its range while threatened is defined as a species likely to become endangered in the foreseeable future. Under the ESA, “*all federal departments and agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act*” (Sec.2(c)). Additionally, the Act requires that, “*each Federal agency shall in consultation with and with the assistance of the Secretary, insure 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 or result in the destruction or adverse modification of habitat of such species.....each agency will use the best scientific and commercial data available*” (Sec.7 (a) (2)). WS consults with the USFWS or the NMFS to ensure that the agencies actions, including the actions proposed in this EA, are not likely to jeopardize the existence of endangered or threatened species or their habitat.

### **National Historic Preservation Act (NHPA) (16 USC 470 et seq.), as amended:**

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment on such undertakings if an agency determines that the

agency's actions are "undertakings". Undertakings are defined in Sec. 800.16(y) as a "project, activity, or program funded in whole or part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; and those requiring a federal permit, license or approval". 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 methods described in this EA that would be available for use under the alternatives 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 were used that could result in effects on the character or use of historic properties. Therefore, the methods that could be used by WS under the relevant 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 hazing or removing animals 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 can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Site-specific consultation as required by the Section 106 of the NHPA would be conducted as necessary in those types of situations.

#### **Federal Actions to Address Environmental Justice in Minority Populations 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 minorities and low-income persons or populations. APHIS implements Executive Order 12898 principally through its compliance with the NEPA. All WS' activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. WS would only use or recommend legal, effective, and environmentally safe methods, tools, and approaches. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minorities and persons or populations of low income.

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

Children may suffer disproportionately from environmental health and safety risks because their physical and mental systems are still developing. Each federal agency must therefore, "make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children" and "ensure that its policies, programs, activities and standards address disproportionate risks to children". WS would only employ and/or recommend legally available and approved methods under the alternatives

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.

**The Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001 et seq.):**

The Native American Graves Protection and Repatriation Act (NAGPRA) establishes procedures for federal agencies when Native American “*cultural items*” are inadvertently discovered on federal or tribal lands. Cultural items may include human remains, funerary objects, sacred objects, and objects of cultural patrimony. In part, the NAGPRA requires federal agencies making such discoveries to notify the Secretary of the Department that manages the federal lands or the tribal leaders on tribal lands on which the discovery was made. Additionally, once a discovery is made, work must be stopped and reasonable efforts must be made to protect the item.

**Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 USC 136 et seq.):**

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. All chemical methods described in Appendix B, are registered with and regulated by the EPA and used or recommended by WS in compliance with labeling procedures and requirements.

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

This law places administration of pharmaceutical drugs, including those immobilizing drugs used for wildlife capture and handling, under the Food and Drug Administration (FDA).

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

This law requires an individual or agency to have a special registration number from the United States Drug Enforcement Administration (DEA) to possess controlled substances, including controlled substances used for wildlife capture and handling.

**Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA):**

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

**Fish and Wildlife Act of 1956 (Section 16 USC 742j-1), Airborne Hunting:**

This Act, passed in 1971 (Public Law 92-159), and amended in 1972 (Public Law 92-502) was added to the Fish and Wildlife Act of 1956 as a new section (16 USC 742j-1) and commonly referred to as the Airborne Hunting Act. It prohibits shooting or attempting to shoot, harassing, capturing or killing any

bird, fish, or other animal from aircraft except for certain specified reasons. Under exception [see 16 USC 742j-1, (b)(1)], state and federal agencies are allowed to protect or aid in the protection of land, water, wildlife, livestock, domesticated animals, human life, or crops using aircraft.

#### **Clean Water Act (Section 401):**

As required by Section 401 of the CWA (see 33 USC 1341), an applicant for a permit issued pursuant to Section 404 of the CWA must also possess a permit from the state in which the discharge originates or will originate, when applicable. The Virginia Department of Environmental Quality is responsible for reviewing Water Quality Certifications applications required by Section 401 of the Clean Water Act.

#### **Clean Water Act (Section 404):**

Section 404 (see 33 USC 1344) of the CWA prohibits the discharge of dredged or fill material into waters of the United States without a permit from the United States Army Corps of Engineers unless the specific activity is exempted in 33 CFR 323 or covered by a nationwide permit by 33 CFR 330.

#### **Food Security Act:**

The Wetland Conservation provision (Swampbuster) of the 1985 (16 USC 3801-3862), 1990 (as amended by Public Law 101-624), and 1996 (as amended by Public Law 104-127) farm bills require all agricultural producers to protect wetlands on the farms they own. Wetlands converted to farmland prior to December 23, 1985 are not subject to wetland compliance provisions even if wetland conditions return because of lack of maintenance or management. If prior converted cropland is not planted to an agricultural commodity (crops, native and improved pastures, rangeland, tree farms, and livestock production) for more than five consecutive years and wetland characteristics return, the cropland is considered abandoned and then becomes a wetland subject to regulations under Swampbuster and Section 404 of the CWA.

#### **Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33):**

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

#### **Flood Plain Management – Executive Order 11988:**

Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse effects associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, *“each agency shall provide leadership and shall take action to reduce the risk of flood loss,*

*to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities”.*

**Protection of Wetlands – Executive Order 11990:**

Executive Order 11990 was signed to “*minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands*”. To meet those objectives, Executive Order 11990 requires federal agencies to consider alternatives to wetland sites, in planning their actions, and to limit potential damage, if a federal agency cannot avoid an activity affecting a wetland.

**Bounties for Coyotes (Code of Virginia § 15.2-926.1):**

This section of the Code states that, “*Any locality may by ordinance permit the killing of coyotes within its boundaries at any time and may pay, out of any available funds, a bounty for each coyote killed within its boundaries. The ordinance may prescribe the conditions to be met and the evidence to be submitted before any such payment is made, as well as the amount of the bounty to be paid.*”

**Open Season on Nuisance Species (Code of Virginia § 29.1-511):**

“*There shall be a continuous open season for killing nuisance species... ”. In this chapter, “coyotes” and “feral swine” as well as “those species designated as such by regulations of the Board, and those species committing or about to commit depredation upon ornamental or shade trees, agricultural crops, wildlife, livestock or other property or when concentrated in numbers and manner as to constitute a health hazard or other nuisance...not include(ing) (i) animals designated as endangered or threatened...(ii) animals classified as game or fur-bearing animals...*” are included in the definition of “*nuisance species*” (§ 29.1-100).

**Game Animals (Code of Virginia § 29.1-516):**

“*..the following persons may kill rabbits or squirrels for their own use during the closed season: 1) a landowner and members of his immediate family...3) tenants residing on the premises, with written permission of the landowner. When such animals are committing substantial damage to fruit trees, gardens, crops or other property, the owner of the premises may kill the animals or have them killed under a permit obtained from the conservation police officer.*”

**Trapping and shooting of fur-bearing animals during closed season (Code of Virginia § 29.1-517):**

“*A landowner may trap or shoot fur-bearing animals upon his own land during closed season when these animals are causing damage to crops or property, or are posing a threat to human health or safety, or are otherwise causing a nuisance.*” In this chapter, “*beaver, bobcat, fox, mink, muskrat, opossum, otter, raccoon and skunk*” are included in the definition of “*fur-bearing animals*” (§29.1-100).

**When killing of beaver permitted (Code of Virginia § 29.1-518):**

“*When beaver are damaging crops or lands, the owner of the premises, his agent or tenant, may kill the animals, or have them killed.*”

**Killing of deer, elk or bear damaging fruit trees, crops, livestock, or personal property; wildlife creating a hazard to aircraft or motor vehicles (Code of Virginia § 29.1-529):**

*“Wherever deer, elk or bear are damaging fruit trees, crops, livestock or personal property utilized for commercial agricultural production....deer (are) causing damage to residential plants...wildlife is creating a hazard to the operation of any aircraft or to the facilities connected with the operation of aircraft....deer are creating a hazard to the operation of motor vehicle traffic...or deer are damaging property in a locality in which deer herd population reduction has been recommended in the current Deer Management Plan....the Director or his designee...shall authorize... animals to be killed...”*

**Open and closed season for trapping, bag limits, etc. (Code of Virginia § 29.1-530):**

*“There shall be a continuous open season for trapping nuisance species...”. In this chapter, “coyotes” and “feral swine” are included in the definition of “nuisance species” (§ 29.1-100). “A landowner or his agent may trap and dispose of...squirrels creating a nuisance...in any area where the use of firearms...is prohibited...”*

**Rules and Regulations for Enforcement of the Virginia Pesticide Law (The Virginia Administrative Code (2 VAC-5 -670, 680, 685)):**

Chapter 39 under Title 3.2 of the Code of Virginia is known as the Virginia Pesticide Control Act. Chapters 670, 680 and 685 of Title 2, Agency 5 of the Virginia Administrative code contain the implementing regulations of the Act. These regulations include the classification and registration of pesticides, the handling, storage and application of pesticides, as well as the certification and registration of sellers and users.

**Nuisance Species Designated (The Virginia Administrative Code (4 VAC 15-20-160):**

In this section of the Code, the VDGIF designates, “house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), black rat (*Rattus rattus*), coyote (*Canis latrans*), feral hog (*Sus scrofa*), nutria (*Myrocastor coypus*); and woodchuck (*Marmota monax*)”, addressed in this EA as a nuisance species. Feral hogs are defined as “any swine that are wild or for which no proof of ownership can be made”.

**Possession, Transportation, and Release of Wildlife by Authorized Persons (The Virginia Administrative Code (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.

**Poisoning of Wild Birds and Wild Animals Prohibited; certain control programs excepted (The Virginia Administrative Code (4 VAC-15-40-50)):**

*“It shall be unlawful to put out poison at any time for the purpose of killing any wild birds and wild animals, provided that rats and mice may be poisoned on one's own property. The provisions of this section shall not apply to the Commissioner of Agriculture and Consumer Services, the United States*



*Department of Agriculture, or their representatives or cooperators, and those being assisted in a control program authorized by those agencies.”*

**Killing by Landowner (The Virginia Administrative Code (4 VAC-15-110-80):**

*“A landowner may kill or have killed foxes at any time on his own land.”*

**Continuous open season for taking striped skunks (The Virginia Administrative Code (4 VAC-15-220-10):**

*“It shall be lawful to take striped skunks (*Mephitis mephitis*) at any time.”*

## **CHAPTER 2: ISSUES AND ALTERNATIVES**

This chapter contains a discussion of the issues which were used to develop alternatives to address the need for action. It also contains a discussion of Integrated Wildlife Damage Management (IWDM) as well as a description of WS' strategies, decision making process and standard operating procedures (SOPs). Finally, this chapter presents alternatives developed to address the issues and meet the need for action. It also presents alternatives considered but not analyzed in detail, with rationale.

### **2.1 ISSUES USED TO DEVELOP THE ALTERNATIVES**

Issues are concerns of the public and/or professional community raised regarding potential adverse effects that might occur from a proposed action. Such issues must be considered in the NEPA decision-making process. Issues related to managing damage associated with mammals in Virginia were developed by WS through discussions with partnering agencies, cooperators, and stakeholders.

The issues as they relate to the possible implementation of the alternatives, including the proposed action alternative, are discussed in Chapter 3. The issues analyzed in detail are the following:

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

A common issue when addressing damage caused by animals are the potential impacts of management actions on the populations of target species. Methods available to resolve damage or threats of damage can be categorized as lethal and non-lethal. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive or unavailable to the species causing the damage, thereby reducing the presence of those species in the immediate area. Lethal methods remove individuals of target species causing the damage, thereby reducing the presence of those species in the area and reducing the local population. The number of target species lethally removed under the alternatives is dependent upon the magnitude of the damage occurring, the level of damage acceptable to individual persons experiencing the damage, the numbers of individual animals involved, and the efficacy of methods employed. Under certain alternatives, both non-lethal and lethal methods could be recommended, as governed by federal, state, and local laws and regulations.

The analysis for the magnitude of impact on the populations of target animals is based on a measure of the number of individuals from each species removed in relation to that species' abundance and/or status (e.g., nuisance species, game species, etc.). 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 trend data, when available.

The analysis to determine the magnitude of impacts on the populations of those species addressed in this EA from the use of lethal methods would be based on a measure of the number of individuals lethally removed in relation to that species' abundance or status. Lethal removal would be monitored by comparing the number of animals lethally removed with overall populations or trends. Lethal methods would only be used by WS at the request of those persons seeking assistance. In many damage situations, lethal removal of wild mammals addressed in this document could occur at any time, or during hunting and trapping seasons. Any activities conducted by WS under the alternatives addressed would occur along with other natural process and human-induced events, such as natural mortality, human-induced mortality from private damage management activities, mortality from regulated harvest, and human-induced alterations of habitat.

Information on wild mammal populations and trends are derived from several sources including harvest data, fur dealer reports and bow hunter surveys. Additional information on those sources of information is provided below.

### ***Annual Hunter Harvest Estimates***

Hunting seasons are established and enforced by the VDGIF. The VDGIF conducts periodic surveys of licensed hunters to estimate the number of animals harvested (e.g., see Kidd et al. 2014a). Although the lethal removal of many wild mammals addressed in this document can occur throughout the year when they are causing damage without need for a license, many are lethally removed by individuals with licenses, and therefore reported during the survey. Survey participants are asked not to report animals trapped during annual established trapping seasons.

### ***Actual Hunter and Trapper Harvest Figures***

The VDGIF establishes and enforces both hunting and trapping seasons and requires that all black bears, bobcats and white-tailed deer harvested are reported to the VDGIF. Therefore, the actual number and not an estimate of each of these species harvested on an annual basis is known.

### ***Annual Fur Dealer Reports***

The VDGIF establishes and enforces trapping seasons and licenses fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals). The VDGIF conducts an annual survey of licensed fur dealers to quantify the number of fur-bearer pelts they purchase or broker from Virginia trappers or hunters and the number of pelts they trapped themselves. This information can be used as an index of furbearer populations (e.g., see Fies 2010a).

### ***Annual Trapper Harvest Estimates***

The VDGIF does not survey licensed trappers on a regular basis. However, a survey of these individuals was conducted in 2013–2014 to determine the number of animals they harvested. This information can be used in conjunction with annual fur dealer reports as an index of furbearer populations.

### ***Rural Mail Carrier's Survey***

Each year the VDGIF enlists U.S. Postal Service employees to record their observations of rabbits, squirrels, quail, and raccoons along rural mail delivery routes. Carriers are asked to write down the number of each species observed while delivering mail along their route over a five day period in August and September. This information can be used as a population index.

## **Issue 2 - Effects of Damage Management Activities on Non-target Animals, Including Threatened and Endangered Species**

A common issue when addressing damage caused by animals are the potential impacts of management actions on non-target species, including threatened and endangered species. Non-lethal methods have the potential to inadvertently disperse or otherwise impact non-targets. Lethal methods remove individuals of the species causing the damage, thereby reducing the presence of those species in the area and the local population. However, lethal methods also have the potential to inadvertently capture or kill non-targets.

The Endangered Species Act (ESA) makes it illegal for any person to 'take' any listed endangered or threatened species or their critical habitat. The ESA defines take as, "to harass, harm, pursue, hunt, shoot,

wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC 1531-1544). Critical habitat is a specific geographic area or areas that are essential for the conservation of a threatened or endangered species. The ESA requires that federal agencies conduct their activities in a way to conserve species. It also requires that federal agencies consult with the appropriate implementing agency (either the USFWS or the NMFS) prior to undertaking any action that may take listed endangered or threatened species or their critical habitat pursuant to Section 7(a)(2) of the ESA.

There may also be concerns that WS' activities could result in the disturbance of eagles that may be near or within the vicinity of WS' activities. Under 50 CFR 22.3, the term "disturb", as it relates to take under the Bald and Golden Eagle Act, has been defined as "to agitate or bother a bald and golden eagles to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." The environmental consequences evaluation conducted in Chapter 3 of this EA will discuss the potential for WS' activities to disturb eagles as defined by the Act.

### **Issue 3 - Effects of Damage Management Activities on Human Health and Safety**

An additional issue often raised is the potential risks to human health and safety associated with the methods employed to manage damage caused by mammals. Both chemical and non-chemical methods have the potential to have adverse effects on human health and safety. Risks can occur to persons employing methods, to persons coming into contact with methods or persons harvesting and then consuming animals which have been previously immobilized with drugs. Risks can be inherent to the method itself or related to the misuse of the method.

#### ***Safety of Chemical Methods Employed***

Potential risks to human health and safety associated with chemical methods are related to the potential for human exposure either through direct or indirect contact with the chemical. Under the alternatives analyzed in detail, chemical methods could be employed or recommended including, euthanasia chemicals, immobilization drugs, repellants, fumigants (chemical gases that are used to lethally remove animals in dens or burrows), predacides (chemicals used to lethally remove predators) and rodenticides (chemicals used to lethally remove rodents). All of these chemical methods except for predacides would be available under all of the alternatives analyzed in detail.

The use of chemical methods is strictly regulated by the DEA, EPA, FDA and VDACS. Restricted use chemicals can only be applied by persons who have been specially trained and certified by the VDACS for their use. These persons (certified applicators) are required to take continuing education credits and exams to maintain their certification. All of the chemical methods listed above, including methods available for use to the public, have specific requirements for their handling, transport, storage, use and disposal under the Code of Virginia and the Virginia Administrative Code. Additional information about these methods can be found in Appendix B.

#### ***Safety of Non-Chemical Methods Employed***

Most methods available to manage damage and threats associated with mammals are considered non-chemical methods. Non-chemical methods available can be grouped into two categories: non-lethal and lethal. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive or unavailable to the species causing the damage, thereby reducing the presence of those species in the area. Examples of non-lethal methods include resource management, physical exclusion, deterrents or live traps. All of these methods are designed to disperse, exclude or make the area where damage is occurring

unattractive to the animals which are associated with the damage. Lethal methods remove individuals of target species causing the damage, thereby reducing the presence of those species in the area and reducing the local population. Lethal methods include shooting, capture and euthanasia, or the reduction of a local population by hunting. All of these non-chemical methods available to address damage would be available for use under any of the alternatives and could be employed by any entity, when permitted.

Like chemical methods, non-chemical methods, if misused, could potentially be hazardous to human health and safety. The primary safety risk of most non-chemical methods occurs directly to the person employing the method. However, risks to others do exist when employing non-chemical methods, such as when using firearms. All of the non-chemical methods available to address damage would be available for use by any entity, when permitted, under all of the alternatives analyzed in detail.

#### **Issue 4 – Humaneness and Animal Welfare Concerns**

The issue of humaneness and animal welfare, as it relates to the killing or capturing of animals 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.*”

Suffering has previously been described by the American Veterinary Medical Association (AVMA), as a “...*highly unpleasant emotional response usually associated with pain and distress*” (AVMA 1987). However, suffering “...*can occur without pain...*,” and “...*pain can occur without suffering...*” because suffering carries with it the implication of occurring over time, 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. However, pain experienced by individual animals probably ranges from little or no pain to considerable pain (California Department of Fish and Game 1991).

The AVMA has previously stated that “[f]or wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but terms such as killing, collecting, or harvesting, recognizing that a distress-free death may not be possible” (AVMA 2001).

Pain and suffering, as it relates to methods available for use to manage animal damage has both a professional and lay point of arbitration. The professional community and the public would be better served to recognize the complexity of defining suffering, because “...*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*” (Kreeger et al. 1990). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness (Bateson 1991).

The decision-making process can involve 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, as those concerns relate to the methods available for use, will be further discussed under the alternatives in Chapter 3. SOPs to alleviate pain and suffering are discussed later in this chapter .

### **Issue 5 – Effects of Damage Management Activities on the Aesthetic Values of Mammals**

An additional issue raised is that activities to alleviate damage and threats associated with mammals would result in the loss of the aesthetic benefits of these mammals to persons in the area where damage management activities take place. Animals are generally regarded as providing utilitarian, monetary, recreational, scientific, ecological, existence and historic values (Conover 2002). These benefits can be tangible or intangible. Both recreational and existence values are related in part to aesthetics. Aesthetics is the philosophy dealing with the nature of beauty or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature and dependent upon what an observer regards as beautiful.

Many people enjoy watching or hearing wild mammals and take pleasure from knowing they exist. In modern societies a large percentage of households have pets. However, some people may consider individual wild animals as “pets” and exhibit affection towards these animals.

Dogs and cats are classified as companion animals in the Code of Virginia and are managed by local law enforcement and animal control authorities. The aesthetic value of dogs or cats may for some people be linked to their status (i.e., owned and under the owner’s direct control, owned but free-ranging or feral). Some owners may never confine or restrain their pet and enjoy knowing they have the freedom of being free-ranging. These people may view their pet differently than an un-owned free-ranging or feral animal.

The values people place on animals is unique to the individual and can be based on many factors. Because these values differ, public attitudes toward animals vary considerably. To alleviate damage, some people support lethal removal, some people believe that all animals should be captured and relocated or handed over to local law enforcement or animal control authorities while others strongly oppose any management and want management agencies to teach tolerance. Some of the people who oppose removal do so because of human-affectionate bonds with individual animals. Attitudes can also differ significantly depending upon if the individual is affected by the damage or threats of damage. As stated previously, methods available to alleviate damage or reduce threats either disperse or otherwise make an area where damage is occurring unattractive or unavailable to the species causing the damage, or alternatively lethally remove individuals of the species causing the damage. These activities reduce the presence of target species in the area where damage is occurring. Therefore, these activities have the potential to affect the aesthetic values of mammals depending upon the values, philosophies, attitudes and opinions of individuals.

### **Issue 6 – Effects of Damage Management Activities on the Regulated Harvest of Mammals**

Another issue commonly identified as a concern is that damage management activities conducted by WS could affect the ability of hunters or trappers to harvest species targeted by management activities. Potential impacts could arise from both lethal and non-lethal damage management methods. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive to the species causing the damage, thereby reducing the presence of those species in the area. Lethal methods remove individuals of the species causing the damage, thereby reducing the local population and the presence of those species in the area. Therefore, lethal methods could reduce the local population or the presence of harvestable species in the area where damage management activities are occurring. In the Commonwealth, Virginia opossum, Eastern cottontail, woodchuck, gray squirrel, fox squirrel, beaver,

muskrat, coyote, red foxes, gray fox, black bear, raccoon, mink, striped skunk, river otter, bobcat, white-tailed deer, and feral swine may be harvested by hunters and trappers.

### **Issue 7 – Effects of Beaver Removal and Dam Manipulation or Removal on Wetlands**

Another issue raised is that activities to alleviate damage and threats associated with beavers would result in the loss of wetlands and the plant and animal species associated with wetland habitat. Wetlands are a valuable component of land-based ecosystems that provide numerous direct and indirect benefits to people and wildlife (e.g., see Costanza et al. 1997, Millennium Ecosystem Assessment 2005). Between the 1780s and the 1980s, Dahl (1990) estimated 53% of the original wetland acres in the lower 48 states were lost, primarily from human development. Over that 200-year time span, Dahl (1990) estimated the wetland acres in Virginia decreased from 1.8 million acres to 1.0 million acres, which represents a 42% decline. Beaver, through their building of dams and impounding water can have a unique role in establishing wetlands that not only provide benefit to the beaver, but to people and other wildlife. Wildlife professionals often consider beaver a “keystone” species for their ability to manipulate and create their own habitats, which can also provide benefits to other wildlife and people. Beaver may also be an inexpensive way of restoring wetlands or creating new wetlands (e.g., see Hey and Phillips 1995, Muller-Schwarze and Sun 2003, Buckley et al. 2011).

The issue of WS’ potential impacts to wetlands could occur from activities conducted to alleviate damage or threats of damage associated with beaver, primarily from the breaching or removal of beaver dams. Beaver dam breaching or removal during activities to manage damage caused by beaver sometimes occurs in areas inundated by water from water impounded by beaver dams. Dam material usually consists of mud, sticks, and other vegetative material. Beaver dams obstruct the normal flow of water, which can change the preexisting hydrology from flowing or circulating waters to slower, deeper, more expansive waters that accumulate bottom sediment over time. The depth of the bottom sediment behind a beaver dam depends on the length of time water covers an area and the amount of suspended sediment in the water.

Beaver dams, over time, can establish new wetlands. Therefore, the breaching or removal of a beaver dam could result in the degrading or removal of a wetland, if wetland characteristics exist at a location where a beaver dam occurs. The preexisting habitat (prior to the building of the dam) and the altered habitat (areas flooded by impounded water) have different ecological values to the species native to the area. Some species may benefit by the addition of a beaver dam that creates a wetland, while the presence of some species of wildlife may decline. For example, some species of fish require fast moving water over gravel or cobble beds, which beaver dams can eliminate; thus, reducing the availability of habitat. In areas where bottomland forests were flooded by beaver dams, a change in species composition could occur over time as trees die. Flooding often kills hardwood trees, especially when flooding persists for extended periods, as soils become saturated. Conversely, beaver dams could be beneficial to other species, such as river otter, Neotropical migratory birds, and waterfowl that require aquatic habitats. If water impounded by a beaver dam persists for an extended period, hydric soils and hydrophytic vegetation could eventually form. This process could take anywhere from several months to years depending on preexisting conditions. Hydric soils are those soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions. In general, hydric soils form much easier where wetlands have preexisted. Hydrophytic vegetation includes those plants that grow in water or on a substrate that is at least periodically deficient in oxygen because of excessive water content. If those conditions exist, then a wetland has developed that would have different wildlife habitat values than an area of impounded water from more recent beaver activity.

In addition, people often raise concerns regarding the use of lethal methods to remove beaver to alleviate damage or threats. If WS removed beavers from an area and / or breached or removed a beaver dam or

installed water flow devices, or recommended the implementation of these actions, the manipulation of water levels by removing/breaching the dam could prevent the establishment of wetlands by preventing water conditions to persist long enough to establish wetland characteristics. Additionally, if WS removed beavers, or recommended the removal of beavers but left or recommended the beaver dam be left undisturbed, the lack of maintenance to the dam by beaver would likely result in the eventual recession of the impounded water as weathering eroded the dam.

## **2.2 DAMAGE MANAGEMENT STRATEGIES**

### **Integrated Wildlife Damage Management (IWDM)**

The most effective approach to resolving wildlife damage is to use an adaptive integrated approach that may call for the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement methods in the most effective manner while minimizing the potentially harmful effects to humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., animal husbandry), habitat modification (e.g., exclusion), animal behavior modification (e.g., scaring), removal of individual offending animals, local population reduction, elimination of invasive species (e.g., feral swine) or any combination of these, depending on the circumstances of the specific damage problem.

### **The IWDM Strategies Employed by WS**

#### **Direct Operational Assistance**

Direct operational assistance includes damage management activities that are directly conducted or supervised by WS personnel. Direct operational assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and when a Memorandum of Understanding, Cooperative Service Agreement, or other comparable document provide for direct damage management by WS. The initial investigation defines the nature, history, and extent of the problem, species responsible for the damage, and methods available to resolve the problem.

#### **Technical Assistance Recommendations**

“Technical assistance” is the provision of information, demonstrations, and advice on available and appropriate wildlife damage management methods and approaches. The implementation of damage management actions is the responsibility of the requester with no direct involvement by WS. In some cases, WS provides supplies or materials that are not readily available. Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems. These strategies are based on the level of risk, need, and the practicality of their application. In some instances, wildlife-related provided to the requestor by WS results in tolerance and / or acceptance of the situation. In other instances, management options are discussed and recommended.

Under APHIS NEPA implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving mammal damage problems.

#### **Education**

An important component of technical assistance is education. Education is important because wildlife damage management is about finding compromise 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.



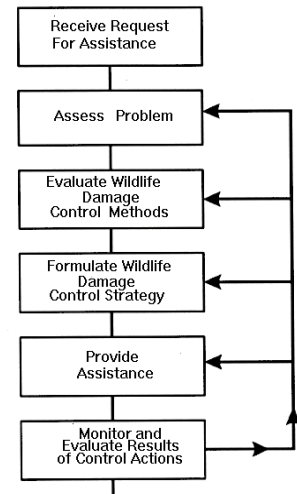
In addition to the dissemination of information and recommendations to those persons requesting assistance with reducing damage or threats, WS provides lectures, courses, and demonstrations to producers, homeowners, Commonwealth and county agents, colleges and universities, and other interested groups on damage management. Additionally, technical papers are presented at professional meetings and conferences so that other natural resource professionals are kept up to date on recent developments in damage management technology, programs, agency policies, laws and regulations.

**Research and Development**

Another important component of technical assistance is the development of new methods. The National Wildlife Research Center (NWRC) functions as the research unit of WS. NWRC uses scientific expertise to develop methods to resolve conflicts between humans and animals while maintaining the quality of the human environment. NWRC research biologists work closely with wildlife managers, researchers, and others to develop and evaluate damage management techniques. NWRC biologists have authored hundreds of scientific publications and reports, and are respected worldwide for their expertise.

**Wildlife Services Decision Making**

WS personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model and described by Slate et al. (1992) (Figure 2.0). WS personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate to reduce damage. WS personnel assess the problem and evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social factors. Methods deemed practical for the situation are then developed into a management strategy. WS would continue to monitor and evaluate the situation as assistance (either technical or direct) is provided, modifying the strategy and methods used to reduce the damage to an acceptable level. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions.



**Figure 2.0** WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflicts.

**Community-based Decision Making**

The WS program follows the “co-managerial approach” to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS could provide technical assistance regarding the biology and ecology of mammals and effective, practical, and reasonable methods available to the local decision-maker(s) to reduce damage or threats. This could include non-lethal and lethal methods depending on the alternative selected. WS and other state, tribal and federal wildlife management agencies may facilitate discussions at local community meetings when resources are available.

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 mammal damage management activities. This process allows decisions on mammal damage management activities to be made based on local input. They may implement management recommendations provided by WS or others on their own, or may request management assistance from

WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

### **2.3 STANDARD OPERATING PROCEDURES FOR MAMMAL DAMAGE MANAGEMENT**

WS' directives and standard operating procedures (SOPs) improve the safety, selectivity, and efficacy of animal damage management activities. WS' directives and SOPs would be incorporated into activities conducted by WS when addressing damage and threats associated with mammals.

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

- The WS Decision Model, designed to identify the most appropriate damage management strategies and their potential impacts, would be used to determine damage management strategies.
- All pesticides have to be registered with the EPA and the VDACS, and must have labels approved by the agency which details the product's ingredients, the type of pesticide, the formulation, classification, approved uses and formulations, potential hazards to humans, animals and the environment as well as directions for use. The registration process for pesticides is intended to assure minimal adverse effects to humans, animals and the environment when chemicals are used in accordance with label directions. Under the (FIFRA) and its implementing guidelines, it is a violation of federal law to use any pesticide in a manner that is inconsistent with its label. WS would follow and use all pesticides according to their label.
- All personnel who would use chemicals would be trained and certified to use such substances or would be supervised by trained or certified personnel.
- All personnel using firearms would be trained according to WS' Directives.
- All euthanasia and immobilization drugs used by WS or recommended by WS would be registered with the FDA, and stored and used in compliance with DEA regulations as required.
- WS' use of traps, snares (cable devices) or other devices would comply with WS Directive 2.450 and WS-Virginia Directive 2.450(b).
- Direct operational assistance would only be conducted by WS after a memorandum of understanding, cooperative service agreement, or other comparable document listing all the methods the property owner or manager will allow to be used on property they own and/or manage was signed by WS and those requesting assistance.
- Carcasses of animals retrieved after damage management activities would be disposed of in accordance with WS Directive 2.515.
- WS would comply with all applicable federal, Commonwealth, and local laws and regulations in accordance with WS Directive 2.210.

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

## 2.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

Several additional SOPs would be 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 removal of wild mammals by WS would be monitored by the VDGIF to ensure cumulative lethal removal is considered as part of population management objectives.
- WS would monitor wild mammal damage management activities to ensure activities do not adversely affect their populations in the Commonwealth.
- WS would conduct dog management in coordination with state and local authorities with jurisdiction over their control in accordance with WS Directive 2.340. In urban areas, WS will refer requests for assistance with dogs to the local animal control or law enforcement authority in accordance with WS-Virginia Directive 2.340(a). Owned dogs captured or killed by WS must be returned to their owners or transferred to animal control authorities immediately (WS-Virginia Directive 2.340(a)). Feral dogs (ownerless or homeless wild dogs) captured unintentionally by WS and uninjured will be transferred to animal control authorities or released onsite (WS-Virginia Directive 2.340(a)). Feral dogs captured unintentionally by WS and injured will be transferred to animal control authorities (WS-Virginia Directive 2.340(a)). If feral dogs are killed unintentionally by WS, WS will notify animal control authorities (WS-Virginia Directive 2.340(a)). When dogs are captured, WS would inform the land owner in accordance with WS Directives 2.340 and WS-Virginia Directive 2.340(a).
- WS would conduct cat management in accordance with WS-Virginia Directive 2.340(a). WS will not target cats with lethal control techniques. Prior to implementation of live capture techniques, WS will make arrangements with an animal shelter or animal control authorities to receive them. Cats captured unintentionally by WS will be transferred to animal control authorities, the property owner or released onsite (WS-Virginia Directive 2.340(a)). Cats determined to be pets will be returned to their owners, transferred to animal control authorities or released onsite (WS-Virginia Directive 2.340(a)). *“WS Virginia personnel shall not participate in Trap-Neuter-Release (TNR) or Trap-Vaccinate-Release (TVR) programs for feral cats and may not transfer captured animals to non-governmental organizations for release into such programs.”*
- The use of non-lethal methods would be considered prior to the use of lethal methods when providing technical assistance and direct operational assistance.
- Management actions would be directed toward specific animals or groups of animals causing damage or threats.

## **Issue 2 - Effects of Damage Management Activities on Non-target Animals, Including Threatened and Endangered Species**

- When appropriate, suppressed firearms would be used to minimize noise impacts.
- If an animal that appears to be a licensed pet is captured, the animal will be handled in accordance with WS Directive 2.450.
- Non-target animals captured in traps would be released unless it was determined that the animal would not survive and/or that the animal could not be released safely.
- M-44s (sodium cyanide) would be used by WS in accordance with the EPA's use restrictions to reduce risks to non-target animals (WS Directive 2.415).
- WS use of M-44s (sodium cyanide) would be restricted in accordance with WS-Virginia Directive 2.415(c).
- WS has consulted with the USFWS to determine the potential risks to federally listed threatened and endangered species in accordance with the ESA.
- WS would review the current federal threatened and endangered species list for Virginia each year to determine if new species have been added and will evaluate potential impacts to those species from mammal damage management activities.
- WS would complete the USFWS's online project review process prior to application of the pesticide zinc phosphide.

## **Issue 3 - Effects of Damage Management Activities on Human Health and Safety**

- Damage management activities would be conducted away from areas of high human activity. If this is not possible, then activities would be conducted during periods when human activity is low (e.g., early morning) whenever possible.
- All chemicals used by WS or recommended by WS would be registered with the EPA, DEA, FDA and/ or the VDACS, as appropriate.
- 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.
- M-44s (sodium cyanide) would be used by WS in accordance with the EPA's use restrictions to reduce risks to human health and safety (WS Directive 2.415). WS use of M-44s (sodium cyanide) would be restricted in accordance with WS-Virginia Directive 2.415(c).
- Explosives would be used by WS in accordance with WS Directive 2.435 and WS Directive 2.625 to reduce risks to human health and safety.
- Controlled chemical immobilization and euthanizing agents will be used by WS in compliance with applicable state and federal laws and regulations to reduce risks to human health and safety (WS Directive 2.430).

- WS would adhere to all established withdrawal times for mammals when using immobilizing drugs for the capture of mammals that were agreed upon by WS, the VDGIF, and veterinarian authorities. If WS receives a request to immobilize mammals during a period of time when the regulated harvest of those species was occurring or during period of time where the withdrawal period could overlap with a harvest season, WS would euthanize the animal or mark the animal with ear tags labeled with a “*do not eat*” warning.
- WS’ employees participating in any aspect of aerial wildlife operations would be trained and/or certified in their role and responsibilities during the operations. All WS’ personnel would follow the policies and directives set forth in WS’ Directive 2.620; WS’ Aviation Operations Manual; WS’ Aviation Safety annual and its amendments; Title 14 of the Code of Federal Regulations; and Federal Aviation Regulations, Part 43, 61, 91, 119, 133, 135 and 137.
- Appropriate warning signs will be posted in accordance with WS Directive 2.450.

#### **Issue 4 – Humaneness and Animal Welfare Concerns**

- WS personnel would be trained in the latest and most humane devices and methods for removing mammals.
- WS’ use of all traps, snares (cable devices), and other capture devices would comply with WS Directive 2.450 and WS-Virginia Directive 2.450(b).
- WS’ use of immobilization and euthanasia methods would comply with WS Directive 2.505 and WS Directive 2.430.
- WS personnel shall only utilize trained dogs (dogs proficient in the skills necessary to perform specific functions in a manner that is responsive to its handler’s commands) in accordance with WS Directive 2.445.

#### **Issue 5 – Effects of Damage Management Activities on the Aesthetic Values of Mammals**

- WS would set capture devices to minimize visibility of captured animals in compliance with WS Directive 2.450.

#### **Issue 6 – Effects of Damage Management Activities on the Regulated Harvest of Mammals**

- The lethal removal of wild mammals by WS could only occur within the parameters established by the VDGIF and would be monitored by the VDGIF to ensure cumulative lethal removal is considered as part of population management objectives.

#### **Issue 7 – Effects of Beaver Removal and Dam Manipulation or Removal on Wetlands**

- WS would remove beaver dams in accordance with federal and state laws and regulations for environmental protection.

## 2.5 ALTERNATIVES CONSIDERED IN DETAIL

Alternatives were developed for consideration based on the issues using the WS Decision model (Slate et al. 1992). The alternatives will receive detailed analysis in Chapter 3. Chapter 2 also discusses alternatives considered but not analyzed in detail, with rationale.

The following alternatives were developed to address the identified issues associated with managing damage and threats associated with mammals:

### **Alternative 1 – WS Would Continue to Address Mammal Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)**

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 associated with mammals. Under this alternative, WS could respond to requests for assistance for managing damage and threats associated with mammals by: 1) taking no action, if warranted, 2) providing technical assistance to property owners or managers on actions they could take to reduce damage or threats of damage, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage or threats of damage. Direct operational assistance could be provided when funding is available through federal appropriations or cooperative funding. WS response to requests for assistance is dependent upon on those persons initiating the request. Those persons receiving technical assistance could 1) take no action, 2) choose to implement WS' recommendations on their own, 3) use the services of a private nuisance wildlife control agent, 4) use volunteer services of private individuals or organizations (e.g., private trappers or hunters), 5) use the services of local law enforcement or animal control authorities (in the case of dogs or cats) or 6) use the services of WS (direct operational assistance) when available. Direct operational assistance would only be conducted by WS after a memorandum of understanding, cooperative service agreement, or other comparable document listing all the methods the property owner or manager will allow to be used on property they own and/or manage was signed by WS and those requesting assistance.

The most effective approach to resolving any animal damage problem is to use an adaptive integrated approach (IWDM) that may call for the use of several methods simultaneously or sequentially. This approach is used by WS for providing both technical and direct operational assistance. WS personnel use a thought process for evaluating and responding to requests for assistance detailed in the WS Decision Model (See *Wildlife Services Decision Making*). IWDM may incorporate both non-lethal and lethal methods depending upon the circumstances of the specific damage problem. Non-lethal methods disperse or otherwise make an area where the damage is occurring unattractive or unavailable to the species causing the damage, thereby reducing the presence of those species in the area. Non-lethal methods would be given priority when addressing requests for assistance (WS Directive 2.101). However, non-lethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model. For example, if those requesting assistance have already used non-lethal methods, WS would not likely recommend or continue to employ those particular methods because their use has already been proven ineffective in adequately resolving the damage or threat. When effective, non-lethal methods would disperse mammals from the area resulting in a reduction in the presence of those mammals at the site.

Lethal methods remove individuals of the species causing the damage, thereby reducing the presence of those species in the area and the local 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 of damage as part of an integrated approach. The number of mammals removed from the population using lethal methods under the proposed action would be dependent on the number of requests

for assistance received, the number of mammals involved with the associated damage or threat, and the efficacy of methods employed. WS may recommend mammals be harvested during regulated hunting and/or trapping seasons or lethally removed under nuisance wildlife regulations in an attempt to reduce the number of mammals causing damage. Appendix B contains a thorough discussion of the methods available for use in managing damage and threats associated with mammals under this alternative. All of the methods listed in the Appendix would be available under this alternative although not all methods would be available for direct implementation by all persons (M-44s (sodium cyanide) are only available for use by WS).

The WS program follows the “*co-managerial approach*” to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, when numerous people are being affected by damage or threats associated with mammals, and a request for assistance is made, WS advocates providing technical assistance to the local decision-maker(s). Requests for assistance often originate from community representatives who have been notified by community members concerned about damage and threats associated with mammals. By involving decision-maker(s) in the process, damage management actions can be presented to allow decisions on damage management to involve those individuals that the decision maker(s) represent. Local decision-maker(s) could be elected officials or appointees who oversee the interests and business of the local community. Local decision-maker(s) could represent the local community’s interest and make decisions for the community or they could relay technical assistance information to a higher authority or the community for discussion and decision-making. Local decision-maker(s) could also request that WS present technical assistance information at public meetings to allow for involvement of the community. Involving the appropriate representatives of the community ensures a community-based decision is made. In the case of private property, 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.

### **Alternative 2 – WS Would Address Mammal Damage Using Technical Assistance Only**

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with mammals with technical assistance only. Technical assistance would be provided as described above under Alternative 1. Appendix B contains a thorough discussion of the methods available for use in managing damage and threats associated with mammals. With the exception of M-44s (sodium cyanide), all methods listed in the Appendix could be available under this alternative.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage associated with mammals as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

### **Alternative 3 – WS Would Not Address Mammal Damage**

Under this alternative, WS would not conduct technical or direct operational assistance to reduce threats or alleviate damage associated with mammals. WS would not be involved with any aspect of managing damage associated with mammals. All requests for assistance received by WS to resolve damage caused by mammals would be referred to the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities. This alternative would not prevent other federal, Commonwealth, and/or local agencies, including private entities from conducting damage management activities directed at alleviating damage and threats associated with mammals. Similar to Alternative 2, with the exception of M-44s (sodium cyanide), all methods listed in the Appendix could be available under this alternative.

Similar to Alternative 2, this alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage associated with mammals as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

## **2.6 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE**

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

### **WS Would Implement Non-lethal Methods before Lethal Methods**

This alternative would require that all non-lethal methods or techniques described in Appendix B be applied to all requests for assistance to reduce damage and threats associated with mammals. 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 damage. If the use of all non-lethal methods failed to resolve the damage or threat, lethal methods would then be employed to resolve the damage.

Those persons experiencing damage or threats often employ non-lethal methods prior to contacting WS for assistance. 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) described is similar to a non-lethal before lethal alternative because the use of non-lethal methods must be considered before lethal methods by WS (see 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.

### **WS Would Use Non-lethal Methods Only**

Under this alternative, the only methods available for recommendation and use in resolving damage or threats associated with mammals would be the non-lethal methods described in Appendix B. The non-lethal methods recommended or used under this alternative would be identical to those identified under Alternatives 1, 2 and 3.

In situations where non-lethal methods were impractical or ineffective to alleviate damages, WS would refer requests for information regarding lethal methods to the VDGIF, the VDACS and/or private entities. Although not recommended or used by WS, lethal methods could continue to be used by others in resolving damage or threats associated with mammals under this alternative. Similar to Alternative 2 and 3, with the exception of M-44s (sodium cyanide), all lethal methods listed in the Appendix would be available under this alternative.

Under this alternative, resource owners or managers frustrated by a lack of WS' assistance with the full range of management methods may try methods not recommended by WS (e.g., poisons). In some cases, resource owners or managers may misuse methods or use methods in excess of what is necessary.

This alternative was not analyzed in detail since the lethal removal of mammals could continue at the levels analyzed in Alternative 1, despite the lack of WS' involvement.



### **WS Would Use Lethal Methods Only**

Under this alternative, the only methods available for recommendation and use in resolving damage or threats associated with mammals would be the lethal methods described in Appendix B. This is in direct conflict with WS Directive 2.101, which directs that WS must consider the use of non-lethal methods before lethal methods. Therefore, this alternative was not considered in detail.

### **WS Would Only Trap and Translocate Mammals**

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods described in Appendix B followed by translocation (the transport and release of an animal from one area to another). Wild mammals are managed by the VDGIF and translocation of them could only occur under the authority of the VDGIF. Dogs and cats are classified as companion animals in the Code of Virginia and are managed by local law enforcement and animal control authorities. The translocation of dogs or cats by WS or other entities is considered animal abandonment and a misdemeanor in Virginia (Code of Virginia § 3.2-6504). Therefore, translocation of dogs and cats could not legally occur and was not analyzed further.

Translocation of animals is generally ineffective in reducing damage and would therefore be ineffective at meeting the need for action because animals are highly mobile and can easily return to damage sites from long distances, and translocation may result in damage problems at the new location (Fischer and Lindenmayer 2000, Seddon et al. 2012). Many animals show strong homing behavior (Bradley et al. 2005) and may return to the site after being relocated. Additionally, given the scope of the issue described in the need for action (Chapter 1), it would be unrealistic to translocate the numbers of animals necessary to reduce damage. There is a perception among some individuals that animals which are translocated because they are causing damage ‘live happily ever after’ (Craven et al. 1998). Unfortunately however, these animals typically have high mortality rates because of the stress of capture, transport and release, aggression by animals of the same species already occupying the new location, disorientation, unsuitable habitat, difficulties finding resources (food, water, shelter) at the new location, attempts to return to the site of capture and increased susceptibility to predation or disease (Nielsen 1988, Craven et al. 1998, Fischer and Lindenmayer 2000, Seddon et al. 2012). Translocation of animals may also result in the transmission of diseases from one area to another (Nielsen 1988). For these reasons, translocation of wildlife is discouraged by WS policy (see WS Directive 2.501) and was not analyzed further.

### **WS Would Implement a Bounty System or Other Means to Reduce the Commonwealth’s Coyote Population**

This alternative would require WS to implement a coyote bounty or other means to reduce the Commonwealth’s coyote population. The assumption of bounty systems is that people will increase their lethal removal in exchange for financial compensation (Bartel and Brunson 2003). WS does not have the authority to establish a bounty system. The management of coyotes is the responsibility of the VDGIF and the authority to implement bounties is held by localities (VAC §§15.2-926.1). WS does not have the authority to manage the Commonwealth’s coyote population, only the damage or threats of damage associated with coyotes, within the parameters established by the VDGIF. The implementation of bounties would not be recommended by WS to reduce damage and threats for several reasons.

Bounties are unlikely to remove enough coyotes to impact the population. When coyotes are lethally removed they are either replaced by transients, dispersing individuals or if these individuals are not available by reproductive compensation (Knowlton et al. 1999). Models have been developed to illustrate what happens to a coyote population when different percentages of the population are lethally removed

(Connolly and Longhurst 1975, Pitt et al. 2001 see also Connolly 1995). Connolly and Longhurst (1975) found that the population would only decline to zero after 50 years of removing 75% of the coyote population every year, if no transients or dispersing individuals were ever available during that 50 year period (Connolly 1995). Research indicates that transients and dispersing individuals exist in the Virginia population and the population of surrounding states (Elfelt 2014). A model developed more recently which included the effect of additional population factors found that when less than 60% of the coyotes were removed in a single year, the population recovered within a year and when 90% were removed in a single year the population recovered in five years (Pitt et al. 2001). Conner et al. (2008) examined the effects of different management strategies on coyote populations using an even more detailed model. The authors found that spatially intensive lethal removal had more long lasting effects compared to random lethal removal. In a study examining Utah's coyote bounty program, the authors found that its implementation failed to reduce the coyote population or reduce the damage occurring (Bartel and Brunson 2003). Additionally, they could not find any evidence that any other bounty has ever reduced coyote abundance or subsequently reduced damage (Bartel and Brunson 2003).

Finally, bounties do not generally remove coyotes in locations where damage and threats are occurring. Bounties encourage the removal of coyotes at times and in places where coyotes are easiest to remove (Collinge and Maycock 1997). This may or may not occur in locations or in close proximity to locations where damage is occurring. Again, the need for action is not to remove the maximum number of coyotes but to manage the damage associated with coyotes.

### **WS Would Use Regulated Hunting and Trapping to Manage Damage Associated With Mammals**

Under this alternative, all requests for assistance received by WS would be addressed by recommending the use of regulated hunting and trapping to reduce populations of those wild mammals causing damage. The VDGIF is responsible for establishing and enforcing hunting and trapping seasons in the Commonwealth. Recreational hunting and trapping by private individuals when based on biological information and properly regulated can be effectively used to manage wildlife populations. However, regulated hunting and trapping is often not allowed in all locations where damage occurs (e.g., airports), during times of year when damage occurs (e.g., when agricultural crops are most vulnerable), or may not remove enough animals to reduce the damage (e.g., because of method restrictions).

For example, in urban and suburban areas where hunting of white-tailed deer with firearms is not allowed, archery hunting may provide an alternative method for managing populations. In these circumstances, archery hunting may be used as an effective management tool to reduce urban deer populations (Kilpatrick and Walter 1999). However, in many circumstances it may be difficult to remove a sufficient number of deer using archery hunting alone to reduce the population to a level that sufficiently reduces damage caused by deer (Williams et al. 2013, Weckel and Rockwell 2013). For example, Ver Stegg et al. (1995) found that it was not possible for archery hunting alone to reduce a deer population in a suburban park in Illinois to meet reduction goals. In similar situations in New Jersey and Pennsylvania, Williams et al. (2013) found that despite extended hunting seasons (5 months), the use of bait, and no harvest limits, hunting was unable to reduce deer densities to a level that would reduce damage. Hunting in these scenarios is limited in its potential to reduce population levels because: 1) some landowners are unwilling to let hunters on their property, 2) some hunters may desire greater densities for hunting, 3) landowners and hunters may not comprehend the number of deer that must be removed to meet goals, and 4) hunters do not always take precautions to avoid educating deer (i.e., altering deer behavior so that they are less susceptible to hunters) (Williams et al. 2013). Additionally, as deer are harvested the amount of effort to remove additional deer must increase (Weckel and Rockwell 2013) and may be undermined as the number of hunters willing to participate, the number of hunting trips and the length of hunts declines (Wiggers 2011, Weckel and Rockwell 2013).

The hunting and trapping of wild mammals can only occur at the discretion of the VDGIF, which ensures that removal occurs to achieve desired population objectives for each species. Therefore, regulated hunting and trapping could continue to occur under any of the alternatives analyzed in detail at the discretion of the VDGIF. Under Alternative 1 (the proposed action alternative) and Alternative 2, WS could recommend, when appropriate, that hunting and/or trapping be used by the resource owner or manager on property they own or manage where damages were occurring. 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 to resolve damage, this alternative was not analyzed in detail.

### **WS Would Eradicate or Suppress Populations of Mammals in the Commonwealth That are Causing Damage**

Under this alternative, all requests for assistance would be addressed using the eradication or suppression of, or the recommendation of eradication or suppression of mammal populations that are causing damage. Wild mammals are managed by the VDGIF and eradication or suppression of their populations could only occur under the authority of the VDGIF. The eradication of any native mammal species is not a desired management goal of VDGIF or WS. Since eradication is not a desired management goal for native mammal species an eradication alternative was not considered in detail.

The suppression of mammal populations would require that WS respond to requests for assistance by using or recommending the managed reduction of populations of mammals causing damage. 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. Typically, WS' activities would be conducted on a very small portion of the sites or areas inhabited or frequented by problem species. However, it is not realistic or practical to consider large-scale population suppression as the basis of the WS program. Nor is the large-scale population suppression of native animals a desired management goal of VDGIF or WS. Therefore, this alternative was not considered in detail.

### **WS Would Use Reproductive Control to Reduce Populations of Wild Mammals in the Commonwealth That are Causing Damage**

Under this alternative, the only method available by WS for recommendation or use in resolving damage or threats associated with wild mammals would be reproductive control. Reproductive control for wildlife can be accomplished either through sterilization (permanent) or contraception (reversible). However, the use and effectiveness of reproductive control as a wildlife population management tool is limited by characteristics of the species (e.g., life expectancy, age at onset of reproduction, population size, etc.), the nature of the local environment (e.g., isolation of target population, access to target individuals, etc.), and other biological factors. In general, if the time needed to reduce damage is a factor in selecting a management method, lethal control will always be more efficient than reproductive control because reproductive control cannot generate a more rapid population decline (Bradford and Hobbs 2008, McLeod and Sanders 2014). In addition to being biologically feasible, reproductive control methods need to be logistically feasible and economically practical.

Although research is ongoing, no known reproductive inhibitors have been registered by the EPA for use in many species of wildlife (Fagerstone et al. 2010, Massei and Miller 2013). Current technology requires direct contact with animals for both the application of sterilization and contraception methods. Delivery mechanisms currently available for contraception methods in mammals include implantation, direct injection, or the use of darts or similar projectiles (Massei and Cowan 2014). The need to capture or make direct contact with a sufficiently large number of target animals with multiple treatments (in the case of contraceptives) to effectively implement this method places considerable logistic and economic

constraints on the adoption of reproduction control as a wildlife management tool for many species. Given these constraints, and the lack of availability of chemical reproductive inhibitors for the management of many species, this alternative was not evaluated in detail.

Currently, the only reproductive inhibitor that is registered with the EPA for use in any of the species addressed in this document is GonaCon™. GonaCon™ was officially registered by the EPA in 2009 for use in reducing fertility in female white-tailed deer. According to the label, only WS or state wildlife management agency personnel or individuals working under their authority can use GonaCon™. However, 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™ is not currently registered for use in Virginia. However, if GonaCon™ or other reproductive inhibitors become available to manage those species addressed in this document the Commonwealth, their use could be evaluated under the proposed action alternative as a method available that could be used in an integrated approach to managing damage.

### **WS Would Implement a Trap-Neuter-Release Program for Feral or Free Ranging Cats**

Under this alternative, WS would use or recommend the use of Trap-Neuter-Release or Trap-Neuter-Return (TNR) programs to resolve damage or threats associated with feral or free ranging cats. This is in direct conflict with Virginia-WS Directive 2.340(a), which states that, “*WS Virginia personnel shall not participate in Trap-Neuter-Release (TNR) or Trap-Vaccinate-Release (TVR) programs for feral cats and may not transfer captured animals to non-governmental organizations for release into such programs*”. Therefore, WS could not use TNR. The implementation of TNR programs would not be recommended by WS to reduce damage and threats for the following reasons.

First, any immediate threats or damage associated with cats continues to persist because animals are not removed from an area. For example, cats will continue to pose a threat to human health and safety at airports from collisions with aircraft (29 collisions were reported in the U.S. in the last 13 years (Dolbeer 2014)) or from zoonosis. Diseases and parasites affecting feral cats can have serious implications for human health given the close association of these animals with humans and pets. For example, in 2002, fleas from a feral cat colony which had grown from 100 to 1,000 cats, despite a TNR effort, caused a daycare center at the University of Hawaii in Manoa to close for two weeks because of concerns about the potential transmission of murie typhus and flea infestations afflicting 84 children and faculty (Jessup 2004). A recent study in Pennsylvania found that humans were more likely to come into contact with a rabid cat (29% of human exposure cases) than any other animal except raccoons (35% of human exposure cases) (Campagnolo et al. 2013). In addition to rabies and murie typhus, feral cats carry other zoonotic diseases including cat scratch disease, salmonella, plague, tularemia, toxoplasmosis, hookworm, and raccoon roundworm (Gerhold 2011, Gerhold and Jessup 2013).

Additionally, cats will continue to pose a threat to native wildlife because they are not removed. Un-owned cats (as opposed to owned cats) are the cause of an estimated 69% of the 1.3-4 billion birds killed by cats and 89% of the 6.3-22.3 billion mammals killed by cats each year in the U.S. (Loss et al. 2013). In contrast to claims that well-fed cats pose little threat to wildlife, hunting and hunger are not linked in domestic cats (Adamec 1976) and well-fed cats still hunt and kill wildlife (Liberg 1984, Castillo and Clarke 2003, Hutchings 2003). Threatened, endangered or species of concern are of particular risk from cats because for these species, even a small number of fatalities can cause significant population declines (Medina et al. 2011). For example, Houghton (2005) found that predation was the most common cause of nest loss for piping plovers (listed as threatened under the ESA in Virginia) and that cats were responsible for 13% of this predation. Even if cats don't kill wildlife, infection from inflicted wounds or the stress of capture can result in mortality and just the presence of cats can reduce reproductive success (Bonnington et al. 2013).

Second, cat populations often remain stable or even increase following TNR programs (Castillo and Clarke 2003, Levy and Crawford 2004, Winter 2004, Foley et al. 2005, Natoli et al. 2006, Longcore et al. 2009). TNR does not reduce populations of cats because it is based on several false assumptions including: 1) rates of abandonment are low, 2) rates of immigration are low, 3) cats will remain at the location at which they are released, 4) all cats can be captured and sterilized and 5) the population will behave as if it were isolated in a closed system (Jessup 2004). Although advocates of TNR assert that TNR “works,” their definition of success is defined by the welfare of the cats not by a reduction in damage or threats associated with cats or by the elimination of feral cats (Longcore et al. 2009). In contrast, those interested in reducing damage and eliminating threats of damage associated with cats would define success as the elimination of feral cats (e.g., Jessup 2004, Nogales et al. 2004). For example, the American Veterinary Medical Association’s Council on Environmental Issues concluded that, “*managed cat colonies do not solve the problems of cat overpopulation and suffering, wildlife predation, or zoonotic disease transmission*” (Barrows 2004).

Finally, other concerns arise when considering the legality of TNR programs given the documented damage caused, 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). It has also been questioned whether the release of neutered cats constitutes animal abandonment.

The need for action is to reduce damage and threats associated with mammals including feral or free ranging cats. The implementation of TNR programs would be ineffective at meeting the need for action because they do not reduce damage and threats associated with feral or free ranging cats. Because implementing TNR programs would fail to meet the need for action, this alternative was not considered further.

### **WS Would Provide Financial Compensation for Damage Associated with Mammals**

Under this alternative, WS would provide financial compensation to those persons requesting assistance who were experiencing damage associated with mammals. This alternative would include site visits to verify damage and identify the species involved. WS would not provide direct operational assistance. The assumption of financial compensation programs for animal damage is that offsetting damages financially can reduce or eliminate any incentive for those persons experiencing damage to lethally remove animals (Bulte and Rondeau 2005).

Dogs and cats in the Commonwealth of Virginia are managed by local law enforcement and animal control authorities. The management of wild mammals is the responsibility of the VDGIF. Currently, no compensation program exists for offsetting damage addressed in the need for action. WS does not have the legal authority to provide financial compensation for damage; only manage the damage or threats of damage.

This EA evaluates different alternatives to meet the need for action. The need for action is to reduce damage and threats associated with mammals. Providing financial compensation to those persons experiencing damage would be ineffective at meeting the need for action because it does not reduce damage and threats. Because providing financial compensation would fail to meet the need for action, this alternative was not considered further.

## CHAPTER 3: ENVIRONMENTAL EFFECTS

This chapter provides the information needed for making an informed selection among the alternatives identified and described in Chapter 2; a selection which not only addresses the need for action identified in Chapter 1 but also addresses the issues identified in Chapter 2. Specifically, this chapter analyzes the environmental consequences of each of the alternatives as those alternatives relate to the issues identified in Chapter 2. Additionally, this chapter compares the environmental consequences of the proposed action / no action alternative to the environmental consequences of the other alternatives.

### Environmental consequences can be direct, indirect, and/or cumulative.

Direct Effects: Caused by the action and occur at the same time and place.

Indirect Effects: These are impacts caused by an action that occur later in time or further removed in distance but are still reasonably foreseeable.

Cumulative Effects: As defined by CEQ (40 CFR 1508.7), these 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.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

### **3.1 ISSUES CONSIDERED IN DETAIL AND THEIR ASSOCIATED ENVIRONMENTAL CONSEQUENCES BY ALTERNATIVE**

The proposed action / no action alternative serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS and Virginia state agencies.

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

The issue of the potential direct and cumulative impacts of conducting the alternatives on the populations of target mammal populations is analyzed for each alternative below.

#### ***Alternative 1 – WS Would Continue to Address Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)***

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 associated with mammals as described in chapter 2.

The issue of the effects on target species arises from the use of non-lethal and lethal methods to address the need for reducing damage and threats; however, the primary concern would be from the use of lethal methods to address damage. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive or unavailable to the species (target species) causing the damage, thereby reducing the presence of those species in the area. When effective, non-lethal methods would disperse mammals from the area resulting in a reduction in the presence of those animals at the site. However, animals responsible for causing damage or threats are moved to other areas with minimal impact on those species'

populations. WS would not employ or recommend these methods be employed over large geographic areas or at such intensity that essential resources would be unavailable and that long term adverse impacts to animal populations would occur. Non-lethal methods are generally regarded as having minimal impacts on overall populations of wildlife because individuals of those species are unharmed. The use of non-lethal methods would not have adverse population impacts under any of the alternatives.

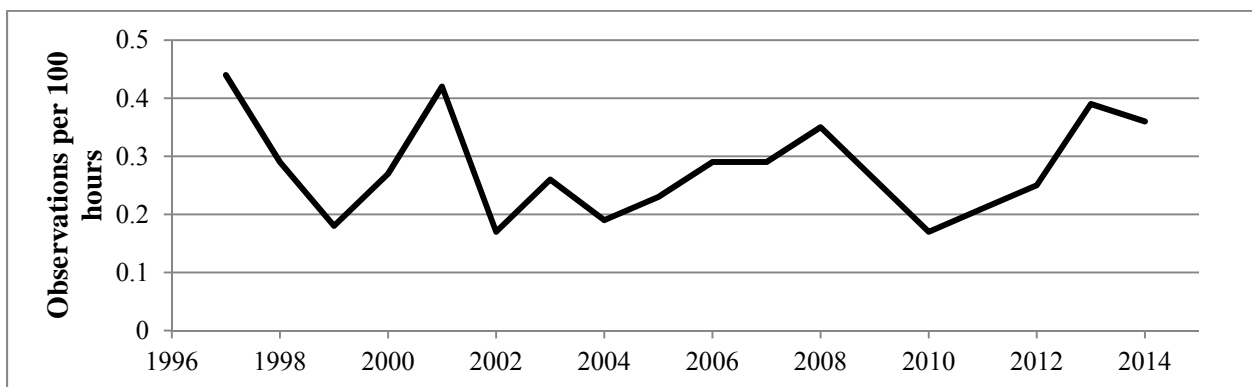
The lethal removal of mammals would be monitored by comparing the number of each species lethally removed with that species’ overall population trend (when available) and / or the magnitude of lethal removal in comparison to other known lethal take occurring (when available) to assure the magnitude of lethal removal is maintained below the level that would cause adverse effects to the viability of species’ populations. Population estimates are unavailable for most species of mammals in Virginia. The potential impacts on mammal populations from the implementation of the proposed action / no action alternative are analyzed for each species below.

### Virginia Opossum Population Impact Analysis

Opossums can be found throughout the eastern U.S. including all of Virginia (Seidenstriker et al. 1987, Linzey 1998, Gardner and Sunkist 2003). They prefer deciduous woodlands with access to water but can be found almost anywhere in their range including areas of dense human habitation (Seidenstriker et al. 1987, Gardner and Sunkist 2003). Opossums are solitary animals (Gardner and Sunkist 2003). Females produce 1–2 litters each year of 1–15 young (Gardner and Sunkist 2003). Opossums are not territorial; their average home range (the area an animal occupies, as opposed to its territory which is the area it defends) varies depending on habitat and sex (2.4–350.8 acres) (Gardner and Sunkist 2003). The population density of opossums in prime habitat in Virginia has been estimated at 10.1 opossums per square mile with a range of 1.3–20.2 per square mile (Seidenstriker et al. 1987).

Surveys of bowhunters’ observations of opossums while afield conducted by the VDGIF since 1997 show a stable trend (Figure 3.0). The Commonwealth’s opossum population is unknown.

**Figure 3.0 –Number of opossums observed per 100 hours during the VDGIF bowhunter survey (1997–2014)** (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a).



The number of opossums lethally removed by WS to alleviate damage and threats as well as the number harvested by trappers and brokered by fur dealers from 2009 to 2014 is shown in Table 3.1. Although lethal removal of opossums can occur throughout the year, many are lethally removed during trapping season. For the first time in many years, the VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 7,927 opossums

were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. From 2009 to 2014, the average annual number of opossum pelts purchased or brokered was 1,288. The total number of opossums lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.1 – Number of opossums addressed in Virginia from 2009 to 2014.**

Year	WS' Lethal Removal <sup>1</sup>	Trapper Harvest <sup>2</sup>	Fur Dealer Transactions <sup>3</sup>
2009	69	No survey conducted	559
2010	79	No survey conducted	1,284
2011	108	No survey conducted	1,045
2012	79	No survey conducted	1,925
2013	78	7,927	2,010
2014	53	No surveys conducted	906
<b>AVERAGE</b>	<b>78</b>	<b>7,927</b>	<b>1,288</b>

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA

<sup>2</sup>Data reported by state fiscal year, Kidd et al. 2014a.

<sup>3</sup>Data reported by state fiscal year, Fies 2010a, Fies 2011b, Fies 2012b, Fies 2013b, Fies 2014b, Fies 2015.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 200 opossums annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 200 opossums would represent 2.5% of the total known annual trapper harvest in 2013 (7,927) or 15.5% of the average number of opossum purchased or brokered by fur dealers (and harvested primarily by trappers). Given the stable number of observations of opossums by bowhunters during the bowhunter survey and the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on opossum populations. WS' lethal removal would be a limited component of the overall harvest and could be considered of low magnitude when compared to the number of opossums being harvested and lethally removed in Virginia. Harvest and lethal removal of opossums can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of opossums lethally removed annually to the VDGIF.

**Bat Population Impact Analysis**

Forty-five species of bats can be found in North America and 17 of these have been documented in Virginia (Reynolds and Fernald 2015). Bats residing in Virginia can be classified as either tree bats or cave bats (Reynolds and Fernald 2015). Tree bats use the bark of trees, wood piles, rocky outcroppings manmade structures (e.g., buildings) and occasionally caves for shelter and are typically solitary (Reynolds and Fernald 2015). In contrast, cave bats use communal caves or manmade structures (e.g., buildings) for shelter and raise their young communally (Reynolds and Fernald 2015).

The Commonwealth's bat populations are unknown. Lethal removal of bats not listed as threatened or endangered can occur throughout the year when they are causing damage, a health hazard or nuisance.



The total number of bats removed by other entities for these reasons in the Commonwealth is unknown. From FY 2009 to FY 2014, WS did not lethally remove any bats, but relocated two bats.

Under the proposed action / no action alternative, WS could provide both technical and direct operational assistance for damage or threats associated with bats. WS personnel are trained and experienced in the identification of damage, the identification of animals responsible for the damage, and the identification of individual animals. If species of bats listed by the USFWS under the ESA or by the VDGIF were identified, WS would consult with the appropriate entity to determine an appropriate course of action. In the past, WS has primarily provided technical assistance. On occasion WS has also provided direct operational assistance, primarily the live capture and relocation of bats from inside to outside a building when there was no potential for people or pets to have been exposed to rabies. The Virginia Department of Health (VDH) recommends that due to the nature of bat bites, “*anyone who has been: 1. Bitten by a bat...2. In direct, bare-skinned contact with a bat...or 3. in a room with a bat and is unable to tell or articulate whether an exposure took place...should be considered exposed*”(VDH 2013b).

White-nose syndrome (WNS) is an emerging disease of bats that has caused population declines of up to 98% in some Virginia hibernacula (Reynolds and Fernald 2015). WS will continue to monitor the impacts of WNS and coordinate management actions with VDGIF for bat species of concern.

#### *Direct, Indirect, and Cumulative Effects:*

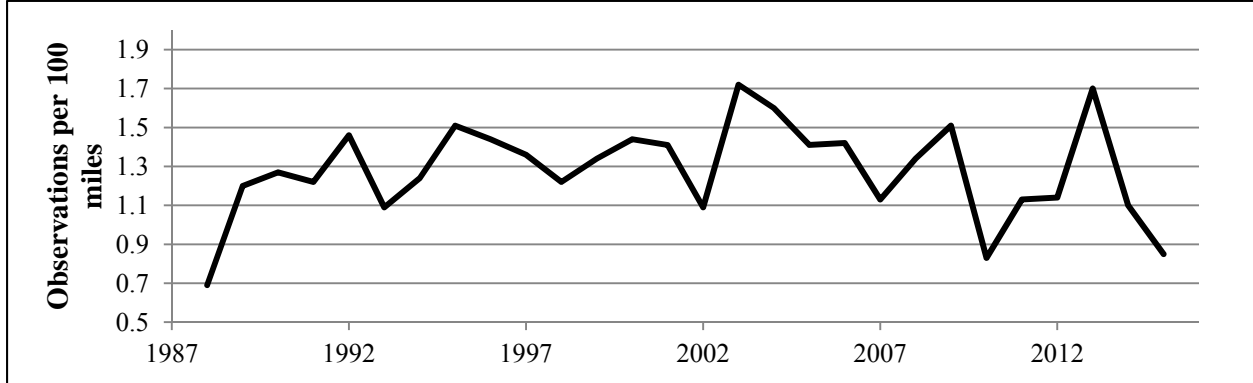
Under the proposed action/no action alternative, WS could not only provide technical and non-lethal direct operational assistance (i.e., relocation) but also lethal direct operational assistance in situations where bats pose a threat to human health and safety (bats must be euthanized to be tested for rabies). Bats would be euthanized using AVMA approved methods. Under the proposed action, WS could lethally remove up to 10 bats annually, of any species composition, consisting of little brown, tri-colored, big brown and evening bats. The lethal removal of up to 10 bats annually to manage damage or threats to human health and safety is not expected to have any adverse impact on bat populations. Any lethal removal would be limited to those individuals deemed causing damage or posing a threat to human health and safety. Lethal removal of bats can only occur at the discretion of the VDGIF. The VDGIF ensures lethal removal occurs to achieve desired objectives. WS would report the number of bats lethally removed annually to the VDGIF.

### **Eastern Cottontail Population Impact Analysis**

Eastern cottontails are widely distributed across much of the U.S. including all of Virginia (Linzey 1998, Chapman and Litvaitis 2003). Preferred habitats include abandoned agricultural fields, areas with a dense shrub understory, pastures, swamps, marshes and suburban areas (DeGraaf and Yamasaki 2001, Chapman and Litvaitis 2003). Females produce 3–4 litters each year of 3–6 young, on average (DeGraaf and Yamasaki 2001, Chapman and Litvaitis 2003). Eastern cottontails are not territorial, their average home range varies depending on season and sex (0.5–40.0 acres) (DeGraaf and Yamasaki 2001, Chapman and Litvaitis 2003). The population density of eastern cottontail has been estimated at anywhere from 0.46 rabbits per acre to 8.09 rabbits per acre (DeGraaf and Yamasaki 2001, Chapman and Litvaitis 2003).

Surveys of rural mail carriers’ observations of rabbits along their routes conducted in cooperation with the VDGIF since 1988 show a stable trend (Figure 3.1). The Commonwealth’s Eastern cottontail population is unknown.

**Figure 3.1 –Number of rabbits observed per 100 miles during the VDGIF rural mail carrier survey (1988–2015) (J. Howell, VDGIF, personal communication 2016).**



The number of Eastern cottontails lethally removed by WS to alleviate damage and threats as well as the number harvested by hunters from 2009 to 2014 is shown in Table 3.2. Although lethal removal of Eastern cottontails can occur throughout the year, many are lethally removed by individuals during hunting seasons, and therefore reported during an annual hunter harvest survey conducted by the VDGIF. The average annual hunter harvest from 2009 to 2014 was 203,180 Eastern cottontails per year. The total number of Eastern cottontails lethally removed by individuals to alleviate damage is unknown.

**Table 3.2 – Number of Eastern Cottontails addressed in Virginia from 2009 to 2014.**

Year	WS' Lethal Removal <sup>1</sup>	Hunter Harvest <sup>2</sup>
2009	98	181,336
2010	70	No survey conducted
2011	64	212,916
2012	74	No survey conducted
2013	242	215,288
2014	48	No survey conducted
<b>AVERAGE</b>	<b>99</b>	<b>203,180</b>

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA.

<sup>2</sup>Data reported by state fiscal year, VDGIF 2010, VDGIF 2012b, Kidd et al. 2014b.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 200 Eastern cottontails annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 200 Eastern cottontails would represent 0.09% of the average number of Eastern cottontails harvested annually by hunters (203,180). Given the stable number of observations of Eastern cottontails by rural mail carriers and the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on Eastern cottontail populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal occurring within Virginia and could be considered of low magnitude when compared to the number of Eastern cottontails being harvested. Harvest and lethal removal of Eastern cottontails can only occur at

the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of Eastern cottontails lethally removed annually to the VDGIF.

### **Eastern Chipmunk Population Impact Analysis**

Eastern chipmunks can be found across much of the Eastern U.S. including all of Virginia (Linzey 1998, DeGraaf and Yamasaki 2001). Preferred habitats include forests and brushy areas (Linzey 1998, DeGraaf and Yamasaki 2001). Females produce two litters each year of 1–8 young, on average (DeGraaf and Yamasaki 2001). Eastern chipmunks are territorial; their average home range varies depending on season and geography (1,000 square feet to >2.5 acres) (DeGraaf and Yamasaki 2001). The population density of Eastern chipmunks has been estimated at anywhere from 0.1 chipmunks per acre to 15.2 chipmunks per acre (Linzey 1998, DeGraaf and Yamasaki 2001).

The Commonwealth's chipmunk population is unknown. Lethal removal of Eastern chipmunks can occur throughout the year when they are causing damage, a health hazard or nuisance. The total number of Eastern chipmunks removed by other entities for these reasons is unknown.

#### *Direct, Indirect, and Cumulative Effects:*

WS did not lethally remove any Eastern chipmunks from FY 2009 to FY 2014. In anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 10 Eastern chipmunks annually under the proposed action / no action alternative to manage damage or threats of damage. Take of up to 10 Eastern chipmunks is not expected to have any adverse impact on the population. Eastern chipmunk populations are not of low density and take would be limited to those individuals deemed causing damage or posing a threat. Lethal removal of Eastern chipmunks can only occur at the discretion of the VDGIF and the VDGIF ensures lethal removal occurs in compliance with desired objectives. WS would report the number of Eastern chipmunks lethally removed annually to the VDGIF.

### **Woodchuck Population Impact Analysis**

Woodchucks, also known as groundhogs, can be observed from eastern Alaska through southern Canada to the Atlantic and south to Georgia and Alabama and west to Kansas and Nebraska (Armitage 2003). Habitat includes open woodlands, pastures, meadows, cultivated fields, road rights-of-way, utility corridors and other human dominated landscapes (DeGraaf and Yamasaki 2001, Armitage 2003). Woodchucks are not social but can live at high densities in close proximity to one another (DeGraaf and Yamasaki 2001, Armitage 2003). The population density of woodchucks has been estimated as ranging from one woodchuck per 2.7 acres to one woodchuck per 20 acres (DeGraaf and Yamasaki 2001) although much higher densities (i.e., 11 per acre or more) have been reported (Twitchell 1939). The average home range is dependent on sex and the availability of food resources, ranging between five and 137 acres (DeGraaf and Yamasaki 2001). Woodchucks have one litter per year of two to six with a mean of approximately five young (DeGraaf and Yamasaki 2001, Armitage 2003). The Commonwealth's woodchuck population is unknown.

The number of woodchucks lethally removed by WS to alleviate damage and threats as well as the number harvested by hunters from 2009 to 2014 is shown in Table 3.3. Although lethal removal of woodchucks can occur throughout the year, many are lethally removed during hunting seasons, and therefore reported during an annual hunter harvest survey conducted by the VDGIF. The average annual hunter harvest from 2009 to 2014 was 160,177 woodchucks per year. The total number of woodchucks lethally removed by individuals to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.3 – Number of woodchucks addressed in Virginia from 2009 to 2014.**

Year	WS' Lethal Removal <sup>1</sup>	Hunter Harvest <sup>2</sup>
<b>2009</b>	123 <sup>{232}</sup>	177,503
<b>2010</b>	110 <sup>{241}</sup>	No survey conducted
<b>2011</b>	153 <sup>{309}</sup>	157,302
<b>2012</b>	109 <sup>{303}</sup>	No survey conducted
<b>2013</b>	142 <sup>{394}</sup>	145,727
<b>2014</b>	94 <sup>{118}</sup>	No survey conducted
<b>AVERAGE</b>	<b>122</b> <sup>{266}</sup>	160,177

<sup>{#}</sup> Number of woodchuck dens destroyed by WS

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA.

<sup>2</sup>Data reported by state fiscal year, VDGIF 2010, VDGIF 2012*b*, Kidd et al. 2014*b*.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 2,000 woodchucks annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 2,000 woodchucks would represent 1.24% of the average number of woodchucks harvested annually by hunters (160,177). As stated in Appendix B, WS could use large gas cartridges to fumigate woodchuck burrows where damage is occurring. The take of 2,000 woodchucks under the proposed action would include woodchucks killed during the fumigation of burrows. Woodchucks are solitary and burrows are rarely shared (Armitage 2003). Based on an average litter size of five young (see average litter size discussion above) and the fact that only the mother provides parental care, fumigation of an occupied burrow site would be expected to lethally remove a maximum of six individuals. Woodchuck burrows can have 1–11 entrances with three being the approximate average number (Twitchell 1939, Merriam 1971, Henderson and Gilbert 1978). Therefore, based on this information, fumigation of three woodchuck burrows could result in a maximum lethal removal of six woodchucks, or the treatment of 500 burrows could result in a maximum lethal removal of 1,000 woodchucks. This figure is very liberal because A) all fumigation would have to occur during spring through mid-summer when young are present (Maher 2006), B) all fumigation would involve treatment of burrows of females with young (e.g., no male burrows would be treated) and C) all fumigation would involve occupied burrows (woodchucks frequently move between burrows. Swihart (1992) found woodchucks used an average of eight burrows. Therefore, treatment of 500 burrows would likely result in a much lower level of lethal removal.

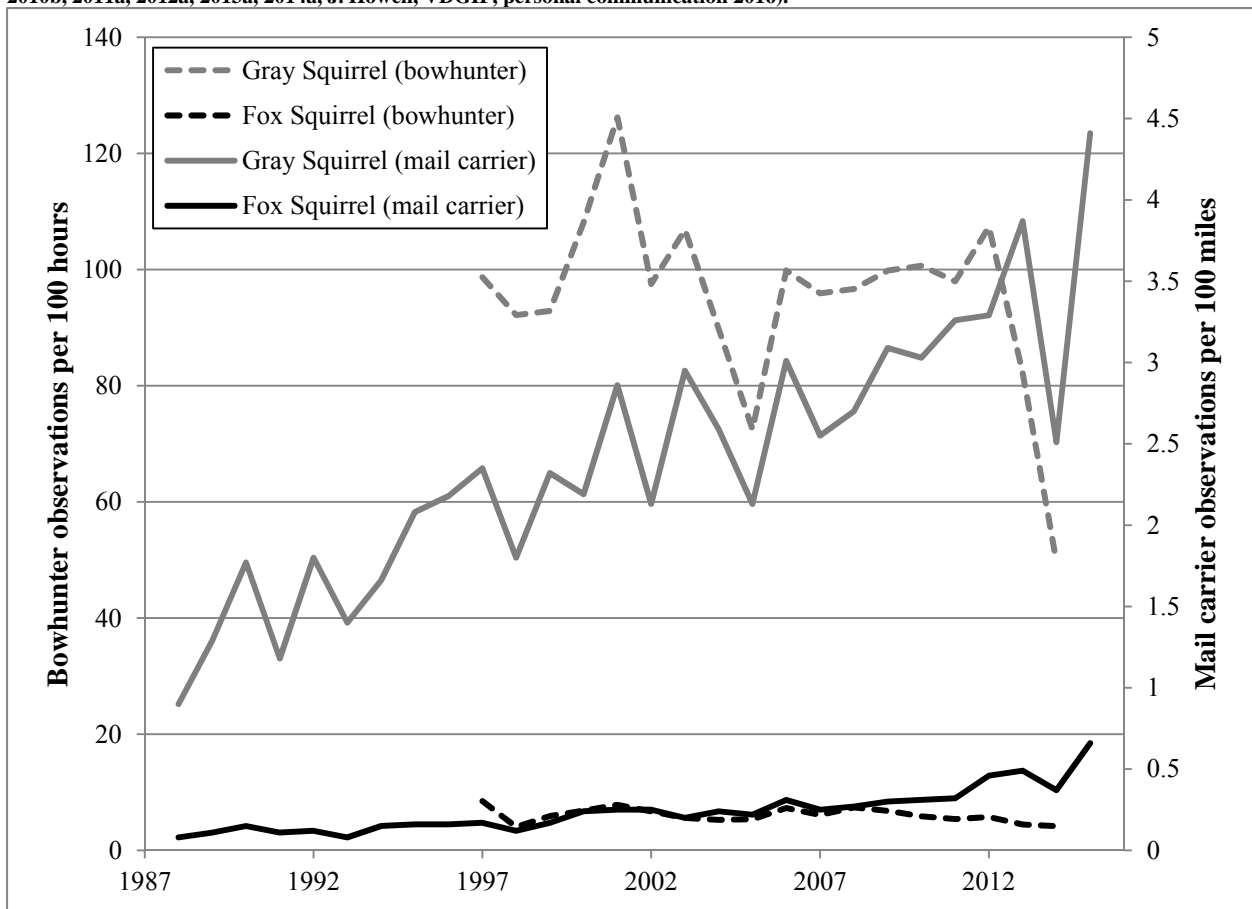
Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on woodchuck populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal occurring within Virginia and could be considered of low magnitude when compared to the number of woodchucks being harvested and lethally removed. Harvest and lethal removal of woodchucks can only occur at the discretion of the VDGIF and the VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report woodchucks lethally removed annually to the VDGIF.

## **Fox Squirrel and Gray Squirrel Population Impact Analysis**

Fox squirrels can be found east of the Rocky Mountains to the Atlantic Ocean and Gulf of Mexico with the exception of portions of Pennsylvania and New York and points north and east (Edwards et al. 2003). Gray squirrels can be found east of the Mississippi (Edwards et al. 2003). In general, fox squirrels prefer mature upland forest with a sparse understory while gray squirrels prefer mature hardwood forest with a dense understory (Edwards et al. 2003). Squirrels are also present in urban and suburban areas (DeGraaf and Yamasaki 2001). Fox and gray squirrels do not live in social groups although they use communal sites (e.g., tree cavities) for shelter (Edwards et al. 2003). Both fox and gray squirrels have 1–2 litters per year of two to three young, on average (Edwards et al. 2003). The population density of squirrels varies considerably depending on habitat (Edwards et al. 2003). Fox squirrel densities have been estimated as ranging from one to 1,321 squirrels per square mile and gray squirrel densities have been estimated as ranging from 47 to 3,647 squirrels per square mile (Edwards et al. 2003). Average home range sizes also vary considerably (Edwards et al. 2003). Fox squirrel home ranges are estimated at 6.2–196.4 acres and gray squirrel home ranges are estimated at 0.9 to 13.3 acres (Edwards et al. 2003). Territoriality is limited to females defending young (Edwards et al. 2003).

Surveys of bowhunters' and mail carriers' observations of squirrels conducted by the VDGIF show increasing or stable trends since their inception (Figure 3.2). The Commonwealth's squirrel population is unknown.

**Figure 3.2 –Number of fox and gray squirrels observed per 100 miles during the VDGIF rural mail carrier survey (1988–2015) and per 100 hours during the VDGIF bowhunter survey (1997–2014)**  
 (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a, J. Howell, VDGIF, personal communication 2016).



The number of fox and gray squirrels lethally removed by WS to alleviate damage and threats as well as the number harvested by hunters from 2009 to 2014 is shown in Table 3.4. Although lethal removal of squirrels can occur throughout the year, many are lethally removed during hunting seasons, and therefore reported during an annual hunter harvest survey conducted by the VDGIF. The average annual hunter harvest from 2009 to 2014 was 67,197 fox and 465,919 gray squirrels per year. The total number of squirrels lethally removed by individuals without licenses to hunt other game or by other entities to alleviate damage in the Commonwealth is unknown.

**Table 3.4 – Number of fox and gray squirrels addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS' Lethal Removal of Fox Squirrels<sup>1</sup></b>	<b>Hunter Harvest of Fox Squirrels<sup>2</sup></b>	<b>WS' Lethal Removal of Gray Squirrels<sup>1</sup></b>	<b>Hunter Harvest of Gray Squirrels<sup>2</sup></b>
<b>2009</b>	0	54,092	2	451,797
<b>2010</b>	0	No survey conducted	4	No survey conducted
<b>2011</b>	0	67,824	1	476,580
<b>2012</b>	3	No survey conducted	2	No survey conducted
<b>2013</b>	0	79,675	9	469,382
<b>2014</b>	0	No survey conducted	1	No survey conducted
<b>AVERAGE</b>	<b>0.5</b>	<b>67,197</b>	<b>3.2</b>	<b>465,919</b>

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal during activities analyzed in separate analyses pursuant to the NEPA.

<sup>2</sup>Data reported by state fiscal year, VDGIF 2010, VDGIF 2012*b*, Kidd et al. 2014*b*.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 10 fox squirrels and 100 gray squirrels annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 10 fox squirrels would represent 0.01% of the average number of fox squirrels harvested annually by hunters (67,197). The lethal removal of up to 100 gray squirrels would represent 0.02% of the average number of gray squirrels harvested annually by hunters (465,919). Given the increasing or stable long term observation trends for both fox and gray squirrels by bowhunters and rural mail carriers during surveys and the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on fox or gray squirrel populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of squirrels being harvested and lethally removed in Virginia. Harvest and lethal removal of squirrels can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of squirrels lethally removed annually to the VDGIF.

**Beaver Population Impact Analysis**

Beavers can be found throughout the U.S. and Canada in suitable habitat (Baker and Hill 2003). Beavers can occupy a wide variety of habitats as long as fresh water is present (e.g., streams, rivers, ponds, lakes, bogs, marsh, reservoirs and drainage ditches) (DeGraaf and Yamasaki 2001, Baker and Hill 2003). Most beavers are members of social groups which share the same territory (Baker and Hill 2003). Groups consist of a breeding pair, the young born in the current year and young of the previous 1–2 years (Baker and Hill 2003). In the eastern U.S., a total of three to eight beavers comprise the average group (Novak 1987). The breeding pair produces a single litter each spring of 2–4 young, on average (Baker and Hill 2003). The population density of beavers has been reported as high as three groups per square mile (Alabama) (Baker and Hill 2003). The Commonwealth's beaver population is unknown.

The number of beavers lethally removed, the number of dams breached or removed by WS to alleviate damage and threats as well as the number harvested by trappers and brokered by fur dealers from 2009 to 2014 is shown in Table 3.5. Although lethal removal of beavers can occur throughout the year, many are lethally removed by individuals during the trapping season (approximately December through February). The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during

the 2013–2014 trapping season. An estimated 5,197 beavers were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. From 2009 to 2014, the average annual number of beaver pelts purchased or brokered was 3,644. The total number of beavers lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.5 – Number of beavers addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS' Lethal Removal<sup>1</sup></b>	<b>Trapper Harvest<sup>2</sup></b>	<b>Fur Dealer Transactions<sup>3</sup></b>
<b>2009</b>	405	No survey conducted	1,949
<b>2010</b>	276	No survey conducted	3,523
<b>2011</b>	426	No survey conducted	4,008
<b>2012</b>	530	No survey conducted	5,463
<b>2013</b>	400	5,197	4,507
<b>2014</b>	292	No surveys conducted	2,415
<b>AVERAGE</b>	<b>388</b>	<b>5,197</b>	<b>3,644</b>

<sup>1</sup>Data reported by federal fiscal year.

<sup>2</sup>Data reported by state fiscal year, Kidd et al. 2014a.

<sup>3</sup>Data reported by state fiscal year, Fies 2010a, Fies 2011b, Fies 2012b, Fies 2013b, Fies 2014b, Fies 2015.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 800 beavers annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 800 beavers would represent 15.4% of the total known annual trapper harvest in 2013 (5,197) or 21.9% of the average number of beavers purchased or brokered by fur dealers (3,644) (and harvested primarily by trappers). Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on beaver populations. WS' lethal removal would be a limited component of the overall harvest and could be considered of low magnitude when compared to the number of beavers being harvested and lethally removed in Virginia. Harvest and lethal removal of beavers can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of beavers lethally removed annually to the VDGIF.

Additionally, under the proposed action/no action alternative, WS could breach, remove or install water control devices on up to 600 dams annually. The breaching or removal of beaver dams would not adversely affect beaver populations because no beavers will be lethally removed during those activities. For a detailed discussion of the effects of beaver dam manipulation or removal on wetlands see Chapter 3, Issue 7.

**Nutria Population Impact Analysis**

Native to the southern part of South America, nutria were introduced into the U.S. around 1900 (Bounds et al. 2003). As of 1999, nutria were established in 15 states including Virginia and its adjoining states (Bounds 2000). Nutria were first reported in Virginia in 1956 (Linzey 1998). Nutria inhabit fresh, salt



and brackish wetland habitats where they forage on the above and below ground portion of wetland plants. At moderate or high densities nutria live in groups of related females and a single male (15–20 individuals) (Kinler et al. 1987). At low densities, females live alone and individual males are associated with multiple solitary females. Nutria breed year round and produce litters of 1–13 young. Home range is dependent upon season, habitat and sex. Average home range sizes have been reported as ranging from 0.93 to 4.0 acres, although a Maryland study reported mean home ranges of 24.2 acres. Population density estimates vary widely from 55.8 to 0.04 nutria per acre in the U.S. The Commonwealth’s nutria population is unknown.

The number of nutria lethally removed by WS to alleviate damage and threats as well as the number harvested by trappers and brokered by fur dealers from 2009 to 2014 is shown in Table 3.6. Although lethal removal of nutria can occur throughout the year, many are lethally removed during trapping seasons. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 144 nutria were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. From 2009 to 2014, the average annual number of nutria pelts purchased or brokered was five. The total number of nutria lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.6 – Number of nutria addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS’ Lethal Removal<sup>1</sup></b>	<b>Trapper Harvest<sup>2</sup></b>	<b>Fur Dealer Transactions<sup>3</sup></b>
<b>2009</b>	4	No survey conducted	1
<b>2010</b>	28	No survey conducted	6
<b>2011</b>	5	No survey conducted	10
<b>2012</b>	25	No survey conducted	11
<b>2013</b>	15	144	0
<b>2014</b>	6	No surveys conducted	1
<b>AVERAGE</b>	<b>14</b>	<b>144</b>	<b>5</b>

<sup>1</sup>Data reported by federal fiscal year.

<sup>2</sup>Data reported by state fiscal year, Kidd et al. 2014a.

<sup>3</sup>Data reported by state fiscal year, Fies 2010a, Fies 2011b, Fies 2012b, Fies 2013b, Fies 2014b, Fies 2015.

*Direct, Indirect, and Cumulative Effects:*

Based on the potential for nutria expansion into new areas in Virginia and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 500 nutria annually under the proposed action / no action alternative to manage damage or threats of damage.

Nutria are a non-native species and are not afforded any protection by the state or federal government. Nutria are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Given the invasive status of nutria, any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. Additionally, executive Order 13112 directs federal agencies to use their programs and authorities to prevent the spread of and control populations of invasive species that cause economic or environmental harm, or harm to human health. While reduction in nutria numbers would be beneficial to the environment, the removal of 500 nutria annually would not pose any significant direct or cumulative impacts to the nutria population throughout the Eastern U.S.

## Muskrat Population Impact Analysis

Muskrats can be found across much of the U.S., including Virginia (Linzey 1998, Erb and Perry 2003). Muskrat habitat includes salt, fresh and brackish marshes, ponds, lakes, streams, rivers, ditches and canals (Erb and Perry 2003). Generally, muskrat social structure consists of a breeding pair and their offspring which remain until fall or spring before dispersing (Boutin and Birkenholz 1987). Muskrats are capable of breeding year round (Boutin and Birkenholz 1987). Females typically produce 2–3 litters a year of 3–10 young (Boutin and Birkenholz 1987, Erb and Perry 2003). Summer home ranges of muskrats in marshes average 135–195 feet in diameter (Erb and Perry 2003). Population density is largely dependent on habitat, season and other variables and range from 2.9 to 40 muskrats per acre (Erb and Perry 2003). The Commonwealth’s muskrat population is unknown.

The number of muskrats lethally removed by WS to alleviate damage and threats as well as the number harvested by trappers and brokered by fur dealers from 2009 to 2014 is shown in Table 3.7. Although lethal removal of muskrat can occur throughout the year, many are lethally removed during the trapping season. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 14,705 muskrats were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. From 2009 to 2014, the average annual number of muskrat pelts purchased or brokered was 9,619. The total number of muskrats lethally removed by other entities to alleviate damage or nuisance issues is unknown.

**Table 3.7 – Number of muskrats addressed in Virginia from 2009 to 2014.**

Year	WS’ Lethal Removal <sup>1</sup>	Trapper Harvest <sup>2</sup>	Fur Dealer Transactions <sup>3</sup>
<b>2009</b>	21	No survey conducted	4,948
<b>2010</b>	8	No survey conducted	8,078
<b>2011</b>	15	No survey conducted	9,513
<b>2012</b>	36	No survey conducted	13,308
<b>2013</b>	26	14,705	14,412
<b>2014</b>	37	No surveys conducted	7,459
<b>AVERAGE</b>	<b>24</b>	<b>14,705</b>	<b>9,619</b>

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal during activities analyzed in the need for action.

<sup>2</sup>Data reported by state fiscal year, Kidd et al. 2014a.

<sup>3</sup>Data reported by state fiscal year, Fies 2010a, Fies 2011b, Fies 2012b, Fies 2013b, Fies 2014b, Fies 2015.

### *Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 250 muskrats annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 250 muskrats would represent 1.7% of the total known annual trapper harvest in 2013 (14,705) or 2.5% of the average number of muskrats purchased or brokered by fur dealers (9,619) (and harvested primarily by trappers). Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS’ proposed lethal removal should not have any significant direct or cumulative impact on muskrat populations. WS’ lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of muskrats being harvested and lethally

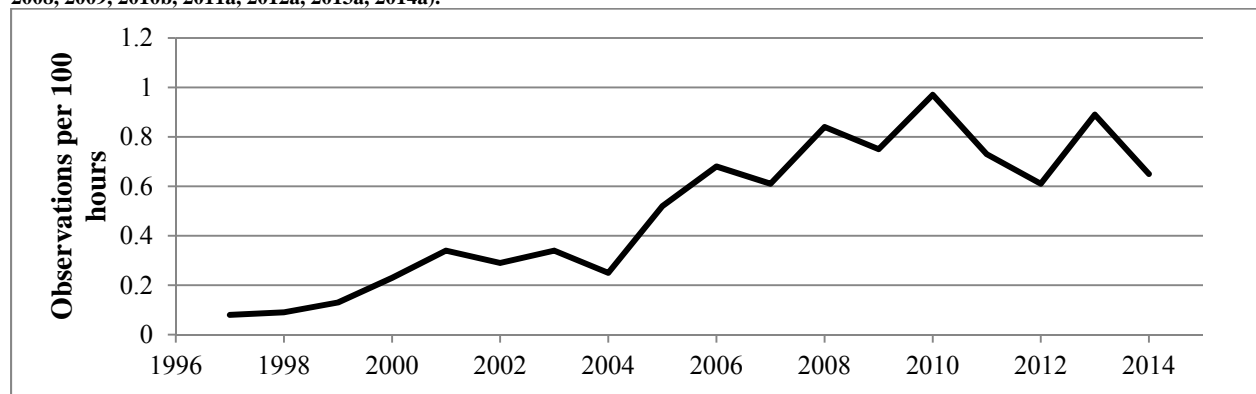
removed in Virginia. Harvest and lethal removal of muskrats can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of muskrats lethally removed annually to the VDGIF.

### Coyote Population Impact Analysis

Originally a western plains species, coyotes began moving eastward around 1900 (Moore and Parker 1992, Parker 1995). Coyotes were first reported in Virginia’s Rockingham County in 1965 (Linzey 1998) and can now be found statewide (M. L. Fies, VDGIF, personal communication 2015). Coyotes inhabit a wide range of habitats (Mastro 2011, Mastro et al. 2012). Most coyotes are members of social groups which share the same territory (Mastro 2011). Territories are typically controlled and maintained by a dominant breeding pair (Gese and Ruff 1997; 1998) and their subordinates (Bekoff and Wells 1986; Gese et al. 1996a, b; Camenzind 1978). Coyotes in the eastern U.S. typically live in groups of 2–4 (Caturano 1983) but larger groups of 3–4 adults and 5–7 pups occur (Mastro 2011). The dominant breeding pair produces a single litter each spring (Kennelly and Johns 1976). In western Tennessee, average litter size (based on placental scars) was 3.4 pups while litters in Massachusetts averaged 4.5 pups ( $n = 16$ ) (Mastro 2011) and litters (based on fetuses) in West Virginia averaged 5.4 pups ( $n = 9$ ) (Albers et al. 2016). The average home range of a coyote in surrounding states varies drastically (2.2–43.5 mi<sup>2</sup>) (Mastro 2011). The number and density of coyotes on the landscape is primarily a function of food abundance on the landscape (Gier 1968, Clark 1972) mediated by social dominance and territoriality (Knowlton et al. 1999). The population density of coyotes in the greater mid-Atlantic region has been reported as ranging from 0.26 coyotes per square mile (New York) to 3.88 coyotes per square mile (South Carolina) (Schrecengost 2007, Frair et al. 2014).

Surveys of bowhunters’ observations of coyotes while afield conducted by the VDGIF since 1997 show an increasing trend (Figure 3.3). Additionally, the VDGIF and other mid-Atlantic state wildlife agencies reported increases in the number of coyotes harvested from 1990 through 2010, suggesting the population is increasing (Mastro 2011). The Commonwealth’s coyote population is unknown.

**Figure 3.3 –Number of coyotes observed per 100 hours during the VDGIF bowhunter survey (1997–2014)** (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a).



The number of coyotes lethally removed by WS as well as the number harvested by hunters and brokered by fur dealers from 2009 to 2014 is shown in Table 3.8. Although lethal removal of coyotes can occur throughout the year, many are lethally removed during the hunting season, and therefore reported during an annual hunter harvest survey conducted by the VDGIF. Survey participants are asked not to report animals trapped. The average annual hunter harvest from 2009 to 2014 was 21,353 coyotes per year. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the

2013–2014 trapping season. An estimated 2,898 coyotes were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. These animals may have been harvested by hunters or trappers; however, the majority are harvested by trappers (M. L. Fies, VDGIF, personal communication 2015). From 2009 to 2014, the average annual number of coyote pelts purchased or brokered was 1,167. The total number of coyotes lethally removed by individuals without hunting licenses or by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.8 – Number of coyotes addressed in Virginia from 2009 to 2014.**

Year	WS' Lethal Removal <sup>1</sup>			Hunter Harvest <sup>3</sup> /Trapper Harvest <sup>4</sup>	Fur Dealer Transactions <sup>5</sup>
	to manage damage outlined in the need for action	to manage damage to livestock <sup>2</sup>	total lethal removal by WS		
<b>2009</b>	7	384 <sup>{1}</sup>	391 <sup>{1}</sup>	17,889	279
<b>2010</b>	22	304	326	No survey conducted	913
<b>2011</b>	24	487	511	23,467	1,636
<b>2012</b>	21	371	392	No survey conducted	1,460
<b>2013</b>	32	341 <sup>{1}</sup>	373 <sup>{1}</sup>	22,705 / 2,898	1,509
<b>2014</b>	30	384 <sup>{1}</sup>	414 <sup>{1}</sup>	No survey conducted	1,210
<b>AVERAGE</b>	<b>23</b>	<b>379<sup>{0.5}</sup></b>	<b>401<sup>{0.5}</sup></b>	<b>21,353 / 2,898</b>	<b>1,167</b>

<sup>{#}</sup> In FY 2009, 2013 and 2014 WS destroyed a single coyote den

<sup>1</sup>Data reported by federal fiscal year, includes non-target lethal removal

<sup>2</sup>This lethal removal is analyzed in separate analyses pursuant to the NEPA

<sup>3</sup>Data reported by state fiscal year, VDGIF 2010, VDGIF 2012*b*, Kidd et al. 2014*b*.

<sup>4</sup>Data reported by state fiscal year, Kidd et al. 2014*a*.

<sup>5</sup>Data reported by state fiscal year, Fies 2010*a*, Fies 2011*b*, Fies 2012*b*, Fies 2013*b*, Fies 2014*b*, Fies 2015.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 500 coyotes annually under the proposed action / no action alternative to meet the need for action as described in this EA.

The lethal removal of up to 500 coyotes would represent 2.3% of the average number of coyotes harvested annually by hunters (21,353) and 2.2% of the total known average annual harvest (22,520) [i.e., average number of coyotes purchased or brokered by fur dealers (and harvested primarily by trappers) plus the average number of coyotes harvested by hunters]. An additional 1,000 coyotes could be lethally removed by WS in the Commonwealth to manage damage and threats to livestock under a separate analysis (USDA 2015*b*). Therefore WS could lethally remove up to 1,500 coyotes annually to protect all resources. This would represent 7.0% of the average number of coyotes harvested annually by hunters and 6.6% of the total known average annual harvest. As stated in Appendix B, WS could use large gas cartridges to fumigate coyote dens where damage is occurring. Although coyote dens may have more than one entrance, coyotes are territorial and therefore it is unlikely that more than a single social group would be associated with any given den site. Studies or observations of adult coyotes at den sites (Till and Knowlton 1983, Coolahan 1990) indicate that fumigation of a den would be expected to only lethally remove pups. Based on an average litter size of six, fumigation of a single coyote den would result in the lethal removal of approximately six pups. Given the increasing number of observations of coyotes by bowhunters during the bowhunter survey and the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal would not have any significant direct or cumulative impact on coyote populations. WS'

lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of coyotes being harvested and lethally removed in Virginia. Harvest and lethal removal of coyotes can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of coyotes lethally removed annually to the VDGIF.

### **Dog Population Impact Analysis**

The analysis to determine the impacts on dogs is based on a measure of the number of individuals captured and injured or killed in the past under the proposed action given the SOPs in place which restrict lethal removal. Methods would only be used by WS at the request of persons seeking assistance. Any activities conducted by WS under the alternatives addressed would occur along with other natural process and human-induced events, such as natural mortality, human-induced mortality from private damage management activities, local law enforcement and animal control authorities.

WS personnel are trained and experienced in the identification of damage, the identification of animals responsible for the damage, the identification of individual animals, and in the selection of and implementation of methods which are as species specific as possible. Management actions are directed towards specific animals or groups of animals responsible for causing damage or posing threats. WS would coordinate with state and local authorities with jurisdiction over dog control in accordance with WS Directive 2.340. In urban areas, WS would refer requests for assistance to the local animal control or law enforcement authority in accordance with WS-Virginia Directive 2.340(a). Non-lethal methods are given priority when addressing requests for assistance (WS Directive 2.101). Owned dogs captured by WS must be returned to their owners or transferred to animal control authorities immediately. Feral dogs captured unintentionally by WS and uninjured will be transferred to animal control authorities or released onsite, and feral dogs captured unintentionally by WS and injured will be transferred to animal control authorities (WS-Virginia Directive 2.340(a)).

The number of dogs in the Commonwealth was estimated to be 1,555,000 animals in 2005 (Bartlett et al. 2005). The number of dogs addressed by WS to alleviate damage and threats as well as the number addressed by Virginia rescue agencies, city facilities and county facilities from 2009 to 2014 is shown in Table 3.9. The number of dogs seized or lethally removed by local law enforcement, animal control authorities or private entities because they are causing damage is unknown.

**Table 3.9 – Number of dogs and dog hybrids captured by WS compared to dogs and dog hybrids received by rescue agencies, city facilities and county facilities in Virginia from 2009 to 2014.**

Year	captured by WS <sup>1</sup>									received by Virginia rescue agencies, city facilities and county facilities <sup>3</sup>		
	Transferred custody			Freed/ Released			Lethal removal			Received	Died in facility	Euthanized
	During activities to manage damage outlined in the need for action	During activities to manage damage to livestock <sup>2</sup>	Total	During activities to manage damage outlined in the need for action	During activities to manage damage to livestock <sup>2</sup>	Total	During activities to manage damage outlined in the need for action	During activities to manage damage to livestock <sup>2</sup>	Total			
2009	1	2	3	0	3(8)	3(8)	0	6	6	122,261	807	34,648
2010	0	0	0	(1)	(5)	(6)	(1)	5	5(1)	132,655	984	34,493
2011	0	0	0	0	1(3)	1(3)	0	5	5	125,787	903	31,071
2012	1	0	1	0	1(1)	1(1)	0	9	9	130,130	914	27,460
2013	1	0	1	(1)	(2)	(3)	0	1	1	125,814	1,009	22,049
2014	3(1)	4	8	0	3(2)	3(2)	0	2(2)	4	122,840	819	18,283
<b>AVERAGE</b>	<b>1 (.16)</b>	<b>1</b>	<b>2.16</b>	<b>(.33)</b>	<b>1.3 (3.5)</b>	<b>1.3 (3.8)</b>	<b>(.16)</b>	<b>4.6 (.33)</b>	<b>5 (.16)</b>	<b>126,581</b>	<b>906</b>	<b>28,000</b>

(#) Individual dogs addressed unintentionally, includes non-target

<sup>1</sup>Data reported by federal fiscal year

<sup>2</sup>This lethal removal is analyzed in separate analyses pursuant to the NEPA

<sup>3</sup>Data reported by calendar year (VDACS 2016)

From 2009 to 2014, WS captured and either freed, released, returned to their owner or transferred to animal control authorities an average of 1.5 dogs per year while conducting activities to reduce damage or threats of damage associated with dogs outlined in the need for action. No dogs sustained serious injuries during this time. During this same period WS did not lethally intentionally remove any dogs although one dog was unintentionally killed during this six year period during activities outlined in the need for action. Documentation and reporting of injuries or death of non-target dogs from WS’s activities is required (WS-Virginia Directive 2.340(a)).

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance, WS could lethally remove up to 25 dogs annually under the proposed action / no action alternative to manage damage or threats of damage. The lethal removal of up to 25 dogs would represent 0.09% of the average number of dogs euthanized (28,000 dogs) and 2.8% of the dogs that died (906 dogs) while in the custody of Virginia’s rescue agencies and city and county facilities on an annual basis from 2009 to 2014. An additional 25 dogs could be lethally removed by WS to manage damage and threats to livestock under a separate analysis (USDA 2015b). Therefore WS could lethally remove up to 50 dogs annually. This lethal removal would represent 0.2% of the average number of dogs euthanized and 5.5% of the dogs that died while in the custody of Virginia’s rescue agencies, city and county facilities on an annual basis from 2009 to 2014. WS’ intentional lethal removal would target specific dogs that are causing damage as outlined in the need for action. No significant direct or cumulative effects on dog populations are expected from implementation of the proposed action / no action alternative.

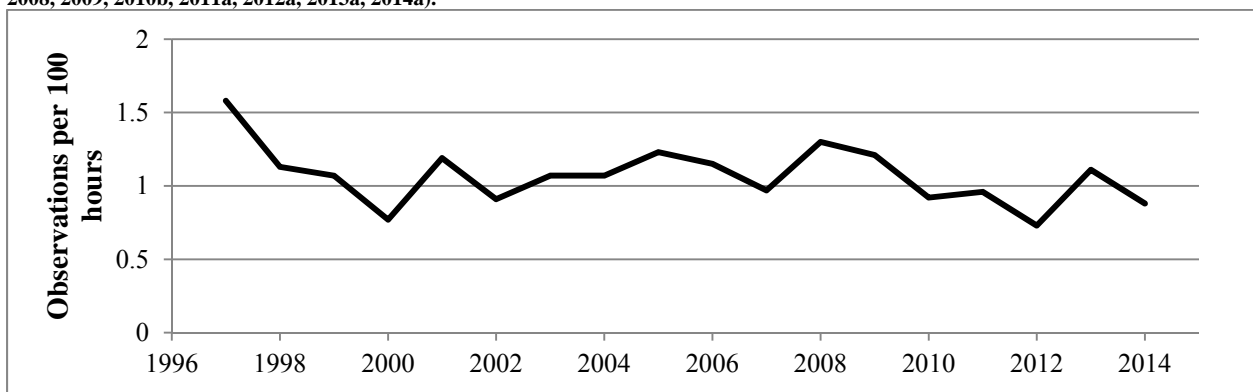
**Red Fox Population Impact Analysis**

Although native to North America, red foxes were largely absent from Virginia and other areas of the mid-Atlantic and southeastern U.S. at the time of European settlement (Linzey 1998, Statham et al. 2012, Frey 2013). By the 1800s, red foxes could be found statewide (Linzey 1998, Statham et al. 2012). Red foxes prefer open habitat (e.g., agricultural areas, grasslands, marshes) mixed with wooded areas and

brushy vegetation (Voigt 1987) but they will also occupy forests as well as urban areas (Cypher 2003). During the breeding season, most red foxes in the eastern U.S. live as a breeding pair which occupies the same territory along with their pups (Voigt 1987, Larivière and Pasitschniak-Arts 1996, Cypher 2003). Occasionally, the mated pair may also share their territory with one or more additional females (Voigt 1987, Larivière and Pasitschniak-Arts 1996, Cypher 2003). Females produce a single litter each spring (Voigt 1987, Larivière and Pasitschniak-Arts 1996, Cypher 2003). Average litter size (based on embryos and placental scars) was 5.3 pups ( $n = 95$ ) in New York (Sheldon 1949) while litters in Michigan averaged 4.9 pups ( $n = 210$ ) (Switzenberg 1950) or 5.1 pups ( $n = 1,809$ ) (Schofield 1958) and litters (based on fetuses) in Indiana averaged 6.8 pups ( $n = 30$ ) (Hoffman and Kirkpatrick 1954). The average home range of a red fox in the eastern U.S. is variable (1.9–7.6 mi<sup>2</sup>) (Major and Sherburne 1987, Harrison et al. 1989, Gooselink et al. 2003). The population density of red foxes has been estimated as ranging from 2.6 red fox per square mile (southern Ontario, Canada) to three times that many in Europe (Voigt 1987).

Surveys of bowhunter observations of red foxes while afield conducted by the VDGIF since 1997 show a stable trend (Figure 3.4). The Commonwealth’s red fox population is unknown.

**Figure 3.4 –Number of red foxes observed per 100 hours during the VDGIF bowhunter survey (1997–2014)** (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a).



The number of red foxes lethally removed by WS as well as the number harvested by hunters and brokered by fur dealers from 2009 to 2014 is shown in Table 3.10. Lethal removal of red foxes can occur throughout the year, but many are removed during hunting and trapping seasons. Red foxes taken during hunting seasons are reported during an annual hunter harvest survey conducted by the VDGIF. Survey participants are asked not to report animals trapped. The average annual hunter harvest from 2009 to 2014 was 7,462 red foxes per year. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 5,556 red foxes were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. These animals may have been harvested by hunters or trappers; however, the majority are harvested by trappers (M. L. Fies, VDGIF, personal communication 2015). From 2009 to 2014, the average annual number of red fox pelts purchased or brokered was 3,089. The total number of red foxes lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.10 – Number of red foxes addressed in Virginia from 2009 to 2014.**

Year	WS' Lethal Removal <sup>1</sup>			Hunter Harvest <sup>3</sup> /Trapper Harvest <sup>4</sup>	Fur Dealer Transactions <sup>5</sup>
	to manage damage outlined in the need for action	to manage damage to livestock <sup>2</sup>	total lethal removal by WS		
<b>2009</b>	77 <sup>{3}</sup>	77	154 <sup>{3}</sup>	9,690	1,871
<b>2010</b>	85 <sup>{17}</sup>	61	146 <sup>{17}</sup>	No survey conducted	2,839
<b>2011</b>	115 <sup>{8}</sup>	80	195 <sup>{8}</sup>	8,776	3,424
<b>2012</b>	97 <sup>{7}</sup>	61 <sup>{1}</sup>	158 <sup>{8}</sup>	No survey conducted	3,175
<b>2013</b>	113 <sup>{2}</sup>	57 <sup>{1}</sup>	170 <sup>{3}</sup>	3,922 / 5,556	4,438
<b>2014</b>	85	82	167	No survey conducted	2,791
<b>AVERAGE</b>	<b>95.3<sup>{6.2}</sup></b>	<b>69.6<sup>{0.3}</sup></b>	<b>165<sup>{6.5}</sup></b>	<b>7,462 / 5,556</b>	<b>3,089</b>

<sup>{#}</sup> Number of red fox dens destroyed by WS

<sup>1</sup>Data reported by federal fiscal year, includes non-target lethal removal

<sup>2</sup>This lethal removal is analyzed in separate analyses pursuant to the NEPA

<sup>3</sup>Data reported by state fiscal year, VDGIF 2010, VDGIF 2012*b*, Kidd et al. 2014*b*.

<sup>4</sup>Data reported by state fiscal year, Kidd et al. 2014*a*.

<sup>5</sup>Data reported by state fiscal year, Fies 2010*a*, Fies 2011*b*, Fies 2012*b*, Fies 2013*b*, Fies 2014*b*, Fies 2015.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 300 red foxes annually under the proposed action / no action alternative to meet the need for action as described in this EA.

The lethal removal of up to 300 red foxes would represent 4.0% of the average number of red foxes harvested annually by hunters (7,462) and 2.8% of the total known average annual harvest (10,551) [i.e., average number of red fox purchased or brokered by fur dealers (and harvested primarily by trappers) plus the average number of red fox harvested by hunters]. An additional 300 red foxes could be lethally removed by WS to manage damage and threats to livestock under a separate analysis (USDA 2015*b*). Therefore, WS could lethally remove up to 600 red foxes annually. This would represent 8.0% of the average number of red foxes harvested annually by hunters and 5.6% of the total known average annual harvest. As stated in Appendix B, WS could use large gas cartridges to fumigate red fox dens where damage is occurring. Although red fox dens often have more than one entrance, red foxes are territorial and therefore it is unlikely that more than a single breeding pair, their pups and possibly one additional female could be associated with any given den site. Based on an average litter size of five pups (see average litter size discussion above), and the fact that only the mother generally occupies the den when pups are present (Lloyd 1983), fumigation of a single den site would be expected to lethally remove six individuals. Given the stable number of observations of red foxes during the bowhunter survey and the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on red fox populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of red foxes being harvested and lethally removed in Virginia. Harvest and lethal removal of red fox can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report red fox lethally removed annually to the VDGIF.

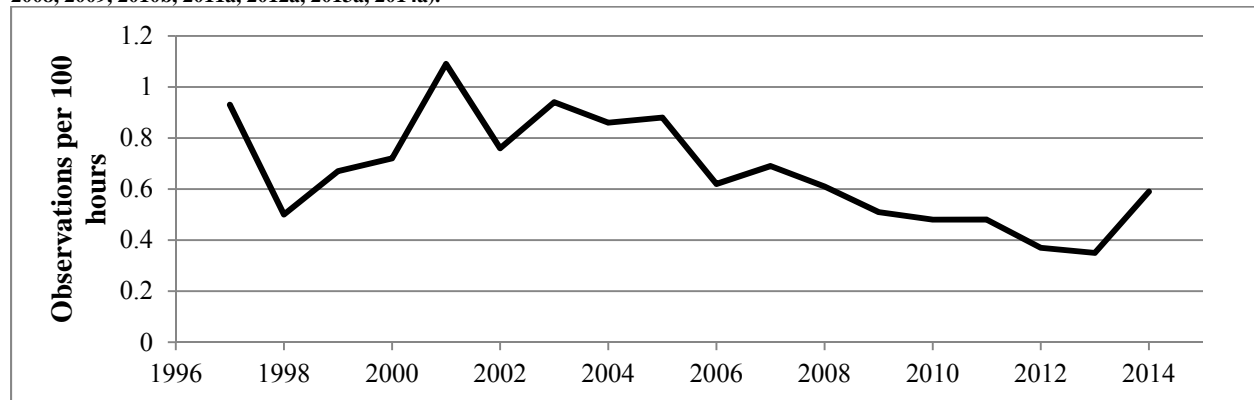


## Gray Fox Population Impact Analysis

Unlike red foxes, gray foxes were present in Virginia at the time of European settlement. Like red foxes, they have expanded their range which now extends from southern Canada into northern South America and from the Atlantic west into the Great Plains, the southwestern U.S. and portions of California and Oregon (Cypher 2003). Gray foxes are considered a woodland species but inhabit a variety of habitats including mixed agricultural/woodland landscapes (Cypher 2003). Little information is available on the social ecology of gray foxes (Cypher 2003). The basic social unit during the spring and summer is a mated pair and their pups (Fritzell 1987, Cypher 2003). Females produce a single litter of one to 10 (with an average of four) young each spring and young become independent by seven months (Fritzell 1987, Cypher 2003). The average home range of gray foxes in the eastern U.S. is highly variable (0.28–2.61mi<sup>2</sup>) (Fritzell 1987). The population density of gray foxes has been estimated as ranging from 3.1 to 5.4 gray foxes per square mile although higher densities have been documented (Fritzell 1987).

Surveys of bowhunter observations of gray foxes while afield conducted by the VDGIF since 1997 indicate a declining trend from 2007 to 2013 followed by a recovery in 2014 (Figure 3.5). The Commonwealth's gray fox population is unknown.

**Figure 3.5 –Number of gray foxes observed per 100 hours during the VDGIF bowhunter survey (1997–2014)** (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a).



The number of gray foxes lethally removed by WS as well as the number harvested by hunters and brokered by fur dealers from 2009 to 2014 is shown in Table 3.11. Lethal removal of gray foxes can occur throughout the year, but many are harvested during hunting and trapping seasons. Gray foxes taken during hunting seasons are reported during an annual hunter harvest survey conducted by the VDGIF. Survey participants are asked not to report animals trapped. The average annual hunter harvest from 2009 to 2014 was 8,177 gray foxes per year. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 3,353 gray foxes were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. These animals may have been harvested by hunters or trappers; however, the majority are harvested by trappers (M. L. Fies, VDGIF, personal communication 2015). From 2009 to 2014, the average annual number of gray fox pelts purchased or brokered was 2,593. The total number of gray foxes lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.11 – Number of gray foxes addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS' Lethal Removal<sup>1</sup></b>	<b>Hunter Harvest<sup>2</sup> /Trapper Harvest<sup>3</sup></b>	<b>Fur Dealer Transactions<sup>4</sup></b>
<b>2009</b>	33	7,134	1,387
<b>2010</b>	22	No survey conducted	2,274
<b>2011</b>	50	9,348	3,082
<b>2012</b>	37	No survey conducted	3,569
<b>2013</b>	53	8,050 / 3,353	3,547
<b>2014</b>	33	No survey conducted	1,699
<b>AVERAGE</b>	<b>38</b>	<b>8,177 / 3,353</b>	<b>2,593</b>

<sup>1</sup>Data reported by federal fiscal year, includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA.

<sup>2</sup>Data reported by state fiscal year, VDGIF 2010, VDGIF 2012b, Kidd et al. 2014b.

<sup>3</sup>Data reported by state fiscal year, Kidd et al. 2014a.

<sup>4</sup>Data reported by state fiscal year, Fies 2010a, Fies 2011b, Fies 2012b, Fies 2013b, Fies 2014b, Fies 2015.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 100 gray foxes annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 100 gray foxes would represent 1.2% of the average number of gray foxes harvested annually by hunters (8,177) and 0.9% of the total known average annual harvest (10,770) [i.e., average number of gray fox purchased or brokered by fur dealers (and harvested primarily by trappers) plus the average number of gray fox harvested by hunters]. Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on gray fox populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of gray foxes being harvested and lethally removed in Virginia. Harvest and lethal removal of gray fox can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report gray fox lethally removed annually to the VDGIF.

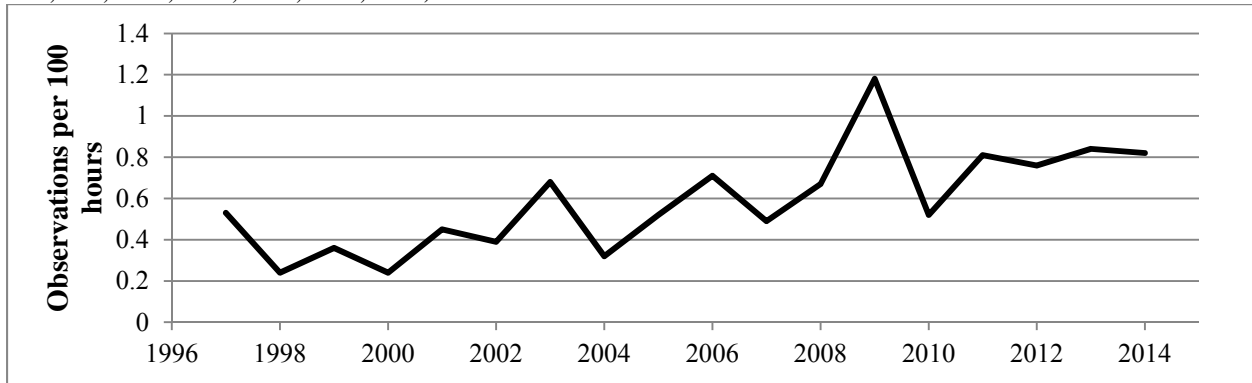
**Black Bear Population Impact Analysis**

The range of black bears is expanding. They are currently found throughout the Pacific Northwest, the Sierra and Rocky Mountains, the northern Great Lakes, the northeast, and south along the Appalachian Mountains (DeGraaf and Yamasaki 2001, Pelton 2003). In Virginia, the range of black bears extends across almost the entire state with occasional sightings in the tidewater region (VDGIF 2012a). No bears have been documented in Northampton County (VDGIF 2012a). Black bears occupy a diverse range of habitats including continuous tracks of forest, forest interspersed with openings (e.g., agricultural areas, brushy fields, riparian areas), and increasingly suburban and urban areas (Pelton 2003, VDGIF 2012a). Black bears are normally solitary except for females with cubs (Pelton 2003). Litter sizes range from 1–3; but four are not uncommon when food is abundant (Pelton 2003, VDGIF 2012a). Males have larger home ranges than females. In Virginia, female home ranges have been documented as ranging from 1–51

square miles while male home ranges have been documented as ranging from 10–293 square miles (VDGIF 2012a). Population densities vary regionally across the state and have been documented as ranging from 1.5 bears per square mile (in the Great Dismal Swamp) to 3.5 bears per square mile (in the mountains of Rockingham County) (VDGIF 2012a).

Surveys of bowhunter observations of black bears while afield conducted by the VDGIF since 1997 have indicated an increasing trend (Figure 3.6). The statewide population was estimated at 16,000–17,000 bears in 2012 and since 2001, the population is estimated to be increasing at a rate of 9.0% annually (VDGIF 2012a).

**Figure 3.6 –Number of black bears observed per 100 hours during the VDGIF bowhunter survey (1997–2014)** (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a).



The number of black bears lethally removed by WS to alleviate damage and threats as well as the number harvested by hunters and taken under kill permits from 2009 to 2014 is shown in Table 3.12. Lethal removal of black bears can occur under kill permits issued by the VDGIF under §29.1-529, or during annual harvest seasons. The average annual hunter harvest from 2009 to 2014 was 2,246 black bears per year while the average annual number of black bears taken under kill permits was 163.

**Table 3.12 – Number of black bears addressed in Virginia from 2009 to 2014.**

Year	WS' Lethal Removal <sup>1</sup>	Hunter Harvest <sup>2</sup>	Lethal removal under Kill Permits <sup>3</sup>
2009	1*	2,319	182
2010	0	2,267	49
2011	0	2,008	156
2012	0	2,142	130
2013	0	2,327	320
2014	1	2,412	146
<b>AVERAGE</b>	<b>0.3</b>	<b>2,246</b>	<b>163</b>

\*Non-target lethal removal during activities analyzed in separate analyses pursuant to the NEPA.

<sup>1</sup>Data reported by federal fiscal year, includes non-target lethal removal

<sup>2</sup>Data reported by state fiscal year, J. Sajecki, VDGIF, personal communication 2015.

<sup>3</sup>Data reported by calendar year, J. Sajecki, VDGIF, personal communication 2015, bears taken under §29.1-529.

*Direct, Indirect, and Cumulative Effects:*

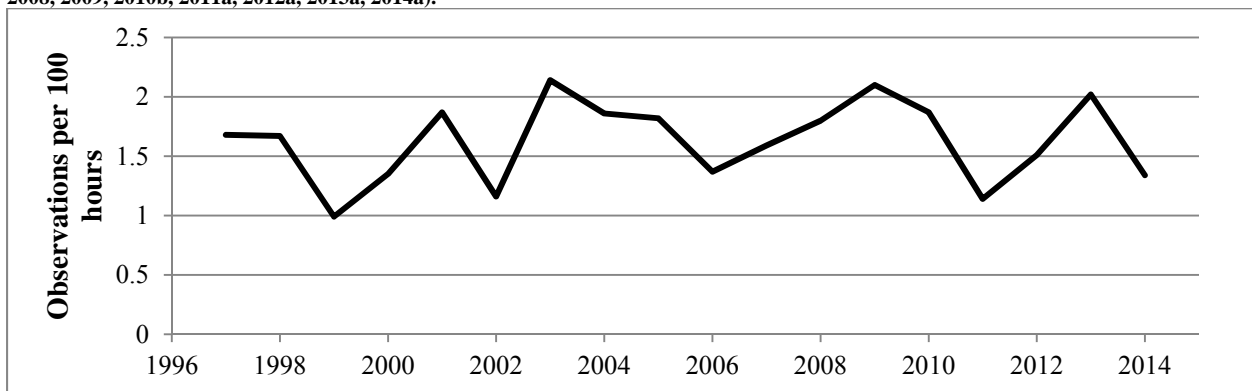
Under the proposed action / no action alternative WS could provide both technical and direct operational assistance for damage or threats associated with black bears. In the past, WS has primarily provided technical assistance, documenting all reports of damage and relaying this information to VDGIF for action determination. WS has also provided both lethal and non-lethal direct operational assistance in coordination with the VDGIF, primarily when bears pose a threat to property and human health and safety at airports or when bears predate or pose a predation threat to livestock. Under the proposed action/no action alternative, WS could lethally remove up to 25 black bears annually to manage damage or threats of damage. The lethal removal of up to 25 black bears would represent 1.1% of the average number of bears harvested by hunters (2,246) and 15.3% of the average number of bears taken under kill permits (163). Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS’ proposed lethal removal should not have any significant direct or cumulative impact on black bear populations. WS’ lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of black bears being harvested and lethally removed in Virginia. Harvest and lethal removal of black bears can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired population objectives. WS would report the number of black bears lethally removed annually, which would ensure cumulative impacts would be considered as part of VDGIF population management objectives for black bears.

**Raccoon Population Impact Analysis**

Raccoons can be observed almost continuously across the U.S. (Gehrt 2003). They occupy a wide variety of habitats including woodlands, woodlands interspersed with fields and areas where water is present (Gehrt 2003). Females produce one litter a year of 3–4 young per year (Gehrt 2003). The common social unit among raccoons is females with young but many animals will also use the same structures for shelter (as many as 23 raccoons have been observed using the same structure) (Sanderson 1987, Gehrt 2003). Their average home range varies depending on habitat, season, age, food availability and sex (12–12,000 acres) (Sanderson 1987). The population density of raccoons has been estimated at anywhere from less than one raccoon per acre to one raccoon per 47 acres (Sanderson 1987, DeGraaf and Yamasaki 2001, Gehrt 2003).

Surveys of bowhunter observations of raccoons while afield conducted by the VDGIF since 1997 show a slightly increasing trend (Figure 3.7). The Commonwealth’s raccoon population is unknown.

**Figure 3.7 –Number of raccoons observed per 100 hours during the VDGIF bowhunter survey (1997–2014)** (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a).



The number of raccoons lethally removed by WS as well as the number harvested by hunters and brokered by fur dealers from 2009 to 2014 is shown in Table 3.13. Lethal removal of raccoons can occur throughout the year, but many are harvested during hunting and trapping seasons. Raccoons taken during hunting seasons are reported during an annual hunter harvest survey conducted by the VDGIF. Survey participants are asked not to report animals trapped. The average annual hunter harvest from 2009 to 2014 was 55,542 raccoons per year. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 19,759 raccoons were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. These animals may have been harvested by hunters or trappers; however, the majority are harvested by trappers (M. L. Fies, VDGIF, personal communication 2015). From 2009 to 2014, the average annual number of raccoon pelts purchased or brokered was 12,385. The total number of raccoons lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.13 – Number of raccoons addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS' Lethal Removal<sup>1</sup></b>	<b>Hunter Harvest<sup>2</sup> /Trapper Harvest<sup>3</sup></b>	<b>Fur Dealer Transactions<sup>4</sup></b>
<b>2009</b>	629	38,546	4,204
<b>2010</b>	588	No survey conducted	11,698
<b>2011</b>	672	55,423	13,384
<b>2012</b>	379	No survey conducted	15,218
<b>2013</b>	327	72,657 / 19,759	20,334
<b>2014</b>	341	No survey conducted	9,471
<b>AVERAGE</b>	<b>489</b>	<b>55,542 / 19,759</b>	<b>12,385</b>

<sup>1</sup>Data reported by federal fiscal year, includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA.

<sup>2</sup>Data reported by state fiscal year, VDGIF 2010, VDGIF 2012*b*, Kidd et al. 2014*b*.

<sup>3</sup>Data reported by state fiscal year, Kidd et al. 2014*a*.

<sup>4</sup>Data reported by state fiscal year, Fies 2010*a*, Fies 2011*b*, Fies 2012*b*, Fies 2013*b*, Fies 2014*b*, Fies 2015.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 1,000 raccoons annually under the proposed action / no action alternative to manage damage or threats of damage. Racoons could also be lethally removed by WS in the Commonwealth to manage rabies under a separate analysis (USDA 2009*a*). However, cumulative removal would not exceed 1,000 raccoons.

The lethal removal of up to 1,000 raccoons would represent 1.8% of the average number of raccoons harvested annually by hunters (55,542) and 1.4% of the total known average annual harvest (67,927) [i.e., average number of raccoons purchased or brokered by fur dealers (and harvested primarily by trappers) plus the average number of raccoons harvested by hunters]. Given the increasing number of observations of raccoons during the bowhunter survey and the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on raccoon populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of raccoons being harvested and lethally

removed in Virginia. Harvest and lethal removal of raccoons can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report raccoon lethally removed annually to the VDGIF.

### **Mink Population Impact Analysis**

Occurring throughout the U.S. except for Arizona and parts of California, Nevada, Utah, New Mexico and Texas, mink can be found in forest, open areas, fresh and salt water wetlands (Eagle and Whitman 1987, Larivière 2003). Minks produce one litter of 1–8 young per year (Eagle and Whitman 1987). They are generally solitary animals with the exception of females with young (Larivière 2003). Mink are considered to be territorial but evidence for this is weak as is reliable home ranges (Larivière 2003). Population density estimates have been recorded as high as one mink per 29.2 acres (Eagle and Whitman 1987). The Commonwealth’s mink population is unknown.

The number of mink lethally removed by WS to alleviate damage and threats as well as the number harvested by trappers and brokered by fur dealers from 2009 to 2014 is shown in Table 3.14. Although lethal removal of mink can occur throughout the year, many are lethally removed during the trapping season. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 719 mink were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. From 2009 to 2014, the average annual number of mink pelts purchased or brokered was 449. The total number of mink lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.14 – Number of mink addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS’ Lethal Removal<sup>1</sup></b>	<b>Trapper Harvest<sup>2</sup></b>	<b>Fur Dealer Transactions<sup>3</sup></b>
<b>2009</b>	0	No survey conducted	253
<b>2010</b>	0	No survey conducted	473
<b>2011</b>	1	No survey conducted	549
<b>2012</b>	0	No survey conducted	512
<b>2013</b>	0	719	509
<b>2014</b>	0	No surveys conducted	398
<b>AVERAGE</b>	<b>0.16</b>	<b>719</b>	<b>449</b>

<sup>1</sup>Data reported by federal fiscal year.

<sup>2</sup>Data reported by state fiscal year, Kidd et al. 2014a.

<sup>3</sup>Data reported by state fiscal year, Fies 2010a, Fies 2011b, Fies 2012b, Fies 2013b, Fies 2014b, Fies 2015.

#### *Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 10 mink annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 10 mink would represent 1.3% of the total known annual trapper harvest in 2013 (719) or 2.2% of the average number of mink purchased or brokered by fur dealers (449) (and harvested primarily by trappers). Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS’ proposed lethal removal should not have any significant direct or cumulative impact on mink populations. WS’ lethal

removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of mink being harvested and lethally removed in Virginia. Harvest and lethal removal of mink can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of mink lethally removed annually to the VDGIF.

### Striped Skunk Population Impact Analysis

Striped skunks can be found across the U.S. in suitable habitat including open forest, grasslands, agricultural areas, wetlands, suburban and urban areas (Rosatte 1987, Rosatte and Larivière 2003). Females typically produce a single litter of 2–10 young a year, although second litters have been documented (Rosatte and Larivière 2003). Striped skunks are solitary with the exception of females with young and the use of communal shelter sites during periods of inclement weather (Rosatte 1987, Rosatte and Larivière 2003). Skunks are not territorial (Rosatte and Larivière 2003). Average home range varies depending on habitat, season, food availability and sex (0.2–4.6 square miles) (Rosatte and Larivière 2003). Population densities of striped skunks have been recorded as high as 14.6 skunks per square mile (Rosatte and Larivière 2003). The Commonwealth’s striped skunk population is unknown.

The number of striped skunks lethally removed by WS to alleviate damage and threats as well as the number harvested by trappers and brokered by fur dealers from 2009 to 2014 is shown in Table 3.15. Although lethal removal of striped skunks can occur throughout the year, many are lethally removed during the trapping season. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 2,946 striped skunks were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of striped pelts purchased or brokered. From 2009 to 2014, the average annual number of striped skunk pelts purchased or brokered was 232. The total number of striped skunks lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.15 – Number of striped skunks addressed in Virginia from 2009 to 2014.**

Year	WS’ Lethal Removal <sup>1</sup>	Trapper Harvest <sup>2</sup>	Fur Dealer Transactions <sup>3</sup>
2009	48	No survey conducted	39
2010	62	No survey conducted	137
2011	69	No survey conducted	172
2012	23	No survey conducted	356
2013	25	2,946	412
2014	14	No surveys conducted	277
<b>AVERAGE</b>	<b>40</b>	<b>2,946</b>	<b>232</b>

<sup>1</sup>Data reported by federal fiscal year, includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA.

<sup>2</sup>Data reported by state fiscal year, Kidd et al. 2014a.

<sup>3</sup>Data reported by state fiscal year, Fies 2010a, Fies 2011b, Fies 2012b, Fies 2013b, Fies 2014b, Fies 2015.

#### *Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 100 striped skunks annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 100 striped skunks would represent 3.3% of the total known annual trapper harvest in 2013 (2,946). It would represent a much higher percentage (43.1%) of the average number of skunks purchased or brokered by fur dealers (232) (and harvested primarily by trappers) because the demand for and average price for skunk fur is low. Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on striped skunks populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of striped skunks being harvested and lethally removed in Virginia. Harvest and lethal removal of striped skunks can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of striped skunks lethally removed annually to the VDGIF.

### River Otter Population Impact Analysis

Today, river otters can be found across much of the eastern U.S., the Pacific Northwest and many western states where their range continues to expand (Raesly 2001, Melquist et al. 2003). Habitat includes a variety of both fresh, salt and brackish water wetlands, streams, ponds, lakes and rivers (Melquist et al. 2003). Females produce a single litter each year of 1–6 young (DeGraaf and Yamasaki 2001, Melquist et al. 2003). Social groups consist of a female and her young (Melquist et al. 2003). Where resources are abundant males may also form groups (Melquist et al. 2003). Otters are territorial (Melquist et al. 2003). Home range estimates range from 0.7 to 22 square miles ((DeGraaf and Yamasaki 2001). Population densities of river otters range from 1 otter per 1.2 mile to 1 otter per 10.6 mile of waterway (DeGraaf and Yamasaki 2001). The Commonwealth's river otter population is unknown.

The number of river otters lethally removed by WS to alleviate damage and threats as well as the number harvested by trappers and brokered by fur dealers from 2009 to 2014 is shown in Table 3.16. Although lethal removal of river otters can occur throughout the year, many are lethally removed during the trapping season. The VDGIF conducted a survey of licensed trappers to quantify the number of animals harvested during the 2013–2014 trapping season. An estimated 1,485 river otters were harvested by trappers during that period. The VDGIF also conducts an annual survey of licensed fur dealers (i.e., persons who buy and sell the hide, pelt or fur of fur-bearing animals) to quantify the number of pelts purchased or brokered. From 2009 to 2014, the average annual number of river otters pelts purchased or brokered was 1,023. The total number of river otters lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.16 – Number of river otters addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS' Lethal Removal<sup>1</sup></b>	<b>Trapper Harvest<sup>2</sup></b>	<b>Fur Dealer Transactions<sup>3</sup></b>
<b>2009</b>	8	No survey conducted	578
<b>2010</b>	4	No survey conducted	978
<b>2011</b>	7	No survey conducted	1,189
<b>2012</b>	9	No survey conducted	1,225
<b>2013</b>	10	1,485	1,380
<b>2014</b>	5	No surveys conducted	790
<b>AVERAGE</b>	<b>7</b>	<b>1,485</b>	<b>1,023</b>

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA.

<sup>2</sup>Data reported by state fiscal year, Kidd et al. 2014a.

<sup>3</sup>Data reported by state fiscal year, Fies 2010a, Fies 2011b, Fies 2012b, Fies 2013b, Fies 2014b, Fies 2015.



*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 20 river otters annually under the proposed action / no action alternative to manage damage or threats of damage.

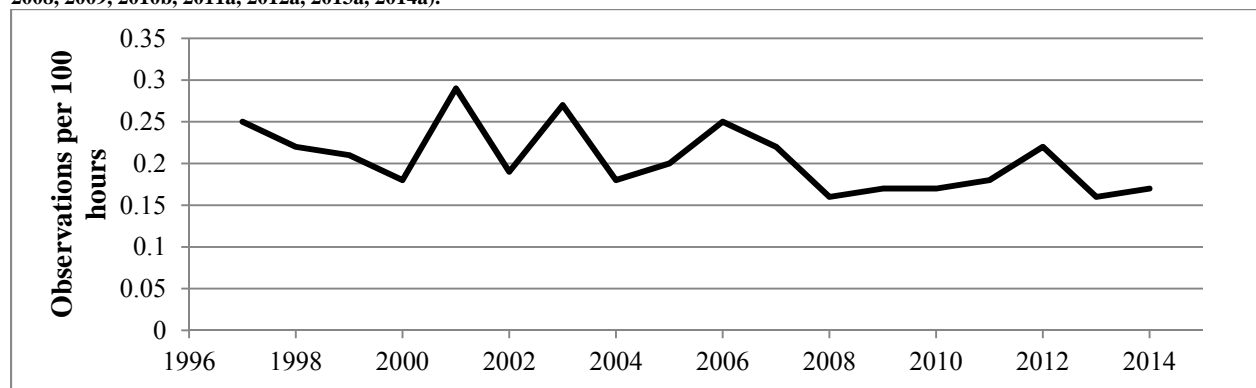
The lethal removal of up to 20 river otters would represent 1.3% of the total known annual trapper harvest in 2013 (1,485) or 1.9% of the average number of river otters purchased or brokered by fur dealers (1,023) (and harvested primarily by trappers). Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on river otter populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of river otters being harvested and lethally removed in Virginia. Harvest and lethal removal of river otters can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report the number of river otters lethally removed annually to the VDGIF.

**Bobcat Population Impact Analysis**

Bobcats can be found in much of the contiguous U.S. (Anderson and Lovallo 2003). Preferred habitat includes rocky country with dense cover, especially mixed and coniferous forests (Anderson and Lovallo 2003). Females produce one litter a year with an average of 1.7 to 3.6 young (Anderson and Lovallo 2003). Bobcats are solitary animals with the exception of females with young (Anderson and Lovallo 2003). Home range varies widely even within studies (Anderson and Lovallo 2003). Across their range, home range has been documented as anywhere from 0.2 to 78 square miles (DeGraaf and Yamasaki 2001). Because they are widely dispersed and secretive in nature, reliable population density estimates are not generally available (Anderson and Lovallo 2003).

Surveys of bowhunter observations of bobcats while afield conducted by the VDGIF since 1997 show a slightly declining trend (Figure 3.8). The Commonwealth's bobcat population is unknown.

**Figure 3.8 –Number of bobcats observed per 100 hours during the VDGIF bowhunter survey (1997–2014)** (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a).



The number of bobcats lethally removed by WS as well as the number harvested by hunters and brokered by fur dealers from 2009 to 2014 is shown in Table 3.17. Although lethal removal of bobcats can occur throughout the year, many are lethally removed during hunting or trapping seasons. The average annual hunter harvest from 2009 to 2014 was 1,003 bobcats per year while the average annual number of bobcats

taken during the trapping season was 734. The total number of bobcats lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.17 – Number of bobcats addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS' Lethal Removal<sup>1</sup></b>	<b>Hunter Harvest<sup>2</sup></b>	<b>Trapper Harvest<sup>3</sup></b>
<b>2009</b>	3	1,044	668
<b>2010</b>	0	946	324
<b>2011</b>	1	1,011	658
<b>2012</b>	5	983	766
<b>2013</b>	0	1,069	956
<b>2014</b>	4	967	1,033
<b>AVERAGE</b>	<b>2</b>	<b>1,003</b>	<b>734</b>

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA. All lethal take except 1 bobcat in 2011 was non-target, unintentional take.

<sup>2</sup>Data reported by state fiscal year, M. L. Fies, VDGIF, personal communication 2016.

<sup>3</sup>Data reported by state fiscal year, M. L. Fies, VDGIF, personal communication 2016.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 10 bobcats annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 10 bobcats would represent 0.9% of the average number of bobcats harvested annually by hunters (1,003), 1.4% of the average number of bobcats harvested annually by trappers (734), and 0.6% of the total known average annual harvest (1,737) [i.e., average number of bobcats harvested by hunters plus the number of bobcats harvested by trappers]. Given the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on bobcat populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of bobcats being harvested and lethally removed in Virginia. Harvest and lethal removal of bobcats can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired objectives. WS would report bobcats lethally removed annually to the VDGIF.

**Cat Population Impact Analysis**

The analysis to determine the impacts on cats is based on a measure of the number of individuals captured and injured or killed in the past under the proposed action given the SOPs in place which restrict lethal removal. Methods would only be used by WS at the request of persons seeking assistance. Any activities conducted by WS under the alternatives addressed would occur along with other natural process and human-induced events, such as natural mortality, human-induced mortality from private damage management activities, local law enforcement and animal control authorities.

WS personnel are trained and experienced in the identification of damage, the identification of animals responsible for the damage, the identification of individual animals, and in the selection of and implementation of methods which are as specific as possible. Management actions are directed towards

specific animals or groups of animals responsible for causing damage or posing threats. WS would coordinate with state and local authorities with jurisdiction over cat control in accordance with WS Directive 2.340. In urban areas, WS would refer requests for assistance to the local animal control or law enforcement authority in accordance with WS-Virginia Directive 2.340(a). WS would only use non-lethal methods to address requests for assistance with cats (WS-Virginia Directive 2.340(a)). Cats would, “not be targeted for capture unless prior arrangements are made with the appropriate animal shelter or law enforcement entity to receive them” (WS-Virginia Directive 2.340(a)). Cats captured unintentionally by WS and uninjured will be transferred to animal control authorities, returned to their owners, handed over to the property owner, or released onsite (WS-Virginia Directive 2.340(a)).

The number of cats in the Commonwealth is unknown. The number of cats addressed by WS to alleviate damage and threats as well as the number addressed by Virginia rescue agencies, city facilities and county facilities from 2009 to 2014 is shown in Table 3.18. The number of cats seized or lethally removed by local law enforcement, animal control authorities or private entities because they are causing damage is unknown.

**Table 3.18 – Number of cats captured by WS compared to cats received by rescue agencies, city facilities and county facilities in Virginia from 2009 to 2014.**

Year	captured by WS <sup>1</sup>			received by Virginia rescue agencies, city facilities and county facilities <sup>3</sup>		
	Transferred custody	Freed/ Released	Lethal removal	Received	Died in facility	Euthanized
2009	20	(13)	4 (1)	112,256	2,741	58,637
2010	19	(20)	(3)	113,888	2,713	56,653
2011	17	1 (5)	0	111,131	2,949	53,634
2012	10	(9)	0	115,029	3,141	49,702
2013	30	1 (8)	(2)	109,720	3,189	42,215
2014	15	(10)	0	100,800	2,203	33,861
<b>AVERAGE</b>	<b>19</b>	<b>0.3 (11)</b>	<b>0.6 (1)</b>	<b>110,470</b>	<b>2,822</b>	<b>49,117</b>

(#) Individual cats addressed unintentionally, includes non-target

\*Activities analyzed in a separate analysis pursuant to the NEPA

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal of one cat in 2009 during activities analyzed in separate analyses pursuant to the NEPA.

<sup>3</sup>Data reported by calendar year (VDACS 2016)

From 2009 to 2014, WS captured and either freed, released, returned to their owner or transferred to animal control authorities an average of 29.6 cats per year while conducting activities to reduce damage or threats of damage associated with cats outlined in the need for action. No cats sustained serious injuries during this time. During this same period WS lethally removed four cats while conducting activities outlined in the need for action. These cats were removed to protect human health and safety prior to the implementation of WS-Virginia Directive 2.340(a). An additional five cats were unintentionally killed during this period during activities outlined in the need for action. Documentation and reporting of injuries or death of cats from WS’s activities is required (WS-Virginia Directive 2.340(a)).

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance, WS could live capture 100 cats annually under the proposed action / no action alternative to manage damage or threats of damage. The live capture and transfer of cats to animal shelters or law enforcement entities should have little to no adverse impact on the statewide population. Cats would be transported promptly in an appropriately sized sanitary container with adequate ventilation. After transfer, the care and final disposition of the cat would be the responsibility of the animal shelter or local law enforcement. WS would not intentionally lethally remove cats under the

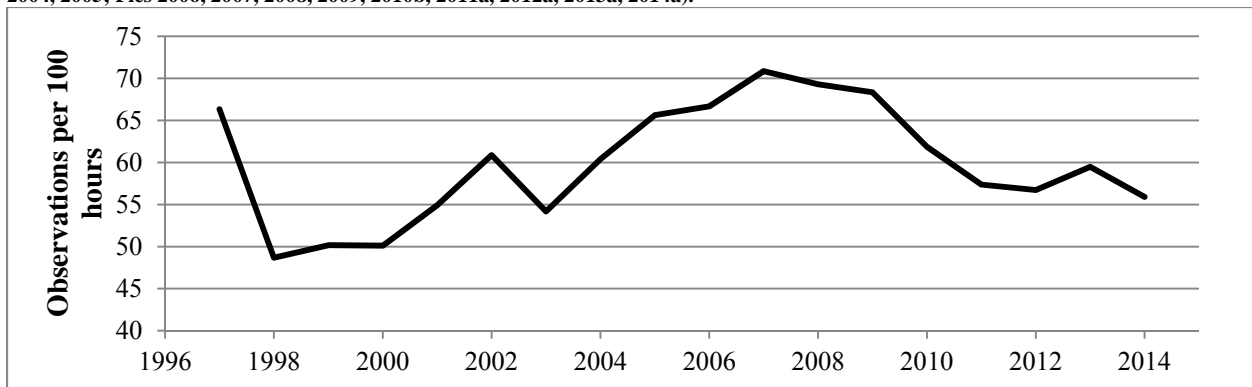
proposed action / no action alternative. Cats are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Given their impacts, (outlined in Chapter 1), any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. No significant direct or cumulative effects on statewide cat populations are expected from implementation of the proposed action / no action alternative.

### White-tailed Deer Population Impact Analysis

White-tailed deer can be found across the U.S. with the exception of Nevada, Utah and parts of Washington, Oregon, Idaho, Wyoming, Colorado, Arizona, New Mexico and California (Miller et al. 2003). Preferred habitat consists of forest with adjacent open habitat (DeGraaf and Yamasaki 2001, Miller et al. 2003). White-tailed deer produce 1–3 young once a year (DeGraaf and Yamasaki 2001). Social structure during the non-breeding season takes two forms; groups composed of a female, her young born that year and her young of previous years or groups composed of adult males (Miller et al. 2003). During the fall and winter these groups may fuse into larger groups (Miller et al. 2003). In the spring, reproductive females isolate themselves until fawns are born and have achieved 8–10 weeks of age (Miller et al. 2003). Home ranges are dependent on a variety of factors ranging in size from 146 to 4,593 acres (DeGraaf and Yamasaki 2001). Population densities vary depending on habitat and can easily exceed 30 deer per square mile (DeGraaf and Yamasaki 2001).

Surveys of bowhunter observations of deer while afield conducted by the VDGIF since 1997 have indicated an overall increasing trend (Figure 3.9). The statewide population was estimated at 901,000–1,117,000 deer in 2015 (VDGIF 2015). Over the past two decades, the statewide deer population has remained stable although regional populations have fluctuated during this time (VDGIF 2015).

**Figure 3.9 –Number of bucks, does and fawns combined observed per 100 hours during the VDGIF bowhunter survey (1997–2014)** (Lafon et al. 1998; Farrar et al. 1999, 2000, 2001, 2002; Lafon et al. 2004; Fies and Norman 2004, 2005; Fies 2006, 2007, 2008, 2009, 2010b, 2011a, 2012a, 2013a, 2014a).



The number of deer lethally removed by WS to alleviate damage and threats as well as the number harvested by hunters or taken under kill or other permits from 2009 to 2014 is shown in Table 3.19. Lethal removal of deer can occur under kill permits issued by the VDGIF under §29.1-529, under the Deer Population Reduction Program (DPOP) or during annual harvest seasons. DPOP allows for the take of deer by recreational deer hunters in urban areas (e.g., airports, parks) outside of the traditional harvest season and/or with weapons reserved for other seasons (VDGIF 2015). Additionally, during annual harvest seasons the VDGIF may issue permits to allow for the additional take of deer to: 1) meet site specific deer management objectives under Deer Management Assistance Program (DMAP) or 2) provide site specific relief for damage occurring to crops or property under the Damage Control Assistance

Program (DCAP). The average annual hunter harvest from 2009 to 2014 (which includes deer taken under DPOP, DMAP and DCAP) was 227,699 deer per year while the average annual number of deer taken under kill permits was 12,006.

**Table 3.19 – Number of white-tailed deer addressed in Virginia from 2009 to 2014.**

Year	WS' Lethal Removal <sup>1</sup>	Hunter Harvest <sup>2</sup>	Lethal removal under Kill Permits <sup>3</sup>
2009	182	259,147	15,083
2010	236	222,074	12,550
2011	198	233,104	11,427
2012	84	215,241	10,498
2013	111	244,440	10,567
2014	113	192,186	11,915
<b>AVERAGE</b>	<b>154</b>	<b>227,699</b>	<b>12,006</b>

<sup>1</sup>Data reported by federal fiscal year; includes non-target lethal removal during activities analyzed in the need for action or in separate analyses pursuant to the NEPA.

<sup>2</sup>Data reported by state fiscal year, M. Knox, VDGIF, personal communication 2016, includes deer taken under DPOP, DMAP and DCAP.

<sup>3</sup>Data reported by calendar year, M. Knox, VDGIF, personal communication 2016, deer taken under §29.1-529.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 1,500 deer annually under the proposed action / no action alternative to manage damage or threats of damage.

The lethal removal of up to 1,500 white-tailed deer would represent 0.65% of the average number of deer harvested by hunters (227,699) and 12.5% of the average number of deer taken under kill permits (12,006). WS' proposed removal, average hunter harvest, and other lethal removal in 2014 combined would represent 26.8% of the low-end population estimate. Given the overall increasing number of observations of deer during the bowhunter survey and the limited lethal removal proposed by WS to alleviate damage and threats when compared to the overall harvest and lethal removal occurring, WS' proposed lethal removal should not have any significant direct or cumulative impact on deer populations. WS' lethal removal would be a limited component of the overall harvest and lethal removal and could be considered of low magnitude when compared to the number of deer being harvested and lethally removed. Harvest and lethal removal of deer can only occur at the discretion of the VDGIF. The VDGIF ensures harvest and lethal removal occurs to achieve desired population objectives. WS would report the number of white-tailed deer lethally removed annually, which would ensure cumulative impacts would be considered as part of VDGIF population management objectives for deer.

**Feral Swine Population Impact Analysis**

Feral swine, also known as feral hogs, feral pigs, wild pigs, wild boar, etc. are defined by the Commonwealth as, “any swine that are wild or for which no proof of ownership can be made” (4 VAC 15-20-160). Feral swine are not native to the western hemisphere, and were first introduced by early settlers (Sweeney et al. 2003). As of 2012, feral swine were established in 38 U.S. states (Miller and Sweeney 2013). In Virginia, feral swine have a known presence in nine counties and a probable presence in 11 counties. Their status in 27 counties is unknown (J. A. Rumbaugh, APHIS WS, personal communication 2016). Not restricted by cold temperatures, feral swine have adapted to a variety of habitats including agricultural areas, hardwood forest, pine plantations, and both fresh and salt water wetlands (Sweeney et al. 2003). Feral swine breed year round and can produce more than one litter per

year of 3–8 but as many as 12 young (Sweeney et al. 2003, West et al. 2009). Social structure is characterized by lone males and groups of females and their young (Sweeney et al. 2003, West et al. 2009). Female groups typically consist of several adults and their young although groups of >25 have been recoded (Sweeney et al. 2003, West et al. 2009). Home range varies dramatically from a few hundred to several thousand acres (West et al. 2009). The population density of feral swine in Texas was found to range from 1.33 feral swine per square mile to 2.45 feral swine per square mile (Texas A&M 2014). The Commonwealth’s feral swine population is unknown.

The number of feral swine lethally removed by WS to alleviate damage and threats from 2009 to 2014 is shown in Table 3.20. The total number of feral swine lethally removed by other entities to alleviate damage or nuisance issues in the Commonwealth is unknown.

**Table 3.20 – Number of feral swine addressed in Virginia from 2009 to 2014.**

<b>Year</b>	<b>WS’ Lethal Removal<sup>1</sup></b>
<b>2009</b>	2
<b>2010</b>	0
<b>2011</b>	1
<b>2012</b>	0
<b>2013</b>	0
<b>2014</b>	18
<b>AVERAGE</b>	<b>3.5</b>

<sup>1</sup>Data reported by federal fiscal year.

*Direct, Indirect, and Cumulative Effects:*

Based on previous requests for assistance and in anticipation of an increase in the number of requests for assistance, WS could lethally remove up to 1,000 feral swine annually under the proposed action / no action alternative to manage damage or threats of damage.

Lethal removal of feral swine can occur throughout the year. VDGIF does not collect harvest information on feral swine therefore, the total number of feral swine removed by other entities is unknown. Feral swine are a non-native species and are not afforded any protection by the state or federal government. Feral swine are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Given the invasive status of feral swine, any reduction in populations, or even the complete removal of populations, could be considered beneficial to the environment. Additionally, executive Order 13112 directs federal agencies to use their programs and authorities to prevent the spread of and control populations of invasive species that cause economic or environmental harm, or harm to human health. While reduction in swine numbers would be beneficial to the environment, the removal of 1,000 feral swine annually would not pose any significant direct or cumulative impacts to the population throughout the Eastern U.S.

**Small Mammal (Insectivore and Rodent) Population Impact Analysis**

Two categories of insectivores, shrews and moles, and several categories of small rodents, including mice, rats, and voles, can be found in Virginia (Linzey 1998). Three species of small rodents, Norway rats, black rats and house mice are not native to North America. Both insectivores and small rodents are prolific breeders.

The Commonwealth's small mammal populations are unknown. Lethal removal of small mammals not listed as threatened or endangered can occur throughout the year when they are causing damage, a health hazard or nuisance. The total number of small mammals removed by other entities for these reasons in the Commonwealth is unknown. From FY 2009 to FY 2014, WS lethally removed 33 small rodents.

*Direct, Indirect, and Cumulative Effects:*

Under the proposed action / no action alternative WS could provide both technical and direct operational assistance for damage or threats associated with small mammals. WS personnel are trained and experienced in the identification of damage, the identification of animals responsible for the damage, and the identification of individual animals. If species of small mammals listed by the USFWS under the ESA or by the VDGIF were identified, WS would consult with the appropriate entity to determine an appropriate course of action. WS could lethally remove up to 500 small mammals annually, of any species composition, consisting of Kirtland's short-tailed shrew (*Blarina brevicauda kirtlandi*), least shrew (*Cryptotis parva parva*), Northern short-tailed shrew (*Blarina brevicauda churchi*), pygmy shrew (*Sorex hoyi winnemana*), Southeastern shrew (*Sorex longirostris longirostris*), ashen masked shrew (*Sorex cinereus cinereus*), masked shrew (*Sorex cinereus fontinalis*), Southern short-tailed shrew (*Blarina carilonensis carilonensis*), Eastern mole (*Scalopus aquaticus aquaticus*), star-nosed mole (*Condylura cristata parva* and *Condylura cristata cristata*), hairy-tailed mole (*Parascalops breweri*), common white-footed mouse (*Peromyscus leucopus leucopus*), deer mouse (*Peromyscus maniculatus nubiterre*), Northern white-footed mouse (*Peromyscus leucopus noveboracensis*), prairie deer mouse (*Peromyscus maniculatus bairdii*), Eastern harvest mouse (*Reithrodontomys humulis virginianus* and *Reithrodontomys humulis humulis*), Lewis' golden mouse (*Ochrotomys nuttalli nuttalli*), house mouse (*Mus musculus musculus*), hispid cotton rat (*Sigmodon hispidus virginianus*), marsh rice rat (*Oryzomys palustris palustris*), black rat (*Rattus rattus*), Norway rat (*Rattus norvegicus norvegicus*), meadow vole (*Microtus pennsylvanicus pennsylvanicus*), pine vole (*Microtus pinetorum scalapsoides*), common pine vole (*Microtus pinetorum pinetorum*), dark meadow vole (*Microtus pennsylvanicus nigrans*), and meadow jumping mouse (*Zapus hudsonius americanus*), under the proposed action/no action alternative, to manage damage or threats to agriculture, natural resources or to property and human health and safety relative to aviation safety. Due to their high reproductive rates and because management activities would be localized, the lethal removal of up to 500 small mammals annually to manage damage or threats is not expected to have any significant adverse impact on small mammal populations in Virginia. Norway rats, black rats and house mice are non-native species, are not afforded any protection, and are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Given the invasive status of Norway rats, black rats and house mice, any reduction in their populations, or even the complete removal of populations, could be considered beneficial to the environment. Executive Order 13112 directs federal agencies to use their programs and authorities to prevent the spread of and control populations of invasive species that cause economic or environmental harm, or harm to human health. WS would report the number of small mammals lethally removed annually to the VDGIF.

### **Wildlife Disease Surveillance and Monitoring**

Under the proposed action / no action alternative, WS' could sample mammals captured live by WS or other entities, mammals that were sick or dying, or animals harvested by hunters for disease. The sampling (e.g., drawing blood, swabbing nasal cavities, collecting fecal samples) and the subsequent release of live-captured mammals would not result in adverse effects to mammal populations since those mammals would be released unharmed on site. Additionally, the sampling of mammals that were sick, dying, or harvested by hunters would not result in the additive lethal removal of mammals that would not have already occurred in the absence of WS' activities. Therefore, the sampling of mammals for disease as described above would not adversely affect the populations of any of the mammals addressed in this EA.

### ***Alternative 2 – WS Would Address Mammal Damage Using Technical Assistance Only***

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with mammals with technical assistance only. Despite no direct involvement by WS in resolving damage and threats, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. Appendix B contains a thorough discussion of the methods available for use in managing damage and threats associated with mammals. With the exception of M-44s (sodium cyanide), all methods listed in the Appendix could be available under this alternative.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action. Therefore, mammal populations in the Commonwealth would not be directly impacted by WS from a program implementing technical assistance only.

#### ***Direct, Indirect, and Cumulative Effects:***

The number of mammals lethally removed under this alternative would likely be similar to the other alternatives. Although one method (M-44s) would not be available under this alternative, those animals removed under Alternative 1 could be removed with other methods by other entities under this alternative. Lethal removal of those species addressed in this EA can occur, depending upon the species, when they are causing damage or a nuisance or during hunting and trapping seasons.

With the oversight of the VDGIF, it is unlikely that mammal populations would be significantly impacted, directly or cumulatively, by the implementation of this alternative. Management actions could be undertaken by a property owner or manager, provided by private nuisance wildlife control agents, provided by volunteer services of private individuals or organizations, or provided by other entities such as the VDGIF. If direct operational assistance is not provided by WS or other entities, it is hypothetically possible that frustration caused by the inability to reduce damage and threats could lead to the inappropriate use of legal methods or the use of illegal methods which could lead to unnecessary killing of wildlife. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

### ***Alternative 3 – WS Would Not Address Mammal Damage***

Under this alternative, WS would not conduct technical or direct operational assistance to reduce threats or alleviate damage associated with mammals. WS would not be involved with any aspect of managing damage associated with mammals. All requests for assistance received by WS to resolve damage caused by mammals would be referred to the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. Similar to Alternative 2, with the exception of M-44s (sodium cyanide), all methods listed in the Appendix could be available under this alternative.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve



or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

*Direct, Indirect, and Cumulative Effects:*

Lethal removal of those species addressed in this EA could continue to occur since depending on the species, lethal removal can occur when they are causing damage or a nuisance, or during hunting and trapping seasons. The number of mammals lethally removed under this alternative and any direct or cumulative population impacts would likely be similar to the other alternatives. However, it is not expected that lethal removal would reach a level of significant direct or cumulative impacts to target wildlife populations.

Management actions could be undertaken by a property owner or manager, provided by private nuisance wildlife control agents, provided by volunteer services of private individuals or organizations, or provided by other entities such as the VDGIF. If direct operational assistance and technical assistance is not provided by WS or other entities, it is possible that a lack of technical knowledge could lead to misidentification and targeting of mammal(s) responsible for damage. It is also possible that frustration caused by the inability to reduce damage and threats along with ignorance on how best to reduce damage and threats could lead to the inappropriate use of legal methods and the use of illegal methods. This may occur if those persons or organizations providing technical assistance have less technical knowledge and experience managing wildlife damage than WS. Illegal, unsafe, and environmentally unfriendly actions could lead to unnecessary killing of wildlife. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

**Issue 2 - Effects of Damage Management Activities on Non-target Animals, Including Threatened and Endangered Species**

As discussed previously, a concern is often raised about the potential impacts to non-target animal populations, including threatened and endangered species, from the use of methods to resolve damage associated with mammals. The potential effects are analyzed below.

***Alternative 1 – WS Would Continue to Address Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)***

The potential adverse effects to non-targets occur from the employment of methods to address damage associated with mammals. Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance.

Standard Operating Procedures (SOPs) discussed in Chapter 2 ensure risks to non-target animals, including threatened and endangered species, would be reduced or prevented under the proposed action / no action alternative. Pertinent SOPs include not only the WS Decision Model (WS Directive 2.201) but also several other SOPs including the following. WS personnel are trained and experienced in the identification of animal damage, the identification of animals responsible for the damage, the identification of individual animals, and in the selection of and implementation of methods which are as species-specific as possible thus reducing the risks to non-target animals including threatened and endangered species. Management actions are directed towards specific animals or groups of animals responsible for causing damage or posing threats. WS consults with the USFWS or the NMFS and the VDGIF to determine the potential risks to federally and state listed threatened and endangered species in accordance with the ESA and Commonwealth laws. Non-lethal methods are given priority when addressing requests for assistance (WS Directive 2.101). Non-target animals captured in traps are released unless it is determined that the animal would not survive and or that the animal cannot be safely released. WS would only employ methods in response to a request for assistance after the property owner

or manager has signed a document agreeing to allow specific methods be used on property they own and/or manage.

### *Non-Lethal Methods*

Non-lethal methods have the potential to cause adverse effects to non-targets primarily through physical exclusion, frightening devices or deterrents (see Appendix B). Any exclusionary device erected to prevent access to resources could also potentially exclude non-target species; therefore adversely impacting that species. The use of frightening devices or deterrents may also disperse non-target species from the immediate area where they are employed. However, the potential impacts to non-targets, like the impacts to target species, are expected to be temporary. WS would not employ or recommend these methods be employed over large geographic areas or at such intensity that essential resources would be unavailable and that long term adverse impacts to non-target populations would occur.

Other non-lethal methods available for use under any of the alternatives are live-capture traps (see Appendix B). WS would use and recommend the use of target-specific attractants and place them or recommend they be placed in areas where target species are active to reduce the risk of capturing non-targets. WS would monitor or recommend traps be monitored frequently so non-target species can be released unharmed. Non-lethal methods are generally regarded as having minimal impacts on populations because individuals are unharmed. Therefore, non-lethal methods would not have any significant adverse impacts on non-target populations of wildlife including threatened and endangered species under this alternative.

Eagles may occur in or near areas where damage management activities are conducted. Routine activities conducted by WS' personnel under the proposed action / no action alternative could occur in areas where eagles are present, which could disrupt the current behavior of an eagle or eagles that are nearby during those activities. As discussed previously, "take" as defined by the Bald and Golden Eagle Protection Act, includes those actions that "disturb" eagles. Disturb has been defined under 50 CFR 22.3 as those actions that cause or are likely to cause injury to an eagle, a decrease in productivity, or nest abandonment by substantially interfering with their normal breeding, feeding, or sheltering behavior.

WS has reviewed those methods available under the proposed action / no action alternative and the use patterns of those methods. The routine measures that WS conducts would not meet the definition of disturb requiring a permit for the take of eagles. The USFWS states, "*Eagles are unlikely to be disturbed by routine use of roads, homes, or other facilities where such use was present before an eagle pair nesting in a given area. For instance, if eagles build a nest near your existing home, cabin, or place of business you do not need a permit.*" (USFWS 2012). Therefore, activities that are species specific and are not of a duration and intensity that would result in disturbance as defined by the Act would not result in non-purposeful take (e.g., unintentional disturbance of an eagle). Activities, such as walking to a site, discharging a firearm, riding an ATV or driving a boat, generally represent short-term disturbances to sites where those activities take place. WS would conduct activities that are located near eagle nests using the National Bald Eagle Management Guidelines (USFWS 2007). The categories that encompass most of these activities are Category D (off-road vehicle use), Category F (non-motorized recreation and human entry), and Category H (blasting and other loud, intermittent noises). These categories generally call for a buffer of 330 to 660 feet for category D and F, and a ½-mile buffer for category H. WS would take active measures to avoid disturbance of bald eagle nests by following the National Bald Eagle Management Guidelines. However, other routine activities conducted by WS do not meet the definition of "disturb" as defined under 50 CFR 22.3. Those methods and activities would not cause injuries to eagles and would not substantially interfere with the normal breeding, feeding, or sheltering behavior of eagles.

## *Lethal Methods*

As previously mentioned, eagles may occur in or near areas where management activities are conducted under the proposed action / no action alternative. Non-purposeful lethal removal of a bald or golden eagle or their nests is considered a “take” as defined by the Bald and Golden Eagle Protection Act. WS has reviewed those methods available under the proposed action / no action alternative and the use patterns of those methods. WS determined that the SOPs that WS uses while conducting damage management activities reduces the likelihood that eagles would be lethally removed (e.g., prohibiting placement of a snare within 50 feet of a carcass which may attract eagles). The number of bald eagles observed in the Eastern U.S. along routes surveyed during the Breeding Bird Survey has shown an increasing trend estimated at 8.6% since 1966 and 13.0% from 2003–2013 (Sauer et al. 2014). The number of both bald and golden eagles observed in the Commonwealth during the Christmas Bird Count has shown a dramatic increasing trend since 1966 (National Audubon Society 2010).

All of the lethal methods listed in Appendix B could be available under this alternative although not all methods would be available for direct implementation by all persons. M-44s (sodium cyanide) are only available for use by WS.

*Shooting* - In cases where shooting was selected as an appropriate method, identification of an individual target would occur prior to application, eliminating risks to non-targets. Additionally, suppressed firearms would be used when appropriate to minimize noise impacts to non-targets. WS’ recommendation that shooting be used would not increase risks to non-targets. Shooting would be selective for target species and the unintentional lethal removal of non-targets would not likely increase based on WS’ recommendation of the method.

*Euthanasia* - Non-target species captured during the implementation of non-lethal capture methods can usually be released prior to euthanasia which occurs subsequent to live-capture. Therefore, no adverse effects to non-targets would occur from the use of euthanasia methods by WS under this alternative. Similarly, WS’ recommendation of euthanasia methods would not increase risks to non-targets because these methods are selective for target species and the unintentional euthanasia of non-targets would not likely increase based on WS’ recommendation of the method.

*Snare (cable device)* - WS would use snares in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives to minimize risks to non-targets. These include but are not limited to § 29.1-521 of the Code of Virginia, 4VAC 15-40-221 and 4VAC 14-40-220 of the Virginia Administrative Code, WS Directive 2.450 and WS-Virginia Directive 2.450(b). WS’ recommendation of the use of snares as a method is not likely to increase the risk to non-targets.

*Bodygrip Trap (e.g., Conibear)* - WS would use bodygrip traps in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives to minimize risks to non-targets. These include but are not limited to § 29.1-521 of the Code of Virginia, 4VAC 15-40-190, 4VAC 15-40-195, 4VAC 15-40-200, and 4VAC 15-40-221 of the Virginia Administrative Code, and WS Directive 2.450. WS’ recommendation of the use of bodygrip traps as a method is not likely to increase the risk to non-targets.

*M-44s (sodium cyanide)* - A common concern regarding the use of M-44s is the potential risk to non-target animals, including threatened and endangered species. M-44s would be used by WS in

accordance with the EPA’s use restrictions (WS Directive 2.415) as well as WS-Virginia Directive 2.415(c) to minimize risks to non-targets.

*Rodenticides* - A common concern regarding the use of rodenticides is the potential risk to non-target animals, including threatened and endangered species. Rodenticides would be used by WS in accordance with their label and WS Directive 2.401 to minimize risks to non-targets.

*Direct, Indirect, and Cumulative Effects:*

The analysis to determine the impacts on non-targets from the use of both lethal and non-lethal methods is based on a measure of the number of individuals lethally removed. Methods would only be used by WS at the request of persons seeking assistance. The number of individuals of non-target species lethally removed during WS damage management activities outlined in the need for action in Virginia from FY 2009 to FY 2014 is shown in Table 3.21. WS lethal removal is shown in comparison to private harvest (for species which are harvestable). Those species lethally removed unintentionally by WS during management activities outlined in the need for action are common throughout Virginia and not considered to be of low density. WS’ unintentional lethal removal of animals that could occur as part of damage management activities outlined in the need for action is limited and is not expected to have any impact on local or statewide populations. The species of animals lethally removed unintentionally in the past by WS is representative of animals that could be unintentionally removed by WS under the proposed action / no action alternative. Additionally, other species could be lethally removed unintentionally during mammal damage management activities. However, the lethal removal of those species would occur infrequently and not at levels that would cause significant adverse effects to those species’ populations.

**Table 3.21 – Species and number of individual animals unintentionally lethally removed by WS during WS’ damage management activities outlined in the need for action compared to total number of individual animals lethally removed both unintentionally and intentionally by WS during WS’ damage management activities to protect other resources and private harvest.**

Species	WS’ Average Annual Lethal Removal (2009 to 2014) <sup>1</sup>			Average Annual Private Harvest <sup>3</sup> (2009 to 2014)
	Lethal removal during activities outlined in the need for action	Lethal removal during activities to manage damage to other resources <sup>2</sup>	Total lethal removal by WS	
Canada goose	<1	2,913	2,913	58,397 <sup>4</sup>
Great blue heron	<1	70	70	n/a
Great horned owl	<1	0	<1	n/a
Mallard	<1	234	234	38,978 <sup>4</sup>
Turkey vulture	<1	108	108	n/a
Turtle <sup>5</sup>	9	<1	9	5,337 <sup>6</sup>
Wild Turkey	<1	12	13	20,354 <sup>7</sup>

<sup>1</sup>Data reported by federal fiscal year. Figures are rounded to nearest whole number. <1 is defined as any number less than one.

<sup>2</sup>This lethal removal is analyzed in separate analyses pursuant to the NEPA

<sup>3</sup>Average annual private harvest includes Canada geese, mallards and wild turkeys taken by hunters as well as snapping turtles harvested for commercial sale.

<sup>4</sup>Hunter Harvest data reported by, Raftovich et al. 2011, Raftovich et al. 2012, Raftovich and Wilkins 2013, Raftovich et al. 2014, Raftovich et al. 2015. Great blue herons (*Ardea herodias*), great horned owls (*Bubo virginianus*) and turkey vultures (*Cathartes aura*) do not have annual harvest seasons.

<sup>5</sup>All turtle species combined. Majority of turtles were snapping turtles.

<sup>6</sup>Commercial snapping turtle harvest data, reported by calendar year, Benjamin Colteaux, personal communication 2015.

<sup>7</sup>Data reported by calendar year, wild turkey harvested 2009 to 2014, G. Norman, VDGIF, personal communication 2014.

The capture and lethal removal that could occur as part of damage management activities to protect resources other than those outlined in the need for action are addressed in separate analyses pursuant to the NEPA. However, species captured and lethally removed both intentionally and unintentionally as part of those damage management activities are also addressed in this EA to ensure a cumulative evaluation of potential effects under the proposed action / no action alternative. Average annual unintentional lethal removal by WS during activities to manage damage outlined in the need for action did not exceed one individual of any species except for turtles. With the exception of turtles, the cumulative impacts of lethal removal on non-target species are within the extent analyzed in separate analyses pursuant to the NEPA. Those documents concluded that WS would not adversely affect the viability of any wildlife species populations through program activities (USDA 2011, USDA 2014).

The average cumulative lethal removal of turtles by WS from FY 2009 to FY 2014 was 7.5 snapping turtles and 1.3 other turtle species (primarily painted turtles) per year. An average annual cumulative lethal removal of 7.5 snapping turtles represents 0.16% of the total average number of snapping turtles harvested annually by commercial operations in the Commonwealth. When compared to the harvest by commercial operations, the magnitude of lethal removal by WS would be considered low.

WS continually monitors, evaluates and makes modifications as necessary to methods or strategy when providing direct operational assistance, to not only reduce damage but also to minimize potentially harmful effects to non-targets. Additionally, WS would annually report lethal removal to the USFWS or VDGIF, which ensures cumulative impacts are considered as part of population management objectives. As previously mentioned, non-lethal methods are generally regarded as having minimal impacts on populations because individuals are unharmed. Therefore, non-lethal methods, including the live-capture and release of non-targets would not have any adverse impacts on non-target populations under this alternative. Unintentional lethal removal could result in declines in the number of individuals in a population; however, the lethal removal of non-target animals by WS under the proposed action would not reach a magnitude where adverse effects would occur to the population of any species.

#### *Threatened and Endangered Species:*

Special efforts are made to avoid jeopardizing threatened and endangered species. Threatened and endangered species listed by the USFWS or the National Marine Fisheries Service (NMFS) under the ESA for the Commonwealth can be found in Appendix C. These lists were obtained and reviewed during the development of this EA.

***Federally Listed Species*** - WS conducted a Biological Assessment, available upon request, to determine what affect, if any, the proposed activities could have on threatened and endangered species or their critical habitat. WS made a “may affect, but not likely to adversely affect” determination for the following species: piping plover, roseate tern, Appalachian monkeyface (*Quadrula sparsa*), birdwing pearlymussel (*Lemiox rimosus*), crackling pearlymussel (*Hemistena lata*), Cumberland bean (*Villosa trabalis*), Cumberland monkeyface (*Quadrula intermedia*), Cumberlandian combshell (*Epioblasma brevidens*), dromedary pearlymussel (*Dromus dromas*), dwarf wedgemussel (*Alasmidonta heterodon*), fanshell (*Cyprogenia stegaria*), finereyed pigtoe (*Fusconaia cuneolus*), fluted kidneyshell (*Ptychobranthus subtentum*), James spiny mussel (*Pleurobema collina*), oyster mussel (*Epioblasma capsaeformis*), purple bean (*Villosa perpurpurea*), rough rabbitsfoot (*Quadrula cylindrica strigillata*), sheepnose mussel (*Plethobasus cyphus*), shiny pigtoe (*Fusconaia cor*), slabside pearlymussel (*Pleuronaia dolabelloides*), snuffbox mussel (*Epioblasma triquetra*), spectaclecase (*Cumberlandia monodonta*), tan riffleshell mussel (*Epioblasma florentina walkeri* (=e. walkeri)), blackside dace (*Phoxinus cumberlandensis*), duskytail darter (*Etheostoma percnurum*), Roanoke logperch (*Percina rex*), slender chub (*Erimystax cahni*), spotfin chub (*Erimonax monachus*), yellowfin madtom

(*Noturus flavipinnis*), Lee County cave isopod (*Lirceus usdagalun*), swamp pink (*Helonias bullata*), and Northeastern bulrush (*Scirpus ancistrochaetus*). WS conducted an informal Section 7 consultation with the USFWS in which the USFWS concurred with WS' determination (Jennifer Stanhope, USFWS, personal communication, January 23, 2017).

**State Listed Species** - The current list of species designated as endangered, threatened, or special concern by the state, as determined by the VDGIF, was obtained and reviewed during the development of the EA (see Appendix D). Based on the review of species listed, WS has determined that the proposed activities would have no effect or would not likely adversely effect the species currently listed by the state.

#### **Summary of non-target animal impact analysis**

Based on WS' determination, the employment of methods by WS would not likely adversely directly or cumulatively affect any non-targets, including threatened and endangered species. No potential indirect effects were identified. WS continually monitors, evaluates and makes modifications as necessary to methods or strategy when providing direct operational assistance, to not only reduce damage but also to minimize potentially harmful effects to non-targets. Additionally, WS consults with the USFWS and the VDGIF to determine the potential risks to eagles and federally and state listed threatened and endangered species in accordance with the Bald and Golden Eagle Protection Act, ESA and Commonwealth laws and annually reports to these entities to ensure that any non-target lethal removal by WS is considered as part of management objectives. Potential direct and cumulative impacts to non-targets, including threatened and endangered species, from the recommendation of methods by WS under this alternative would be expected to be insignificant. No indirect effects were identified for this issue.

#### ***Alternative 2 – WS Would Address Mammal Damage Using Technical Assistance Only***

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with mammals with technical assistance only. Direct operational assistance provided by WS as described above would not be available.

Despite no direct involvement by WS in resolving damage and threats, those persons experiencing damage caused by mammals could continue to alleviate damage by employing both non-lethal and lethal methods. With the exception of M-44s (sodium cyanide), all methods listed in Appendix B could be available under this alternative. Non-lethal methods have the potential to inadvertently disperse non-target animals while lethal methods have the potential to inadvertently capture or kill non-target animals as described under Alternative 1.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action. Therefore, non-target populations would not be directly impacted by WS from a program implementing technical assistance only.

#### ***Direct, Indirect, and Cumulative Effects:***

If direct operational assistance is not provided by WS or other entities, it is possible that frustration caused by the inability to reduce damage and threats could lead to the inappropriate use of legal methods or the use of illegal methods which could lead to real but unknown effects on other animal populations. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003).

Potential impacts to non-target animals, including threatened and endangered species, from the recommendation of methods by WS under this alternative would be variable. If methods were employed as recommended by WS, potential direct or cumulative risks to non-targets would likely be low and similar to the proposed action / no action alternative. WS' involvement would not be additive to lethal removal that could occur since the individual requesting WS' assistance could conduct damage management activities without WS' involvement. However, if methods were not employed as recommended or methods that are not recommended were employed, potential direct, indirect or cumulative impacts to non-targets are likely to be higher. However, impacts would not be expected to be significant.

### ***Alternative 3 – WS Would Not Address Mammal Damage***

WS would not be involved with any aspect of managing damage associated with mammals. Therefore, WS would have no direct impact to non-targets or threatened and endangered species under this alternative. All requests for assistance received by WS to resolve damage associated with mammals would be referred to the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. Lethal removal could continue as stated under Alternative 2.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

#### ***Direct, Indirect, and Cumulative Effects:***

Potential impacts to non-target species, including threatened and endangered species, would be variable under this alternative. If direct operational assistance and technical assistance is not provided by WS or other entities, it is possible that frustration caused by the inability to reduce damage and threats along with ignorance on how best to reduce damage and threats could lead to the inappropriate use of legal methods and the use of illegal methods. Illegal, unsafe, and environmentally unfriendly actions could lead to unnecessary killing of non-target animals. In the past, people have resorted to the illegal use of chemicals and methods to alleviate wildlife damage issues (White et al. 1989, USFWS 2001, FDA 2003). However, if appropriate direct operational assistance and technical assistance was provided by persons knowledgeable and experienced in managing damage associated with mammals, the risks would be similar to Alternative 2. However, impacts would not be expected to be significant.

### **Issue 3 - Effects of Damage Management Activities on Human Health and Safety**

An additional issue often raised is the potential risks to human health and safety associated with the methods employed to manage damage associated with mammals. Both chemical and non-chemical methods have the potential to have adverse direct, indirect or cumulative effects on human health and safety. Risks can occur both to persons employing methods and persons coming into contact with methods. Risks can be inherent to the method itself or related to the misuse of the method. Potential effects of damage management activities on human health and safety under each of the three alternatives are analyzed below.

***Alternative 1 – WS Would Continue to Address Mammal Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)***

Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. Standard Operating Procedures (SOPs) discussed in Chapter 2 ensure risks to human health and safety would be reduced or prevented. Pertinent SOPs include not only the WS Decision Model (WS Directive 2.201), an evaluation process for the appropriateness of methods (WS Directive 2.101) and the use of integrated management (WS Directive 2.105), but also several other precautions including the following. WS identifies hazards in advance of work assignments and provides employees with personal protective equipment (PPE). WS employees must adhere to safety requirements and use appropriate PPE. WS employees are required to work cooperatively to minimize hazards and immediately report unsafe working conditions (WS Directive 2.601). Damage management activities would be conducted away from areas of high human activity (e.g., in areas closed to the public) or during periods when human activity is low (e.g., early mornings, at night) to the extent possible. WS would only conduct mammal damage management activities on a given property in response to a request for assistance after the property owner or manager has signed a document agreeing to allow the use of specific methods on property they own and/or manage. Although hazards to human health and safety from both non-lethal and lethal methods exist, those methods would generally be regarded as safe when used by individuals trained and experienced in their use and with regard and consideration of possible risks to human health and safety.

***Direct, Indirect, and Cumulative Effects:***

Non-chemical methods available for use under any of the alternatives are: live-capture traps (e.g., foot hold traps, cage traps), lethal traps (i.e., bodygrip traps) and snares (cable devices) (see Appendix B). The risk traps and snares (cable devices) pose to human health and safety are small to non-existent. Traps can only be triggered through direct activation of the device. Therefore, if left undisturbed, these traps would pose no risk. WS would use traps and snares in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives. WS would not implement these methods in locations or in such a manner in which they would pose hazards to WS staff or the public. When recommending these methods, WS would caution against their misuse.

WS personnel are trained and experienced in the use of firearms. WS employees who use shooting as a method must comply with WS Directive 2.615 and all standards described in the WS Firearms Safety Training Manual. Directive 2.615 requires that personnel undergo regular training, adhere to a set of safety standards, submit to drug testing, and are subject to the Lautenberg Amendment. WS' recommendation that hunting or shooting be used would not increase risks to human health and safety above those already inherent. When used appropriately and with consideration of human safety, risks associated with firearms are minimal. When recommending that hunting or shooting be used, WS would caution against the improper use of firearms. Because the use of firearms would be available under any of the alternatives and their use could occur whether WS was consulted or not, the risks to human health and safety would be similar among all the alternatives.

WS personnel are trained and experienced in the use of explosives. WS employees who are authorized to use explosives as a method must comply with all policies, procedures, and training requirements described in the WS Explosives Safety Manual and WS Directives 2.625 and 2.435. Risks associated with explosives are minimal when used appropriately and with consideration of human safety. When recommending that explosives be used, WS would caution against their improper use. Because the use of explosives would be available under any of the alternatives and their use could occur whether WS was consulted or not, the risks to human health and safety would be similar among all the alternatives.



All chemical methods listed in Appendix B could be available under this alternative; although not all methods would be available for direct implementation by all persons (M-44s (sodium cyanide) are only available for use by WS). The use of chemical methods is strictly regulated by the DEA, EPA, FDA and VDACS. Chemical methods used or recommended by WS would be registered as required by federal and state law (see Appendix B). When recommending chemical methods, WS would caution those persons against their misuse. Following label requirements eliminates risks to human health and safety.

The use of some pesticides (e.g., M-44s, zinc phosphide) is restricted to those persons who have been specifically trained and certified by the VDACS for their use. WS personnel that use restricted use pesticides would be certified as pesticide applicators by the Commonwealth of Virginia and would be required to wear appropriate PPE they are provided with (WS Directive 2.601).

M-44s would be used by WS in accordance with the label and EPA's use restrictions to minimize risks to human health and safety (WS Directive 2.415). WS use of M-44s to protect livestock would be restricted to fenced areas where livestock graze in accordance with WS-Virginia Directive 2.415(c). Because M-44s administer sodium cyanide in a single dose, the risk of exposure is primarily dependent upon a person approaching and physically triggering a device by pulling on the top of the device which is staked into the ground and covered in a fetid attractant or lure. Sodium cyanide is supplied by the manufacture to the applicator in sealed single dose capsules which are inserted directly into the M-44 device. Requirements for storage, transport and application of these capsules eliminates the likelihood that humans would be exposed to sodium cyanide in the environment. Thus, a potential impact to humans from environmental exposure is minimal to non-existent. Of additional concern is the potential exposure of people to animals that have ingested sodium cyanide. However, the chemical reaction and mode of action (chemical asphyxiation) limits the amount of compound present in the environment or in tissues that could be available to persons handling or consuming these animals (Howard and Hanzal 1955). Additionally, if ingested at sub-toxic levels, sodium cyanide is rapidly detoxified and excreted by the kidneys (EPA 2006a, HSDB 2015).

The use of chemical immobilization and euthanasia drugs or substances is restricted. WS personnel that possess or use these substances would be trained and certified in accordance with WS Directive 2.430. WS personnel that use these drugs or substances would be required to wear appropriate PPE they are provided with (WS Directive 2.601). Additionally, *"the acquisition, storage, and use of ... (these substances would be) ... in compliance with applicable program, Federal, State, and local law and regulations"* (WS Directive 2.430). When using immobilizing drugs, WS would adhere to all established withdrawal times agreed upon by WS, the VDGIF, and veterinarian authorities. If WS receives a request to immobilize mammals during a period of time when the regulated harvest of those species was occurring or during period of time where the withdrawal period could overlap with a harvest season, WS would euthanize the animal or mark the animal with ear tags labeled with a *"do not eat"* warning. This would eliminate risks to human health and safety from persons consuming animals that had or potentially had immobilizing drugs remaining in their systems.

Although no significant impacts to human safety occurred from WS' use of methods to alleviate damage associated with mammals in Virginia from FY 2009 to FY 2014, two minor incidents did occur during this period of time. In FY 2013, a member of the public received a minor abrasion and light bruise but no significant injury when they entered an area that was closed to the public (closed area was designated with signs) and stepped on a foot-hold trap. In FY 2014, one WS employee sustained heavy bruising to one of his hands when it was pinched in a body-grip trap.

The direct, indirect or cumulative risks to human safety from the use of chemical and non-chemical methods, when used appropriately and by trained personnel, is considered insignificant. The amount of

chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. Based on potential use patterns, the chemical and physical characteristics of the above mentioned chemical methods, and factors related to the environmental fate, no significant direct, indirect or cumulative impacts are expected from the chemical components used or recommended by the WS program.

### ***Alternative 2 – WS Would Address Mammal Damage Using Technical Assistance Only***

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with mammals with technical assistance only. Direct operational assistance provided by WS as described above would not be available. This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals.

Despite no direct involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage could continue to alleviate damage by employing both non-chemical and chemical methods. With the exception of M-44s (sodium cyanide), all methods listed in Appendix B could be available under this alternative.

#### *Direct, Indirect, and Cumulative Effects:*

Private efforts to reduce or prevent damage would be expected to increase, and would likely result in less experienced persons implementing damage management methods which may have a greater risk to human health and safety than under Alternative 1. Ignorance and/or frustration caused by the inability to reduce losses could lead to illegal use of toxicants by others which could lead to unknown impacts to humans.

Potential impacts to human health and safety from the recommendation of methods by WS under this alternative would be variable. If methods were employed as recommended by WS and according to label requirements, in the case of chemical methods, potential risks to human health would likely be similar to the proposed action / no action alternative. However, if methods were not employed as recommended or methods that are not recommended are employed, risks could increase. However, impacts would not be expected to be significant.

### ***Alternative 3 – WS Would Not Address Mammal Damage***

Under this alternative, WS would not be involved with any aspect of managing damage associated with mammals. Therefore, WS would have no direct impact to human health and safety under this alternative. All requests for assistance received by WS to resolve damage associated with mammals would be referred to the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage could continue to alleviate damage by employing both non-chemical and chemical methods. This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, private businesses and/or private individuals. Those persons experiencing damage or threats could take action using those methods legally available to resolve or prevent damage as permitted by federal, Commonwealth, and local laws and regulations or those persons could take no action.

#### *Direct, Indirect, and Cumulative Effects:*

Potential impacts to human health and safety would be variable under this alternative. If direct operational assistance and technical assistance is not provided by WS or other entities, it is possible that

frustration caused by the inability to reduce damage and threats along with ignorance on how best to reduce damage and threats could lead to the inappropriate use of legal methods and the use of illegal methods. Illegal, unsafe, and environmentally unfriendly actions could lead to higher risk to health and safety. However, if appropriate direct operational assistance and technical assistance was provided by persons knowledgeable and experienced in managing damage caused by mammals, the risks would be similar to Alternative 2. Additionally, impacts would not be expected to be significant.

#### **Issue 4 – Humaneness and Animal Welfare Concerns**

As described in Chapter 2, humaneness and animal welfare concerns associated with methods available to reduce damage associated with mammals has been identified as an issue. The humaneness and animal welfare concerns of the methods as they relate to the alternatives are discussed below.

##### ***Alternative 1 – WS Would Continue to Address Mammal Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)***

Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance.

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. Under this alternative, WS could employ or recommend methods viewed as inhumane by some persons. This could include WS killing or capturing and either subsequently killing or immobilizing and then releasing target animals using the best and most appropriate method(s) available. WS’ use of methods under the proposed action / no action alternative would adhere to applicable state and local laws and regulations as well as WS’ Directives (see Appendix B for WS Directives specific to methods). These include but are not limited to guidelines for the types of devices or drugs which can be used, frequency in which capture devices must be checked and manner in which they must be applied. When recommending methods, WS would caution against their misuse.

The AVMA states “... euthanasia is the act of inducing humane death in an animal” and that “... if an animal’s life is to be taken, it is done with the highest degree of respect, and with an emphasis on making the death as painless and distress free as possible” (AVMA 2013). Additionally, euthanasia methods should minimize any stress and anxiety experienced by the animal prior to unconsciousness.” Although use of euthanasia methods to end an animal’s life is desirable, as noted by the AVMA, 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 use terms such as killing, collecting, or harvesting, recognizing that a distress-free death may not be possible (AVMA 2007).

AVMA (2013) notes, “While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as appropriate for a particular species may not be available or may become less than an ideal choice due to differences in circumstances. Conversely, when settings are atypical, methods normally not considered appropriate may become the method of choice. Under such conditions, the humaneness (or perceived lack thereof) of the method used to bring about the death of an animal may be distinguished from the intent or outcome associated with an act of killing. Following this reasoning, it may still be an act of euthanasia to kill an animal in a manner that is not perfectly humane or that would not be considered appropriate in other contexts. For example, due to lack of control over free-ranging wildlife and the stress associated with close human contact, use of a firearm may be the most appropriate means of euthanasia. Also, shooting a suffering animal that is in extremis, instead of catching and transporting it to a clinic to euthanize it using a method normally considered to be appropriate (e.g., barbiturates), is consistent with

one interpretation of a good death. The former method promotes the animal's overall interests by ending its misery quickly, even though the latter technique may be considered to be more acceptable under normal conditions (Yeates 2010). Neither of these examples, however, absolves the individual from her or his responsibility to ensure that recommended methods and agents of euthanasia are preferentially used.

AVMA (2013) recognizes that there is "an inherent lack of control over free-ranging wildlife," accepting that firearms may be the most appropriate approach to their euthanasia, and acknowledging that the quickest and most humane means of terminating the life of free-ranging wildlife in a given situation may not always meet all criteria established for euthanasia (i.e., distinguishes between euthanasia and methods that are more accurately characterized as humane killing). Because of the variety of situations that may be encountered, it is difficult to strictly classify methods for termination of free-ranging wildlife as acceptable, acceptable with conditions, or unacceptable. Furthermore, classification of a given method as a means of euthanasia or humane killing may vary by circumstances. These acknowledgments are not intended to condone a lower standard for the humane termination of wildlife. The best methods possible under the circumstances must be applied, and new technology and methods demonstrated to be superior to previously used methods must be embraced.

*Direct, Indirect, and Cumulative Effects:*

M-44s (sodium cyanide), would only be available for use under this alternative. An assessment of humaneness of specific toxicants can include the time that elapses until death. Sodium cyanide is a fast acting chemical administered in a single dose in the M-44 device (EPA 2006b). The majority of coyotes triggering M-44 devices and receiving a dose of sodium cyanide died within 1–5 minutes (Burns et al. 1990).

The efficacy and therefore, the humaneness of methods would be based on the skill and knowledge of the person employing methods. WS personnel are experienced professionals skilled in their use of methods. When selecting methods, WS evaluates all potential tools for their humaneness, effectiveness, ability to target specific species and individuals, as well as other factors. Consequently, management methods would be implemented by WS in the most humane manner possible. With the exception of M-44s, all methods listed in the Appendix B would be available for use under any of the alternatives. Therefore, the issue of humaneness associated with methods and any direct impacts would be similar across any of the alternatives since those methods could be employed 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 2.

WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations where non-lethal damage management methods are not practical or effective. No indirect adverse impacts were identified for this issue.

***Alternative 2 – WS Would Address Mammal Damage Using Technical Assistance Only***

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with mammals with technical assistance only. Direct operational assistance provided by WS as described above would not be available.

Despite no direct involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal

methods. The issue of humaneness of methods under this alternative is likely to be perceived as similar to humaneness issues discussed under the proposed action / no action alternative. 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 / no action alternative.

*Direct, Indirect, and Cumulative Effects:*

WS could instruct and demonstrate the proper use and placement of methodologies to increase effectiveness in capturing target species and to ensure methods are used in such a way as to minimize pain and suffering. However, the efficacy of methods employed by an individual would be based on the skill and knowledge of the requester in resolving the damage despite WS' demonstration. Therefore, a lack of understanding of the behavior of mammals or the improper identification of the animal causing damage along with inadequate knowledge and skill in using methodologies to alleviate the damage or threats could lead to incidents with a greater probability of being perceived as inhumane. In those situations, the pain and suffering are likely to be regarded as greater than those discussed in the proposed action / no action alternative.

Those people requesting assistance would be directly responsible for the use and placement of methods and if monitoring or checking of those methods does not occur in a timely manner, captured animals could experience suffering or distress. The amount of time an animal is restrained under the proposed action / no action alternative would be shorter compared to a technical assistance alternative if those persons requesting assistance and implementing methods are not as diligent or timely in checking methods. If those persons requesting assistance from WS apply methods recommended by WS as intended, then those methods would be applied as humanely as possible to minimize pain and distress. If those persons provided technical assistance by WS apply methods not recommended by WS or do not employ methods as intended or without regard for humaneness, then the issue of method humaneness would be of greater concern since pain and distress of animals would likely be higher.

***Alternative 3 – WS Would Not Address Mammal Damage***

Under this alternative, WS would not be involved with any aspect of managing damage associated with mammals. All requests for assistance received by WS to resolve damage associated with mammals would be referred to the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities.

Despite no involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods. 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. A method considered inhumane would still be perceived as inhumane regardless of the person or entity applying the method. However, even methods generally regarded as being humane could be employed in inhumane ways. Methods could be employed inhumanely by those people inexperienced in the use of those methods or if those people were not as diligent in attending to those methods.

*Direct, Indirect, and Cumulative Effects:*

The efficacy and therefore, 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 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 alleviate damage and threats associated with mammals. Therefore, those methods considered inhumane would continue to be available for use under this alternative. If those people experiencing damage apply those methods considered humane methods as intended and in consideration of the humane use of those methods, then the issue of method humaneness would be similar across the alternatives. If those persons experiencing damage were not provided with information and demonstration on the proper use of those methods and employed humane methods in ways that were inhumane, the issue of method humaneness could be greater under this alternative. However, the level at which people would apply humane methods inhumane under this alternative based on a lack of assistance is difficult to determine and could just as likely be similar across the alternatives.

### **Issue 5 – Effects of Damage Management Activities on the Aesthetic Values of Mammals**

People often enjoy watching or hearing wild mammals and take pleasure from knowing they exist as part of the natural environment. The aesthetic value of cats and dogs may for some people be linked to their status (i.e., owned and under the owner's direct control, owned but free-ranging or feral). Some owners may never confine or restrain their pet and enjoy knowing they have the freedom of being free-ranging. These people may view their pet differently than an un-owned free-ranging or feral animal. Those methods available to alleviate damage are intended to disperse and/or remove mammals. These activities reduce the presence of target species in the area where damage is occurring. Therefore, these activities have the potential to affect the aesthetic values of mammals depending upon the values, philosophies, attitudes and opinions of individuals. The effects on the aesthetic value of mammals as it relates to the alternatives are discussed below. No indirect effects were identified for this issue.

#### ***Alternative 1 – WS Would Continue to Address Mammal Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)***

Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The implementation or recommendation of methods by WS under this alternative would likely result in the dispersal, exclusion, or removal of individual animals to alleviate damage and threats. In some instances where animals were dispersed or removed, the ability of interested persons to observe and enjoy these animals could temporarily decline. Those animals removed, dispersed or lethally removed by WS under this alternative, would likely be those same animals that could and likely would be removed, dispersed or lethally removed by those individuals experiencing damage in the absence of assistance from WS. Since those animals removed, dispersed or lethally removed by WS under this alternative could be removed by other entities, WS' involvement would not likely be additive to the number of animals that could be removed in the absence of WS' involvement. In many damage situations, lethal removal of wild mammals addressed in this document could occur at any time, or during hunting and trapping seasons.

#### ***Direct, Indirect, and Cumulative Effects:***

WS' lethal removal of mammals over the last six years has been of low magnitude when compared to the private harvest of wild mammals and the number of cats and dogs that were euthanized and died while in the custody of Virginia's rescue agencies, city and county facilities (see Issue 1, Alternative 1 for additional information on impacts to target animals). Given the limited lethal removal proposed by WS under this alternative when compared to the known sources of mortality and population information, mammal damage management activities conducted by WS pursuant to the proposed action / no action alternative would not adversely affect the aesthetic value of mammals.

When damage associated with mammals has occurred, any removal of animals by the property or resource owner would likely occur whether WS was involved with taking the animals or not. Therefore, the activities of WS are not expected to have any direct, indirect or cumulative adverse effects on this element of the human environment if occurring at the request of a property owner and/or manager.

### ***Alternative 2 – WS Would Address Mammal Damage Using Technical Assistance Only***

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with mammals with technical assistance only. Direct operational assistance provided by WS as described above would not be available. The provision of technical assistance by WS under this alternative is unlikely to increase the number of animals addressed because those individuals experiencing damage could and likely would employ both lethal and non-lethal methods in the absence of WS' assistance.

#### ***Direct, Indirect, and Cumulative Effects:***

Since animals could continue to be lethally removed, removed or dispersed under this alternative, despite WS' lack of direct involvement, the aesthetic values associated with mammals would likely be similar to the other alternatives. The lack of WS' direct involvement would not lead to a reduction in the number of animals removed, dispersed or lethally removed since WS has no authority to regulate the removal, harassment or lethal removal of wild mammals, cats or dogs. That authority rests with the VDGIF (in the case of wild mammals), VDACS, or local law enforcement or animal control authorities (in the case of cats and dogs). Because those individuals experiencing damage could and likely would continue to employ both lethal and non-lethal methods, despite WS' lack of direct involvement under this alternative, the impacts to the aesthetic value of mammals and any direct, indirect or cumulative impacts would be similar to the other alternatives. Impacts would only be lower than the proposed action / no action alternative if those individuals experiencing damage were not as diligent in employing methods as WS would be if conducting direct operational assistance. If those people experiencing damage abandoned the use of those methods then those mammals associated with the damage would likely remain in the area and available for observing by those people interested in doing so.

### ***Alternative 3 – WS Would Not Address Mammal Damage***

Under this alternative, WS would not be involved with any aspect of mammal damage management. Therefore, WS would have no direct impact on the aesthetic values of mammals under this alternative. All requests for assistance received by WS to resolve damage associated with mammals would be referred to the VDGIF, the VDACS, local law enforcement or animal control authorities and/or private entities. Despite no involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods.

#### ***Direct, Indirect, and Cumulative Effects:***

Since animals could continue to be removed, harassed or lethally removed under this alternative, despite WS' lack of involvement, the ability to watch or hear these animals would likely be similar to the other alternatives. The lack of WS' involvement would not lead to a reduction in the number of animals removed, harassed or lethally removed since WS has no regulatory authority. That authority rests with the VDGIF (in the case of wild mammals), VDACS, or local law enforcement or animal control authorities (in the case of cats and dogs). Under this alternative, those individuals experiencing damage could and likely would continue to employ both lethal and non-lethal methods, despite WS' lack of involvement. Therefore, the impacts to the aesthetic value of mammals and any direct, indirect or cumulative impacts would be similar to the other alternatives. Impacts would only be lower than the proposed action / no action alternative if those individuals experiencing damage were not as diligent in

employing methods as WS would be if conducting direct operational assistance. If those people experiencing damage abandoned the use of those methods then the mammals associated with the damage would likely remain in the area and available for observing by those people interested in doing so.

### **Issue 6 – Effects of Damage Management Activities on the Regulated Harvest of Mammals**

Another issue commonly identified as a concern is that damage management activities conducted by WS could affect the ability of hunters or trappers to harvest species targeted by management activities. Potential impacts could arise from both lethal and non-lethal damage management methods. Non-lethal methods disperse or otherwise make an area where damage is occurring unattractive to the species (target species) causing the damage, thereby reducing the presence of those species in the area. Lethal methods remove individuals of the target species causing the damage, thereby reducing the local population and the presence of those species in the area. Therefore, lethal methods could reduce the local population or the presence of mammals in the area where damage management activities are occurring. Virginia opossum, Eastern cottontail, woodchuck, fox squirrel, grey squirrel, beaver, nutria, muskrat, coyote, red fox, black bear, raccoon, mink, striped skunk, river otter, bobcat, white-tailed deer, and feral swine may be harvested by hunters and/or trappers.

#### ***Alternative 1 – WS Would Continue to Address Mammal Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)***

Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The VDGIF is responsible for classifying mammals as fur-bearing animals, game animals or nuisance species and establishing and enforcing hunting and trapping seasons and licensing fur dealers. With the exception of nutria and feral swine, the proposed number of lethally removed mammals would be of low magnitude when compared to the private harvest (see Issue 1, Alternative 1 for additional species specific information). Nutria and feral swine are non-native species and are not afforded any protection by the state or federal government.

#### ***Direct, Indirect, and Cumulative Effects:***

With oversight by the VDGIF, the lethal removal of mammals by WS or the recommendation of lethal methods by WS would not limit the ability to harvest these species. All lethal removal by WS would be reported to VDGIF annually to ensure that removal by WS is incorporated into cumulative population management objectives established for these species. Given the increasing or stable number of observations of many of the mammals outlined in the need for action during the bowhunter surveys, WS' proposed lethal removal as well as the cumulative lethal removal from all known sources is below the level of removal that would cause a decrease in the population. Based on the limited lethal removal proposed by WS and the oversight by VDGIF, WS' lethal removal of mammals under this alternative would have no direct, indirect, or cumulative effect on the ability of those people interested in harvesting these species.

#### ***Alternative 2 – WS Would Address Mammal Damage Using Technical Assistance Only***

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with mammals with technical assistance only. Direct operational assistance provided by WS as described above would not be available. The provision of technical assistance by WS under this alternative is unlikely to increase the number of animals addressed because those individuals experiencing damage likely would employ both lethal and non-lethal methods in the absence of WS' assistance.



*Direct, Indirect, and Cumulative Effects:*

Since mammals could continue to be lethally removed or dispersed under this alternative, despite WS' lack of direct involvement, the ability to harvest these animals would be similar among the alternatives. WS' recommendation of methods would not limit the ability of those people interested in harvesting animals from doing so. The number of animals lethally removed annually would be regulated and adjusted by the VDGIF. Direct, indirect and cumulative effects would be similar to Alternative 1.

***Alternative 3 – WS Would Not Address Mammal Damage***

Under this alternative, WS would not be involved with any aspect of mammal damage management. Therefore, WS would have no direct impact on the ability to harvest animals under this alternative. Despite no involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage could continue to alleviate damage by employing both non-lethal and lethal methods.

*Direct, Indirect, and Cumulative Effects:*

The number of animals lethally removed annually would be regulated and adjusted by the VDGIF. Direct, indirect and cumulative effects would be similar to Alternative 1.

**Issue 7 – Effects of Beaver Removal and Dam Manipulation or Removal on Wetlands**

As described in Chapter 2, another issue raised is that activities to alleviate damage and threats associated with beavers would result in the loss of wetlands and the plant and animal species associated with wetland habitat. The issue of WS' potential impacts to wetlands could occur from activities conducted to alleviate damage or threats of damage associated with beaver, primarily from the breaching or removal of beaver dams. Beaver dams obstruct the normal flow of water, which can change the preexisting hydrology from flowing or circulating waters to slower, deeper, more expansive waters. Over time, beaver dams can establish new wetlands. Therefore, the breaching or removal of a beaver dam could result in the degradation or loss of a wetland, if wetland characteristics exist at a location where a beaver dam occurs.

Additionally, there is a concern that if beaver are removed from an area but the beaver dam was left undisturbed, the lack of maintenance to the dam by beaver would likely result in the eventual recession of the impounded water as weathering eroded the dam which could lead to the degradation or loss of a wetland. There is also a concern that the removal of beaver in conjunction with the breaching or removal of a beaver dam could not only lead to the degradation or loss of a wetland but also prevent the establishment of new wetlands.

***Alternative 1 – WS Would Continue to Address Mammal Damage through an Adaptive Integrated Approach (Proposed Action / No Action Alternative)***

Under the proposed action / no action alternative, WS could provide both technical assistance and direct operational assistance to those persons requesting assistance. The implementation or recommendation of methods by WS under this alternative would likely result in the dispersal or lethal removal of beaver and or the removal or manipulation of dams or the installation of water flow devices. The removal or manipulation of dams or installation of water flow devices would reestablish the preexisting hydrology which could lead to the degradation or loss of a wetland (if one was present) (e.g., reduce water levels to alleviate flooding). Overtime, the dispersal or lethal removal of beaver or alternatively the dispersal or lethal removal of beaver in conjunction with the removal or manipulation of dams or the installation of water flow devices could also reestablish the preexisting hydrology which could lead to the degradation or loss of a wetland (if one was present) or prevent the establishment of new wetlands. The intent of these actions would be to reduce the damage associated with beavers and dams, not to degrade wetlands.

Standard Operating Procedures (SOPs) for beaver damage management discussed in Chapter 2 ensure impacts to wetlands are reduced or eliminated. Pertinent SOPs include not only the WS Decision Model (WS Directive 2.201), an evaluation process for the appropriateness of methods (WS Directive 2.101) and the use of integrated management (WS Directive 2.105), but also several other precautions. WS would remove beaver dams in accordance with federal and state laws and regulations for environmental protection. The removal of beaver dams is regulated under Section 404 of the Clean Water Act (CWA) and Virginia’s State Water Control Law (SWCL). Upon receiving a request to conduct direct operational assistance, WS would visually inspect the dam and the associated water impoundment to determine if removal of the dam would require consultation under section 404 of the CWA (40 CFR 232.2) and/or Virginia’s SWCL. If necessary, WS would consult with the U.S. Army Corps of Engineers (USACE) and the Virginia Department of Environmental Quality (VDEQ), or advise those persons requesting direct operational assistance consult with the USACE and the VDEQ, to determine if a permit or mitigation would be necessary to remove the beaver dam while ensuring compliance with the CWA. When providing technical assistance to those persons requesting assistance with damage associated with beaver dams, WS would advise those persons requesting assistance contact the USACE and the VDEQ.

Under the proposed action/no action alternative, WS could breach, remove or install water control devices on 600 dams annually. From FY 2009 to FY 2014, WS removed or breached an average of 230 beaver dams (225 with hand tools and five with explosives) annually in response to requests for assistance to reduce damage and threats (Table 3.22). These activities occurred in accordance with guidance from the USACE.

**Table 3.22 – Number of beaver dams addressed in Virginia from 2009 to 2014<sup>1</sup>.**

<b>Year</b>	<b>Number of dams breached with hand tools</b>	<b>Number of dams breached with explosives</b>	<b>Total number of dams breached or removed by WS</b>
<b>2009</b>	261	11	272
<b>2010</b>	159	7	166
<b>2011</b>	208	5	213
<b>2012</b>	223	3	226
<b>2013</b>	256	3	259
<b>2014</b>	244	2	246
<b>AVERAGE ANNUAL</b>	<b>225</b>	<b>5</b>	<b>230</b>

<sup>1</sup>Data reported by federal fiscal year.

WS personnel are trained and experienced in the identification of animal damage, the identification of animals responsible for the damage, in the identification of wetlands, and in the selection of and implementation of methods which reduce or eliminate impacts to the environment including wetlands. WS consults with the USACE and the VDEQ to determine the potential impacts to wetlands from WS activities.

*Direct, Indirect, and Cumulative Effects:*

The manipulation of water levels by WS through dam breaching, dam removal, or installation of water flow devices would typically be associated with dams constructed during recent beaver activity. Therefore, conditions at the site would not have existed long enough for a true wetland to become established (i.e., hydric soils, hydrophytic vegetation, and hydrological function). WS’ activities associated with dam breaching, dam removal, or the installation of water flow devices would only be

conducted to restore the normal flow of water through drainages, streams, creeks, canals, and other watercourses where flooding damage was occurring or would occur and would not affect substrate.

All methods available to address beaver damage would be available for use under any of the alternatives. WS would not employ but may recommend the use of heavy equipment to resolve damage associated with beaver dams under this alternative. Those beavers dispersed or lethally removed and or the removal or manipulation of dams by WS under this alternative would likely be those same beavers or dams that could and likely would be dispersed, removed or manipulated by those individuals experiencing damage in the absence of assistance from WS. Since those animals or dams dispersed, removed or manipulated by WS under this alternative could be removed by other entities, WS' involvement would not likely be additive to the number of beavers or dams that could be dispersed, removed or manipulated in the absence of WS' involvement. The lethal removal of beavers can occur throughout the year by a landowner when they are causing damage or a nuisance or posing a threat to human health or safety, or during trapping seasons. The removal or manipulation of dams can occur in accordance with the CWA and/or Virginia's SWCL. Therefore, the activities of WS are not expected to have any direct, indirect or cumulative adverse effects.

### ***Alternative 2 – WS Would Address Mammal Damage Using Technical Assistance Only***

Under this alternative, WS would provide those persons requesting assistance with managing damage and threats associated with mammals with technical assistance only. Direct operational assistance provided by WS as described above would not be available. The provision of technical assistance by WS under this alternative is unlikely to increase the number of beavers or dams addressed because those individuals experiencing damage likely would employ both lethal and non-lethal methods in the absence of WS' assistance. All methods listed in Appendix B could be available under this alternative. However the use of explosives maybe limited since the property owner or manager would be required to locate a person properly licensed to use explosives and willing to conduct the work.

#### ***Direct, Indirect, and Cumulative Effects:***

Since beavers could continue to be dispersed or lethally removed and dams could continue to be removed or manipulated or water flow devices installed under this alternative, despite WS' lack of direct involvement, the impacts to wetlands would be similar among the alternatives. The number of beavers lethally removed annually is regulated by the VDGIF and the circumstances under which dams can be removed is regulated under the CWA and/or Virginia's SWCL. Direct, indirect and cumulative effects would be similar to Alternative 1.

### ***Alternative 3 – WS Would Not Address Mammal Damage***

Under this alternative, WS would not be involved with any aspect of mammal damage management. All methods listed in Appendix B could be available under this alternative. However the use of explosives maybe limited since the property owner or manager would be required to locate a person properly licensed to use explosives and willing to conduct the work.

#### ***Direct, Indirect, and Cumulative Effects:***

WS would have no direct impact on wetlands under this alternative. Since beavers could continue to be dispersed or lethally removed and dams could continue to be removed or manipulated or water flow devices installed under this alternative, despite WS' lack of involvement, the impacts to wetlands would be similar among the alternatives. The number of beavers lethally removed annually is regulated by the VDGIF and the circumstances under which dams can be removed is regulated under the CWA and/or Virginia's SWCL. Direct, indirect and cumulative effects would be similar to Alternative 1.

### **3.2 ISSUES NOT CONSIDERED FOR COMPARATIVE ANALYSIS**

The following resource values in the state are not expected to be significantly impacted by any of the alternatives analyzed as none of the alternatives cause any significant ground disturbance: soils, geology, minerals, water quality/quantity, flood plains, critical habitats (areas listed in threatened and endangered species recovery plans), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Therefore, these resources will not be analyzed.

Additional issues were identified by WS during the scoping process of this EA. Those issues were considered by WS during the development of this EA. However, those issues will not be analyzed in detail for the reasons provided. The following issues will not be analyzed in detail in this EA:

#### **Effects of Mammal Damage Management Activities on Biodiversity**

An issue identified as a concern is that managing mammal damage could affect biodiversity or the diversity of species. When managing damage, WS does not attempt to eradicate any species of native wildlife. The purpose of damage management is to reduce or alleviate the damage or threats of damage by targeting individuals or groups of animals identified as causing damage or posing a threat of damage. Wild mammals are managed by the VDGIF. Lethal removal of these animals can only occur at the discretion of the VDGIF, which ensures that removal occurs to achieve desired population objectives for these species. Dogs and cats are managed by local law enforcement and animal control authorities. Therefore, any decision regarding the management of feral dog and feral cat populations occurs at their discretion. Any reduction of a local population would be temporary because immigration from adjacent areas or reproduction would replace those animals removed. Therefore, damage management activities conducted pursuant to any of the alternatives would not adversely affect biodiversity.

#### **A Loss Threshold Should Be Established Before Allowing Lethal Methods**

An issue commonly identified as a concern is that a threshold of damage or economic loss should be established and reached before lethal methods can be used to resolve damage and that damage caused by mammals should be a cost of doing business. For any given damage situation, there are varying thresholds of tolerance exhibited by those people affected. The point at which people begin to implement damage management methods are often unique to the individual and can be based on many factors (e.g., economic, social, aesthetics). How damage is defined is also often unique to the individual and damage occurring to one individual may not be considered damage by another individual. Therefore the threshold of damage or economic loss that can be tolerated is also unique to the individual.

#### **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. Under any of the alternatives, animals causing damage or posing threats could be lethally removed with firearms. Lead is a metal that can be poisonous to animals. Risk of lead exposure to animals occurs primarily when they ingest lead shot or bullet fragments. Lead ammunition may be used by any person implementing damage management methods under any of the alternatives.

Deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through an animal, if misses occur, or if the carcass is not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns have been raised that lead from bullets introduced into the environment from shooting activities could lead to the contamination of either ground water or surface water from runoff. The amount of lead that becomes soluble in soil is usually

very small (0.1-2.0%) (EPA 2005). Stansley et al. (1992) studied lead levels in water that was directly subjected to high concentrations of lead shot because of intensive target shooting at shooting ranges. The study detected elevated lead levels in water in a stream and a marsh that were in the shot “*fall zones*” at one shooting range, but did not find higher lead levels in a lake into which the stream drained, with the exception of one sample collected near a parking lot (Stansley et al. 1992). 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. Stansley et al. (1992) also indicated that even when lead shot has accumulated at high levels in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water downstream. Ingestion of lead shot, bullets or associated fragments is not considered a significant risk to fish and amphibians (Rattner et al. 2008). Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around the impact areas were far below the “*action level*” of 15 parts per billion as defined by the Environmental Protection Agency (EPA) (*i.e.*, requiring action to treat the water to remove lead). These studies suggest that the very low amounts of lead that could be deposited from damage management activities would have minimal effects on lead levels in soil and water.

Lead ammunition (for hunting or target shooting) is only one of many sources of lead in the environment. Other sources which can settle into soil and water include lost fishing sinkers (an approximated 3,977 metric tons of lead fishing sinkers are sold in the United States annually; Rattner et al. 2008), and airborne emissions from metal industries (e.g., lead smelters, iron production, steel production), manufacturing industries, and waste incineration (EPA 2013a). Since in many damage situations, the lethal removal of wild mammals addressed in this document could occur at any time or during hunting and trapping seasons, WS’ assistance with removing animals causing damage would not be additive to the environmental status quo. The amount of lead deposited into the environment may be lowered by WS’ involvement in activities due to efforts by WS to ensure projectiles do not pass through, but are contained within the carcass, which would limit the amount of lead potentially deposited into soil from projectiles passing through the carcass. The proficiency training received by WS’ employees in firearm use and accuracy increases the likelihood that animals are lethally removed humanely in situations that ensure accuracy and that misses occur infrequently, which would further reduce the potential for lead to be deposited in the soil from misses or from projectiles passing through carcasses. In addition, WS’ involvement would ensure efforts were made to retrieve and dispose of carcasses lethally removed using firearms to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that would be deposited into the environment from WS’ activities due to misses, the bullet passing through the carcass, or from carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination.

### **Damage Management Should Not Occur at Taxpayer Expense**

An issue was raised that damage management should not be provided at the expense of taxpayers. Activities conducted by WS to manage damage or threats associated with mammals in Virginia may be funded by a variety of sources including, but not limited to, federal appropriations, the Commonwealth of Virginia, and other cooperative funding. These activities include both technical assistance and direct operational assistance, when requested. Under the proposed action, funding could come from these and/or other sources. A federal appropriation is allotted for the maintenance of the WS-Virginia program. The remainder of the WS-Virginia program is funded by cooperative, federal, and non-federal funding.

### **Global Climate Change / Greenhouse Gas Emissions**

The WS program activities that may result from the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur as a result of the proposed action. The proposed action would meet

requirements of applicable federal laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

### **Coyote Populations May Respond to Lethal Removal through Compensatory Reproduction**

An issue identified as a concern is that coyotes compensate for reductions in their population by reproducing at an earlier age and having more pups per litter. This issue makes the assumption that the coyote population in Virginia currently exists at a level where the implementation of the alternatives would remove enough coyotes alone or cumulatively to a level in which coyotes would compensate reproductively. The alternatives are intended to mitigate damage and not have significant direct or cumulative impacts on coyote populations.

### **3.3 SUMMARY OF ENVIRONMENTAL CONSEQUENCES UNDER THE PROPOSED ACTION / NO ACTION ALTERNATIVE**

No significant cumulative environmental impacts are expected from any of the three Alternatives. Under the proposed action /no action alternative, the lethal removal of mammals by WS would not have a significant impact on overall mammal populations, but some short-term local reductions may occur. Additionally, WS would not have a significant direct, indirect, or cumulative impact on the ability of hunters or trappers to harvest species targeted by management activities. WS would not have a significant direct, indirect or cumulative impact on non-target animal populations or threatened and endangered species. Under the proposed action / no action alternative, direct impacts to human health and safety would be low, and indirect and cumulative impacts would be eliminated when methods are used appropriately in adherence with SOPs and label requirements by trained personnel. Similarly, adherence to SOPs and selection and implementation of methods by trained personnel insures methods would be implemented in the most humane manner possible under the proposed action / no action alternative. Any direct, indirect or cumulative impacts on humaneness would be in part up to a person's perception of humaneness and similar across the alternatives. Under the proposed action / no action alternative, the aesthetic values of mammals are not expected to be impacted directly, indirectly or cumulatively. WS' actions taken to minimize or eliminate damage would be constrained in scope, duration and intensity, for the purpose of minimizing or avoiding impacts. WS' SOPs are designed to reduce the potential negative effects of WS' actions by identifying and responding to both anticipated and unanticipated changes in wildlife populations and the environment. WS continually monitors, evaluates and makes modifications as necessary to methods or strategy when providing assistance, to not only reduce damage, but also to identify and minimize potentially harmful effects. This process allows WS to take into consideration other influences in the environment in order to avoid adverse impacts. Although some persons will likely be opposed to WS' participation in damage management activities, the analysis in this EA indicates that WS' integrated damage management program to reduce damage or threats associated with mammals, as described in the proposed action/ no action alternative, would not result in significant adverse cumulative impacts on the quality of the human environment.

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## **APPENDIX B: METHODS AVAILABLE FOR PREVENTING, REDUCING AND ELIMINATING DAMAGE AND THREATS ASSOCIATED WITH MAMMALS IN THE COMMONWEALTH OF VIRGINIA**

A variety of methods are potentially available to the WS program. Various federal, Commonwealth, and local statutes and regulations and WS Directives govern WS' use of these methods. The following methods and materials may be recommended or used in technical assistance and direct damage management efforts of the WS program. Not all methods would be considered effective, efficient, practical, or legal in every situation and may not be recommended or utilized.

### **NON-LETHAL METHODS (NON-CHEMICAL)**

#### **RESOURCE MANAGEMENT**

Resource management includes a variety of practices that may be used by resource owners or managers to reduce the potential for damage associated with mammals. Implementation of these practices is appropriate when the potential for damage can be reduced without substantially increasing a resource owner's costs or diminishing their ability to manage resources pursuant to goals. Resource management recommendations are generally made through WS' technical assistance efforts.

**Animal Husbandry:** This category includes modifications in the level of care and attention given to livestock, selection of livestock type or breed, shifts in the timing or location of breeding and births, and introduction of human custodians. The level of attention given to livestock varies. Generally, when the frequency and intensity of livestock handling increases, so does the degree of protection.

Altering animal husbandry to reduce damage associated with mammals has many limitations. For example, confinement may not be possible when grazing conditions require livestock to scatter. Hiring extra people, building secure holding pens, and adjusting the timing of births is usually expensive. The expense associated with a change in husbandry practice may exceed the savings. WS encourages resource owners to use these strategies where they may be beneficial, but does not conduct direct operational assistance.

***Selection of Livestock Type, Breed, or Both:*** In areas where damage occurs, the selection of less vulnerable types of livestock (e.g., cows vs. sheep) may reduce the risk of predation. Similarly, the selection of a particular breed of livestock over another may reduce the risk of predation.

***Scheduling:*** The risk of predation to livestock diminishes with age and the increase in size. Shifts in breeding schedules can reduce the risk of predation by altering the timing of births to coincide with the greatest availability of natural food items for predators or to occur out of sync with times in which predators have the greatest need for food items (e.g., when young are present). Adjusting the timing of births is usually expensive. The timing of births may be related to weather or seasonal marketing of livestock.

***Selective Pasturing:*** Moving livestock to locations where predation has historically been low during times when livestock is most vulnerable (e.g., during birthing).

***Confinement During Birthing:*** The risk of predation is usually greatest with immature livestock, and females giving birth. This risk can be reduced by holding pregnant females and newborns in pens or sheds.

***Sanitation:*** Disposal of dead livestock so that it cannot serve as an attractant to predators.

***Herders / Monitoring:*** Herding generally refers to the use of human custodians to stay with livestock day and night generally for the purpose of moving animals between large, often unfenced, pastures. The presence of herders or alternatively, frequent and close monitoring of livestock may alert owners managers of signs of damage sooner than infrequent monitoring may.

**Crop Selection and Scheduling:** In areas where damage to crops from mammals occurs, different crops can be planted that are less attractive to the mammals causing damage. Alternatively, crops can be planted at an earlier or later date to coincide with periods when there is a greater availability of natural food items. This practice depends on the species causing damage, the availability of alternate food sources, and the market for alternative crops. Research has been conducted on damage resistant crop varieties with little success.

***Lure Crops:*** If depredation cannot be avoided by careful crop selection or a modified planting schedule, lure crops can sometimes be used to mitigate the potential loss. Lure crops are crops planted or left for consumption by wildlife as an alternate food source. To improve the efficacy of this technique, frightening devices should be used in nearby non-lure crop fields and wildlife should not be disturbed in the lure crop fields. This approach provides relief for critical crops by sacrificing less important or specifically planted fields. Establishing lure crops is sometimes expensive, requires considerable time and planning to implement, and may attract other unwanted species to the area. Implementation of this method is limited by the authority of those involved to manage the property.

**Beaver Dam Breaching and Removal:** This method involves the partial or complete removal of materials that beavers have deposited to obstruct the flow of water or alternatively the routing of water around or through these materials to restore the flow of water. Beavers construct dams from logs, sticks, mud and other natural materials. The removal of beaver dams is regulated under section 404 of the Clean Water Act (40 CFR 232.2). Upon receiving a request to conduct direct operational assistance, WS would visually inspect the dam and the associated water impoundment to determine if characteristics exist at the site that would meet the definition of a wetland under section 404 of the CWA (40 CFR 232.2). If necessary, WS would notify the entities requesting assistance that a permit might be required to remove the dam and to seek guidance from the United States Army Corps of Engineers and the Virginia Department of Environmental Quality. When providing operational assistance, WS would remove beaver dams in accordance with federal and state laws and regulations for environmental protection. Damage caused by beavers could be addressed in a variety of ways.

***Pipe Systems:*** These systems are designed to modify beaver behavior through deception (Taylor and Singleton 2014). Beavers may associate the sound of and movement of water with a need to dam or obstruct the flow of water (Taylor and Singleton 2014). These systems use pipes or channels to move water through materials deposited by beavers (i.e., dams) to provide relief by restoring some of the flow of water. Pipe systems may be made of metal, wood, plastic or other materials. Pipes may or may not be perforated. These systems require regular maintenance to be effective.

***Fence Systems:*** These systems are designed to exclude beavers from the area around a culvert, placing materials in the culvert or simply be a modification of the culvert design that inhibits beavers from blocking the culvert (Jensen et al. 1999, Taylor and Singleton 2014). For additional information see **Conventional Fencing**.

***Water Flow Devices:*** These devices use a combination of both pipes and fencing to move water through materials deposited by beavers. Examples include the Clemson Pond Leveler and

flexible pipe and fencing systems (e.g., Castor Master™, double filters, Flexible Pond Leveler™) (Taylor and Singleton 2014). The devices require regular maintenance and cannot be installed at all locations (e.g., topography inhibits installation) (Taylor and Singleton 2014).

**Manual:** Manual removal involves the removal of materials with hand rakes, pitch forks, shovels, winches or other similar tools. It may also involve the use of heavy equipment. WS would not employ but may recommend the use of heavy equipment to resolve damage associated with beaver dams.

**Habitat Management:** In general, the type, quality, and quantity of habitat are directly related to the species of wildlife in an area. Therefore, it is possible to manage habitat in a way that discourages its use by specific species. For example, thick vegetation can be pruned or cleared to eliminate denning and loafing sites or areas where predators can observe or stalk livestock from, or trees can be pruned or removed to eliminate a ladder from which raccoons can gain access to an attic. This vegetation may also serve as areas to feed on or cache (hide food for future consumption) food. Additionally, palatable vegetation (e.g., apple trees) which may serve as an attractant can be removed to make an area less attractive. The limitations of habitat management as a method of reducing wildlife damage are determined by the characteristics of the species involved, the nature of the damage, economic feasibility, and other factors. Legal constraints may also exist which preclude altering particular habitats (e.g., wetlands). In most cases, the resource or property owner or manager is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect.

**Modification of Human Behavior:** Altering human behavior may resolve conflicts between humans and animals. For example, eliminating the feeding of wildlife and free-ranging or feral animals may reduce the presence of animals in a given area and with it the damage occurring. This includes the inadvertent feeding allowed by improper disposal of garbage or leaving pet food outdoors where other animals can consume it. In Virginia, it is illegal for any person to place, distribute, or allow the placement of food, minerals, carrion, trash, or similar substances when it attracts any species of wildlife in such numbers or circumstances to cause property damage, endanger any person or wildlife, or create a public health concern (4 VAC 14-40-286). The Commonwealth of Virginia allows localities to prohibit dogs from running at large (Code of Virginia § 3.2-6538). The public does not always comply with laws and ordinances and these statutes must be enforced to be effective.

## **PHYSICAL EXCLUSION**

Physical exclusion methods restrict the access of mammals to resources or areas where damage is occurring. These methods can provide effective prevention of damage in many situations. However, exclusionary devices which are 100% effective at excluding mammals can be more costly than the value of the resources being protected, especially for large areas. In addition, some exclusionary devices require labor intensive maintenance which can further reduce their cost-effectiveness.

**Confinement:** Livestock or pets can be confined to barns, sheds or other structures when the risk of predation is greatest (e.g., night). Mesh wire hutches, cages or aviaries can provide similar protection.

**Conventional Fencing:** Fences, either temporary or permanent, can be effective in excluding mammals. With any type of fencing the height of the fence must be tall enough, the distance between the fence and the ground or the distance between wires must be small enough to exclude animals. Many mammals are able to climb over, jump over, dig under or pass through many fences if motivated. For this reason, barbed wire, rail, picket, cable wire and non-electrified high-tensile fences may not be effective at excluding mammals. Woven wire, wire mesh or stockade fences, although not mammal proof, when

properly installed and maintained (e.g., mesh must be kept stretched tight and mesh must be attached securely to posts or the ground) do provide a barrier. Gates or doors reinforced with fencing or panels which leave minimal gaps when closed or which incorporate sills ensures the integrity of woven wire or mesh fence. Fences with overhangs at the top and aprons at the bottom are effective at excluding additional animals. Fencing requires maintenance because animals are quick to exploit gaps.

**Electric Fencing:** Electric fences can be built for temporary or permanent use. Temporary electric fences can be constructed of polywire, poly tape or ElectroNet™. Permanent fences can be constructed with either multiple single strand wires or a combination of woven wire or wire mesh and single strand wires. In general, electric fencing is effective at reducing damage but no fence is 100% effective at excluding all mammals because animals that are willing to expose themselves to electric shock, can avoid electric wires while passing through, digging under or jumping over fences or exploiting times when the fence wasn't charged. Also, some species, including red foxes will continually test electric fences after receiving electric shocks (Poole and McKillop 2002, Robley et al. 2007). Limits of this application include the ability to erect, electrify and maintain electricity to the fence, keep the wires free from contact with vegetation, and test the fence regularly.

**Fladry:** Fladry is a barrier technique that attaches small pieces of flagging to either a temporary or permanent electrified or un-electrified fencing. The movement of the flags in the wind makes a visual barrier which acts as a deterrent.

**Barriers:** Cliff faces, bodies of water, the wall of a barn and a variety of other natural and manmade structures provide a barrier to mammal movements and restrict access to resources. Used in conjunction with proper fencing these barriers can be effective. Barriers made of various kinds of materials (e.g., flashing, hardware cloth, steel wool, copper gauze, sheet metal, foam caulk, quick setting concrete) can be applied, arranged or designed to effectively exclude mammals. For example, in parks and similar areas trash containers which people can open but black bears and other wildlife cannot can be installed. Dams can be constructed using stone rip-rap to prevent muskrats from burrowing into them. Rigid plastic mesh or heavy paper can be wrapped around the trunks of trees to protect them from cottontail rabbits.

**Predator Exlosures on Nests:** Studies have shown that predator exlosures can help minimize predation to piping plover and other shorebird nests (Smith et al. 2011). However, this minimization is largely limited to eggs, as chicks leave the nest bowl soon after hatching. Several authors have noted that predators will associate exlosures with a potential meal causing increased predation on adults (Nol and Brooks 1982, Johnson and Oring, 2002, Neuman et al. 2004, and Isaksson et al. 2007). Therefore the use of exlosures should be carefully evaluated prior to use (Smith et al. 2011).

## **FRIGHTENING DEVICES OR DETERRENTS**

Frightening devices are used to repel animals from areas where they are causing damage or posing threats of damage. The success of frightening methods depends on an animal's fear of, and subsequent aversion to, offensive stimuli (Shivik and Martin 2001). A persistent effort is usually required to effectively apply frightening techniques and the techniques must be sufficiently varied to prolong their effectiveness. Over time, animals often habituate to commonly used scare tactics and ignore them. The time it takes for animals to habituate can generally be lengthened by using devices which are periodic, random or animal activated. As with other methods, these techniques tend to be more effective when used as part of an integrated management program.

**Physical Human and Vehicle Harassment or Hazing:** Physical human harassment or hazing involves people pursuing animals on foot, clapping their hands, or shouting. Vehicle harassment involves people

pursuing animals with remote control vehicles, or with non-motorized or motorized boats or motor vehicles. These techniques can be used in conjunction with other methods to disperse animals from areas where they cause damage or threats.

**Acoustic Stimuli:** This category includes using a variety of noise making devices including but not limited to car horns, air horns, stereo systems, radios, bioacoustics, ultrasonic devices, propane exploders, pyrotechnics, etc. The effectiveness of noise on mammals is generally limited because animals become accustomed to and learn to ignore them. It must be noted that sound-scare devices can also scare people, livestock, pets or non-target wildlife when they are used in their vicinity.

**Visual Stimuli:** Different types of lights (e.g., floodlights, strobe lights, lasers, revolving lighting units), scarecrows or effigies (which mimic humans or a predator), moving and or reflective material (e.g., mylar tape), and other threatening images (some animals have a fear of new objects) have been used with mixed results. In general, the type of stimuli, the number of devices, and their location are determined by the size of the area to be protected and by the power sources available. However, most animals rapidly become accustomed to such stimuli and they are not generally effective in the long-term. Devices activated by motion, body-heat or radar may delay habituation.

**Other Stimuli:** Repellants are substances used to discourage or disrupt particular behavior and are effective because they are irritating, cause sickness or stimulate fear (Mason and Clark 1997). Bone tar oil, predator urine, pepper and other similar substances have been used in an effort to deter mammals. Unfortunately, for many species of mammals there are no known repellants that are effective after repeated exposure. These and other similar substances are non-restricted substances available for use by the public.

**Devices Using Multiple Stimuli:** One device which uses multiple stimuli is called the electronic guard. It is a frightening device composed of a blinking strobe and a siren which are activated by a timer and a light sensor. When operational the device automatically turns on at sunset and randomly flashes and omits sound for a few seconds at several minute intervals throughout the night, automatically turning off at sunrise (USDA 2002). The device was designed specifically to reduce predation on livestock (Linhart 1984, Linhart et al. 1984, Linhart et al. 1992) but can be used in other applications. Another device consists of an illuminated pop-up scarecrow and a CD player with audio tracks likely to elicit fear (e.g., aggressively barking dogs, shotgun barrages) and designed to turn on when activated by the target animal. A similar device, the movement-activated guard uses a strobe light and recorded sound effects to disperse predators when activated by movement (Shivik et al. 2003). These and similar devices can be activated by motion, body-heat or radar. These and other similar devices can be temporarily effective in reducing damage in some situations.

**Projectiles:** Different types of projectiles (water from a hose, paint balls, sticks, small rocks etc.) maybe used to frighten animals. These techniques can be used in conjunction with other methods to disperse animals from areas where they cause damage or threats.

**Guard Animals:** This method involves pasturing dogs, donkeys or llamas with sheep or goats and in some cases cattle for the purpose of reducing damage or threats from predators. In general, the effectiveness of the method is dependent upon the individual guard animal, the individual predator and the number of livestock being guarded. Guard dogs have also been used to protect agricultural crops from white-tailed deer (VerCauteren et al. 2005). Effectiveness is improved when combined in conjunction with other methods (Walton and Field 1989).

**Mixed Species Grazing:** Pasturing sheep which have been bonded to cattle with cattle has been shown to reduce predation (Anderson et al. 1987, Hulet et al. 1987, Hulet et al. 1989).

Additionally, pasturing goats, sheep and cattle together when these animals have formed bonds so that they stay together has been shown to reduce predation (Hulet et al. 1989). Mature sheep and cattle usually graze separately but young lambs placed with cows soon form bonds, traveling and grazing together (Hulet et al. 1987). Although young goats do not bond tightly with cattle, young goats did bond well with sheep and traveled and grazed with sheep that were traveling and grazing with heifers (Hulet et al. 1989). Although cattle are predated upon, predation levels on cows is much lower than that of sheep and goats. The presence of cattle may be adequate to act as a predation deterrent.

## **CAPTURE WITH LIVE CAPTURE DEVICES**

Mammals can be live captured through the use of several methods listed and described in detail below. Upon capture, animals could be relocated or euthanized. However, in most situations animals captured in live traps are subsequently euthanized (see lethal methods). For discussion of why animals are not generally relocated see Section 3.2. Wild mammals are managed by the VDGIF and translocation could only occur under the authority of the VDGIF. Cats and dogs are managed by local law enforcement and animal control authorities. WS would return cats and dogs to their owners, transfer them to animal control authorities, transfer them to the property owner or release them onsite in accordance with (WS-Virginia Directive 2.340(a)). WS would use capture devices in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives to reduce risks to persons and non-target animals.

**Hand Capture:** Hand capture involves using hands to take hold of an animal.

**Catch Poles:** Catch poles consist of a long pole with a loop of cable at one end and a tightening / release mechanism on the other. Use involves slipping the loop over the animal's head and then tightening it. Commonly used by animal control professionals.

**Nets:** Open-meshed material fashioned in a manner to trap, catch or ensnare.

**Hand Nets:** Hand nets are used to catch animals in confined areas. These nets resemble fishing dip nets with the exception that they are larger and have long handles. A variation of the hand net is a round throw-net with weights at the edges of the net, similar to that used for fishing.

**Cannon / Rocket Nets:** Cannon or rocket netting involves setting bait in an area that would be completely contained within the dimensions of a manually propelled net. The launching of the rocket net occurs too quickly for the animals to escape.

**Net Gun:** This technique fires a net from a shoulder mounted gun which captures the target animal.

**Bow Nets:** Bow nets are small circular net traps. The nets are hinged and spring loaded so that when the trap is set it resembles a half moon. The net is set over a food source and triggered by an observer using a pull cord.

**Mist Nets:** Mist nets, made of a very fine mesh, are hung vertically in a drape like fashion. Bats become entangled when they fly into it. These nets are generally used for capturing bats entrapped in structures. Mist nets are monitored closely, to ensure that any captured bats can be promptly removed.

**Drop Nets:** Drop nets are set above a food source and triggered by an observer.



**Cage Traps:** These traps, which are typically fully enclosed, are used to capture animals alive. Traps are baited with foods or other items attractive to the target animal (see **ATTRACTANTS** below). Cage traps must be checked frequently to ensure that captured animals are not subjected to extreme environmental conditions. For example, an animal may die quickly if the cage trap is placed in direct summertime sunlight. Another potential problem with the use of cage traps is that some animals fight to escape and injure themselves in the process. WS SOPs require that traps be checked frequently so any captured animals can be addressed in a timely manner. Careful placement of traps at locations likely to capture target animals and the use of appropriate attractants further increases the selectivity of this method. Non-target species are released during these checks unless it is determined that the animal would not survive or that the animal cannot be released safely. Some target animals including canids avoid cage traps (Phillips and Schmidt 1994, Shivik et al. 2005). Individual non-target animals may become “trap happy” and purposely get captured to eat the bait, making the trap unavailable to catch target animals. These behaviors can make a cage trap less effective.

**Box Traps:** Box traps are usually rectangular, made with wood or metal supports and heavy gauge wire mesh. Animals enter through door(s) which are typically triggered to close when weight is applied to a pan or treadle or remotely by an observer. Doors may also be triggered to close by behavior specific to the target animal (see **Corral Trap** for examples). Sherman<sup>TM</sup> traps are a specific type of box trap made of sheet metal instead of wire mesh and designed to capture small mammals or Eastern chipmunks. Clover traps are a specific type of box trap made with netting instead of wire mesh and designed specifically to capture deer.

**Suitcase Trap (e.g., Hancock<sup>TM</sup>, Bailey<sup>TM</sup>):** As the name suggests, suitcase traps are shaped like a suitcase or clam shell with two identical halves that close to capture an animal when the triggering mechanism is engaged. Specifically designed for beaver, these traps have also been modified to capture otter.

**Culvert Trap:** Made of steel culverts or similar materials these traps have a door on one or both ends. Usually mounted on trailers, these traps are specifically designed to capture black bears. The door(s) are triggered to close when the animal engages a trigger mechanism.

**Corral Trap:** Corral traps may be constructed from steel or wood supports with wire fencing and are typically circular in shape. They are open at both the top and bottom. These traps are used to capture animals alive. Traps are baited with foods or other items attractive to the target animal (see **ATTRACTANTS** below). Animals enter through door(s) which are triggered by an observer, a trigger mechanism, or root stick. Alternatively, doors may be of a one way design, exploiting an animal’s natural tendencies. For example, feral swine exhibit rooting behavior which makes them susceptible to being trapped in traps with doors that are hinged at the top and tilted inward at the bottom, and allow the animal to root underneath the door and enter the trap, but not exit.

**Live-restraint Traps:** These devices are designed to capture animals alive and unharmed. WS SOPs require that traps are checked frequently so any captured animals can be addressed in a timely manner. Non-target species are released during these checks unless it is determined that the animal would not survive or that the animal cannot be released safely. Following Best Management Practices, which are carefully researched recommendations, ensures that standards for animal welfare, efficiency, selectivity, practicality and safety are met (e.g., AFWA 2014a; 2014b; 2014c). Best Management Practice research conducted by the Association of Fish and Wildlife Agencies is ongoing which ensures improvement and modernization as new tools become available. Additionally WS has worked for many years on modifications to increase the selectivity, effectiveness and humaneness of foot-hold traps (Fagerstone and Keirn 2012).

**Foot-hold Traps:** Foot-hold traps are spring powered devices set the ground which grasp and restrain an animal by its foot when the triggering mechanism is stepped on and two curved bars close to hold it. Traps are specifically designed in different sizes for different sized animals and can be equipped with tension setting devices which exclude non-target animals weighing less than the target animal. Animals that weigh more than the target animal are typically excluded because they can easily overcome the holding power generated by the springs and free themselves. Careful placement of traps at locations likely to capture target animals and the use of appropriate attractants (see **ATTRACTANTS** below) further increases the selectivity of this method. Foot-hold traps are difficult to keep operational during wet or freezing conditions and may require more time and labor than other methods.

**Enclosed Foot-hold Traps:** Enclosed foot-hold traps are spring powered devices staked into the ground which grasp and restrain an animal by its foot when the animal reaches through a small opening to investigate an attractant (e.g., EGG™ Trap, Lil' Grizz Get'rz™ Trap, Duffer's™ Trap etc.). These traps are specifically designed to capture raccoons and opossums. Non-target animals are excluded not only because of the size of the opening but also because of the dexterity required to pull on a lever and trigger the trap. Careful placement of traps at locations likely to capture target animals and the use of appropriate attractants (see **ATTRACTANTS** below) further increases the selectivity of this method.

**Glue Boards:** These devices consist of a rigid piece of plastic, cardboard or similar material with the horizontal surface coated in an adhesive. They may be enclosed or open. Animals making contact with the adhesive are restrained. Careful placement of traps at locations likely to capture target animals and exclude non-target animals and the use of appropriate attractants (see **ATTRACTANTS** below) increases the selectivity of this method. WS would only use glue boards to address small mammals (i.e., insectivores and rodents). As with all live capture devices, traps would be checked frequently and target animals would be subsequently euthanized (see lethal methods).

**Snares (Cable Device):** Cable restraints also known as snares may be used as either live capture or lethal devices. Modern snares are composed of stranded steel cable formed into a loop with a sliding lock and affixed to an immovable object or a stake. As the snare loop is pulled closed by the forward movement of the animal being captured, the lock slides down the cable, but the lock cannot slide in the opposite direction. Snares set to capture an animal by the neck are usually lethal, while snares positioned to capture the animal around the body or leg can be used as a live capture method. The use of “stops” which keep the cable from becoming completely restricted allows for their use as a live capture method. Careful placement of snares at locations where target animals are moving through a restricted area (e.g., a hole in a fence into a pasture, trail through thick vegetation adjacent to a pasture) and the use of appropriate attractants (see **ATTRACTANTS** below) increases the selectivity of this method. The incorporation of ‘break away’ devices also increases selectivity, enabling larger non-target animals to prevent the snare from restraining them. WS SOPs require that snares are checked frequently so any captured animals can be addressed in a timely manner. Non-target species are released during these checks unless it is determined that the animal would not survive or that the animal cannot be released safely. Dogs captured in snares and accompanied by humans can be released unharmed. Following Best Management Practices, which are carefully researched recommendations, ensures that standards for animal welfare, efficiency, selectivity, practicality and safety are met (AFWA 2014a; 2014b). Best Management Practice research conducted by the Association of Fish and Wildlife Agencies is ongoing which ensures improvement and modernization as new tools become available.

**Attractants:** Attractants including, baits, scents or lures are used to increase the efficacy of other methods by enticing an animal to investigate a particular location where capture methods (e.g., cage traps, corral traps, live-restraint traps) or toxicants (e.g., M-44 devices) are deployed. These attractants can be either natural or synthetically based. Scents or lures are usually blends of volatile natural substances including urine, musk, organs (glands) and essential oils (Turkowski et al. 1983, Kimball et al. 2000). However, attractants can also be synthetically based. For example, fatty acid scent is a synthetic mixture of several volatile fatty acids found in fermented egg (Roughton 1982, MSDS 2005). Baits include any foods or combination of foods attractive to the target animal. Visual attractants (e.g., feathers) can also be used to entice an animal to investigate a particular location. These are non-restricted substances available for use by the public.

## **DOGS**

Trained dogs may be used to assist in locating appropriate locations to place capture devices by alerting their handlers to areas where target animals have traveled, urinated, or defecated. This use of trained dogs may increase the selectivity of both live and lethal capture methods. When conditions allow trained dogs can also aid in the application of other methods (e.g., shooting) by detecting individuals or their dens or alternatively to attract (decoy) animals into shooting range. These dogs may also scent mark (urinate or defecate) which may serve as an attractant to other canids. Dogs trained and used for these purposes must stay with their handler to be effective. Properly trained and disciplined dogs should not make contact with target animals and have minimal effect on non-target animals. WS would use trained dogs in compliance with WS Directive 2.445.

## **JUDAS PIGS**

This technique involves attaching a radio and / or GPS transmitter to a feral swine that has been captured and then releasing it at the site of capture. The animal would be monitored using signals emitted from the transmitter. Once this animal or “Judas pig” has joined other feral swine, those feral swine are either lethally removed or become additional Judas pigs. The original animal with the transmitter may be lethally removed or released to join additional feral swine and the process repeated. If Judas pigs sustain injuries and it is determined that they would not survive during application of this method by WS, they will be euthanized in accordance with WS Directive 5.505. WS would handle Judas pigs in compliance with all WS SOPs and WS Directives.

## **NON-LETHAL METHODS (CHEMICAL)**

Non-lethal chemical methods could include reproductive inhibitors and repellents.

**Reproductive Inhibitors:** Reproductive control for wildlife can be accomplished either through sterilization (permanent) or contraception (reversible) means. However, the use and effectiveness of reproductive control as a wildlife population management tool is limited by characteristics of the species (e.g., life expectancy, age at onset of reproduction, population size, etc.), environmental factors (e.g., isolation of target population, access to target individuals, etc.), socioeconomic, and other factors. Currently, the only reproductive inhibitor that is registered with the EPA for use in any of the species addressed in this document is GonaCon™. GonaCon™ was officially registered by the EPA in 2009 for use in reducing fertility in female white-tailed deer. According to the label, only WS or state wildlife management agency personnel or individuals working under their authority can use GonaCon™. However, 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™ is not currently registered for use in Virginia. However, if GonaCon™ or other reproductive inhibitors become available to manage those species addressed in this document the Commonwealth, their

use could be evaluated under the proposed action alternative as a method available that could be used in an integrated approach to managing damage.

**Repellents:** Chemical repellents are non-lethal chemicals used to discourage or disrupt particular behaviors of wildlife. There are three main types of chemical repellents: olfactory, taste, and tactile. Effective and practical chemical repellents should be nonhazardous to wildlife; nontoxic to humans, animals and the environment; resistant to weathering; easily applied; reasonably priced; and capable of providing good repellent qualities. The reaction of different individual animals to a single chemical formulation varies and this variation in repellency may be different from one habitat to the next. Examples include but are not limited to; Go Away™, Deer B Gon®, Ro-pel®, Deer Away®, Deer Off®, Liquid Fence®, Deer Stopper®, Deer Out®, and Rabbit & Groundhog Out®. Chemical repellents are strictly regulated, and suitable repellents are not available for many mammal species or wildlife damage situations.

**Chemical Immobilization Drugs:** The use of chemical immobilization drugs is restricted. WS personnel that possess or use these substances would be trained and certified in accordance with WS Directive 2.430. WS personnel that use these drugs or substances would be required to wear appropriate PPE they are provided with (WS Directive 2.601). Additionally, “*the acquisition, storage, and use of ... (these substances would be) ... in compliance with applicable program, Federal, State, and local law and regulations*” (WS Directive 2.430). WS would capture animals using live capture devices and handle animals in compliance with all WS SOPs and WS Directives (see **Live Capture Devices** above).

***Ketamine Hydrochloride*** (e.g., ***Ketaset®***, ***Vetalar®***): Ketamine is an anesthetic or type of drug that produces anesthesia (more specifically a cyclohexane or dissociative anesthetic) (Kreeger 1999). Widely used in wildlife, it causes sections of the nervous system to disassociate, eliminating pain (Haigh 1982, Kreeger 1999). These drugs are also thought to have amnesic properties (animals cannot remember the event) (Kreeger 1999). When used alone, ketamine is a poor muscle relaxant and may produce seizures (Haigh 1982, Kreeger 1999). For this reason, ketamine is usually used with other drugs such as xylazine (see ***Xylazine*** below).

***Telazol®*** (***Tiletamine Hydrochloride and Zolazepam Hydrochloride***): Telazol® is an anesthetic or type of drug that produces anesthesia (more specifically a cyclohexane or dissociative anesthetic) (Kreeger 1999). It is mixture of two drugs, tiletamine and zolazepam. It causes sections of the nervous system to disassociate, eliminating pain (Kreeger 1999). These drugs are also thought to have amnesic properties (animals cannot remember the event) (Kreeger 1999). The combination of drugs suppresses undesirable side effects, speeds the time it takes for the drug to take effect and reduces the amount of drug required (Haigh 1982).

***Xylazine Hydrochloride*** (e.g., ***Romprun®***, ***Cervizine™***, ***AnaSed®***): Xylazine is a sedative (Kreeger 1999). It acts on the central nervous system providing muscle relaxation and loss of sensitivity to pain (Kreeger 1999). Commonly used with other drugs such as ketamine to produce relaxed anesthesia (see ***Ketamine*** above). The combination of these drugs suppresses undesirable side effects (e.g., the muscle tension commonly associated with Ketamine).

**Explosives:** Materials deposited by beavers may also be removed with the aid of explosives. See **Beaver Dam Breaching and Removal** for regulatory information. Explosives are defined as any chemical mixture or device that serves as a blasting agent or detonator. Explosives are generally used to breach beaver dams that are too large to remove using other methods. WS would only use binary explosives to remove beaver dams. Binary explosives consist of two components (ammonium nitrate and nitromethane) that are separately contained. These two components are not classified as “explosives” until they are mixed. Once mixed, binary explosives are considered “high explosives” and subject to a wide range of

federal and state regulations. Detonating cord and detonators are also considered explosives. WS who are authorized to use explosives as a method are required to attend extensive explosive safety training and spend time with a certified explosive specialist in the field prior to obtaining certification. WS employees must comply with all policies, procedures, and training requirements described in the WS Explosives Safety Manual and WS Directives 2.625 and 2.435. Risks associated with explosives are minimal when used appropriately and with consideration of human safety. When recommending that explosives be used, WS would caution against their improper use.

### **LETHAL METHODS (NON-CHEMICAL)**

**Recreational Hunting and Trapping:** Where appropriate, WS recommends that those persons experiencing damage and threats associated with mammals consider hunting or trapping at the damage site as an option for reducing damage. Lethal removal of wild animals addressed in this EA can occur, depending upon the species and when they are causing damage or a nuisance or during regulated hunting and trapping seasons. Hunting and trapping not only has the potential to remove individuals causing damage but also reinforces harassment programs as part of an integrated approach. Valid hunting and trapping licenses are required for the implementation of this method unless exempt.

**Shooting:** Shooting is the practice of selectively removing target animals using firearms. Shooting, when deemed appropriate, can be highly effective in removing those individual animals responsible for causing damage and posing threats. It is selective for target species. It is also effective in supplementing harassment as part of an integrated approach. Animals removed by WS are killed as quickly and humanely as possible in accordance with WS Directive 2.505. WS employment of this method may include but is not limited to the use of vehicles (including aircraft), elevated platforms, illuminating devices (e.g., spotlights, night vision, Forward Looking Infrared Devices (FLIR)), suppressors, and attractants (e.g., bait, calling, decoy dogs). Calling refers to the use of mouth or electronically recorded and mechanically amplified animal calls or sounds to attract animals into shooting range. Decoy dogs are dogs trained to attract or decoy animals into shooting range. Dogs trained and used for this purpose must stay with their handler to be effective. Properly trained and disciplined dogs should not make contact with target animals and have minimal effect on non-target animals. WS would use trained dogs in compliance with WS Directive 2.445. WS would use aircraft for the application of this method in compliance with WS Directive 2.620 and all federal and state laws and regulations.

**Aerial Shooting:** Aerial shooting or aerial hunting (*i.e.*, shooting from an aircraft) consists of visually sighting target animals in the problem area and shooting them from an aircraft. Aerial hunting is species-selective and can be used for immediate control of feral swine to reduce damage if weather, terrain, and cover conditions are favorable. WS has used aerial hunting for disease surveillance in other states (*e.g.*, taking deer samples for chronic wasting disease and searching for carcasses in areas where an anthrax outbreak has occurred). Fixed-wing aircraft are most frequently used in flat and gently rolling terrain whereas helicopters with better maneuverability have greater utility and are safer over brush covered ground, timbered areas, steep terrain, or broken land where animals are more difficult to spot.

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

Aircraft overflights have created concerns about disturbing wildlife. The National Park Service (1995) reviewed studies on the effects of aircraft overflights on wildlife. Their report revealed that a number of

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

**Live Capture Followed by Non-Chemical Euthanasia:** Animals can be live captured through the use of several methods listed and described in detail above (see **CAPTURE WITH LIVE CAPTURE DEVICES**). Upon capture, euthanasia could occur via shooting or cervical dislocation (in the case of small mammals). WS would kill animals as quickly and humanely as possible in accordance with WS Directive 2.505.

***Cervical Dislocation:*** This method is sometimes used to euthanize small mammals which are captured in live traps (e.g., Sherman traps). The animal is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA approves this technique as a humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of small mammals (i.e., insectivores and rodents) (AVMA 2001). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (AVMA 2001).

**Snares (Cable Device):** Cable restraints also known as snares may be used as either live capture or lethal devices. Modern snares are composed of stranded steel cable formed into a loop with a sliding lock and affixed to an immovable object or a stake. As the snare loop is pulled closed (by the forward movement of the animal being captured), the lock slides down the cable but the lock cannot slide in the opposite direction. Snares set to capture an animal by the neck are usually lethal. Careful placement of snares at locations where target animals are moving through a restricted area (e.g., a hole in a fence into a pasture, trail through thick vegetation adjacent to a pasture) and the use of appropriate attractants (see **ATTRACTANTS** above) increases the selectivity of this method. The incorporation of ‘stops’ and ‘break away’ devices also increases selectivity, enabling some non-target animals to avoid restraint. WS would incorporate these devices in compliance with WS-Virginia Directive 2.450(b). WS SOPs require that snares are checked frequently so any captured animals can be addressed in a timely manner. Non-target species are released during these checks unless it is determined that the animal would not survive or that the animal cannot be released safely. Dogs captured in snares and accompanied by humans can be released unharmed. Following Best Management Practices, which are carefully researched recommendations, ensures that standards for animal welfare, efficiency, selectivity, practicality and safety are met (e.g., AFWA 2014a; 2014b). Best Management Practice research conducted by the Association of Fish and Wildlife Agencies is ongoing which ensures improvement and modernization as new tools become available.

**Denning:** The practice of locating and lethally removing animals at the location of a den is known as denning. Den sites are used by coyotes and foxes for bearing and rearing young (Parker 1995, Cypher 2003). Denning is highly selective for target species and individuals. However, dens can be exceedingly difficult to locate rendering the method labor intensive. Denning methods may include euthanasia with large gas cartridges (see **gas cartridges**) or via live capture followed by euthanasia. WS would kill animals as quickly and humanely as possible in accordance with WS Directive 2.505.

**Bodygrip Traps:** Designed to quickly and humanely kill the target animal that activates it, these spring driven devices have one or two jaws that close on the top or both the top and bottom of animal's neck. Following Best Management Practices, which are carefully researched recommendations, ensures that standards for animal welfare, efficiency, selectivity, practicality and safety are met. Best Management Practice research conducted by the Association of Fish and Wildlife Agencies is ongoing which ensures improvement and modernization as new tools become available. WS would use bodygrip traps in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives to minimize risks to non-targets.

**Rotating Jaw Traps:** (e.g., Conibear™ bodygrip trap, Bridger™ bodygrip trap, etc.). These two jawed devices are most commonly set underwater for the capture of aquatic rodents. Traps are specifically designed in different sizes for different sized animals. Traps are triggered to close when the animal attempts to move through the jaws and trips the wire triggers. Triggers can be configured to exclude non-target animals. Rotating jaw traps can also be set within an enclosure (e.g., a tube or box) in a manner that excludes larger animals (i.e., the size of the enclosure, size of the opening, and distance from the opening to the trap serve to exclude non-targets). Careful placement of traps at locations likely to capture target animals and the use of appropriate attractants (see **ATTRACTANTS** below) further increases the selectivity of this method.

**Snap Traps:** Commonly known as mouse or rat traps, snap traps have a single jaw attached to a piece of wood or other stiff material. The trap is triggered to close when the baited treadle is disturbed. Careful placement of traps at locations likely to capture target animals and the use of appropriate attractants (see **ATTRACTANTS** below) further increases the selectivity of this method.

## **LETHAL METHODS (CHEMICAL)**

The use of chemical methods is strictly regulated by the DEA, EPA, FDA and VDACS.

All pesticides have to be registered with the EPA and must have labels approved by the agency which detail the product's ingredients, the type of pesticide, the formulation, classification, approved uses and formulations, potential hazards to humans, animals and the environment and directions for use. The registration process for pesticides is intended to assure minimal adverse effects to humans, animals and the environment when chemicals are used in accordance with label directions. Under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and its implementing guidelines, it is a violation of federal law to use any pesticide in a manner that is inconsistent with its label. These chemicals can only be applied by persons who have been specially trained and certified by the VDACS for their use. These persons (certified applicators) are required to take continuing education classes and exams to maintain their certification. Each of the chemical methods listed below have specific requirements for their handling, transport, storage, application and disposal under the Code of Virginia and the Virginia Administrative Code.

All pesticides used by WS are registered as required by the FIFRA (administered by the EPA and the VDACS). WS' personnel that use restricted-use chemicals are certified as pesticide applicators by the Commonwealth of Virginia and are required to adhere to all certification requirements set forth in FIFRA and Virginia pesticide control laws and regulations. Additionally, WS' personnel that use restricted-use chemical methods would abide by all federal and state laws and regulations for their handling, transport, storage, application and disposal. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner or manager.

Pharmaceutical drugs, including those used in wildlife capture and handling are registered with the FDA and must be stored and used in compliance with both FDA and DEA regulations. These regulations are intended to ensure minimal adverse effects to humans, animals and the environment. Those possessing or using drugs must be registered to do so with the DEA under the Controlled Substances Act. Those using drugs must also comply with the Animal Medicinal Drug Use Clarification Act (AMDUCA). These drugs also have specific requirements for their handling, transport, storage, application and disposal under the Code of Virginia and the Virginia Administrative Code.

All euthanasia and immobilization drugs or substances used by WS or recommended by WS would be registered with the FDA, and stored and used in compliance with Federal and state laws and regulations as required. WS personnel that possess or use these substances would be trained and certified in accordance with WS Directive 2.430. Additionally, “*the acquisition, storage, and use of ... (these substances would be) ... in compliance with applicable program, Federal, State, and local law and regulations*” (WS Directive 2.430). When using immobilizing drugs, WS would adhere to all established withdrawal times agreed upon by WS, the VDGIF, and veterinarian authorities. If WS receives a request to immobilize mammals during a period of time when the regulated harvest of those species was occurring or during period of time where the withdrawal period could overlap with a harvest season, WS would euthanize the animal or mark the animal with ear tags labeled with a “*do not eat*” warning. This would eliminate risks to human health and safety from persons consuming animals that had or potentially had immobilizing drugs remaining in their systems. Chemical immobilization and euthanasia drugs or substances are only used on private, public, or tribal property sites with authorization from the property owner or manager.

**M-44s (sodium cyanide)** (*EPA Reg. No. 56228-15*): Sodium cyanide is a restricted use pesticide administered in a single dose in the M-44 device (*EPA 2006b*). An M-44 device is triggered when an animal bites and pulls on the top of the device which is staked into the ground and covered in a fetid attractant or lure. When the device is triggered, sodium cyanide powder is ejected into the mouth and reacts with moisture to produce hydrogen cyanide gas (*USDA 2010*). The gas is absorbed into the lungs and death by chemical asphyxiation occurs because cyanide inhibits an enzyme essential to the utilization of oxygen (*EPA 1994*). Sodium cyanide is supplied by the manufacture to the applicator in sealed single dose capsules which are inserted directly into the M-44 device. M-44s are registered for use in managing grey fox which are suspected of preying upon livestock and poultry and managing coyote, dog and red fox and grey fox which are suspected of preying upon species listed under the ESA or are vectors of communicable diseases. Additional uses of M-44 by WS in Virginia are analyzed in a separate analyses pursuant to the NEPA. M-44s are registered for use in Virginia by WS only and therefore would only be available under the proposed action alternative.

WS would only place M-44s on a given property in response to a request for assistance after the property owner or manager has signed a document agreeing to allow M-44s be used on property they own and/or manage. This document may advise these persons to contact and inform persons utilizing or adjoining the property of control activities. Additionally, WS verbally advises those persons to contact and inform persons utilizing or adjoining the property of control activities. M-44s would be used by WS in accordance with the EPA’s 26 use restrictions to minimize risks to humans, non-target animals and the environment (*WS Directive 2.415*). Additionally, WS use of M-44s to protect livestock would be restricted to fenced areas where livestock graze during late winter, spring and summer in accordance with *WS-Virginia Directive 2.415(c)*. WS use of M-44s to protect species listed under the ESA would be restricted to Accomack and Northampton Counties in accordance with *WS-Virginia Directive 2.415(c)*. For detailed discussions on the potential effects of the use of M-44s on non-target animals, human health and safety and the environment see **CHAPTER 3**.



*M-44s (sodium cyanide) Primary Hazard Profile* - Sodium cyanide is a restricted use pesticide administered in a single dose in the M-44 device (EPA 2006b). The likelihood of obtaining a lethal dose is dependent on encountering an M-44 device and triggering a device by pulling on the top of the device which is staked into the ground. Shivik et al. (2014) found that only one other species, cows, were equally or more likely than coyotes to investigate M-44's set to protect livestock in pastures in Virginia and West Virginia but that no non-canid activated an M-44. Non-canids such as cows are generally not susceptible to M-44's because they do not grab and pull on M-44 devices (Shivik et al. 2014). Animals triggering the device die in approximately two minutes (Connolly et al. 1986) and appear to show no overt signs of distress or pain (USDA 2010). Acute lethal dose (LD50)<sup>6</sup> values have been estimated for a variety of bird, mammal and aquatic species (Wiemeyer et al. 1986, Timm 1994b, HSDB 2015). Acute lethal doses (LD<sub>50</sub>) values for canids range from 4 to 8 mg/kg (Chen and Rose 1952, Savarie and Garrison 1976, Sterner 1979). When ingested at sub toxic levels it is rapidly detoxified and excreted by the kidneys (EPA 2006a). Mortality or any adverse effect on growth or reproduction is unlikely to result from sub lethal or repeated sub-lethal exposures (Howard and Hanzal 1955).

*M-44s (sodium cyanide) Secondary Hazards*-Secondary poisoning is unlikely to non-existent because the chemical reaction and mode of action (chemical asphyxiation) limits the amount of compound present in tissues that could be available to scavengers (Howard and Hanzal 1955). Additionally, as stated above when ingested at sub toxic levels it is rapidly detoxified and excreted by the kidneys (EPA 2006a, HSDB 2015).

*M-44s (sodium cyanide) Environmental Degradation*- When used together with the M-44 device sodium cyanide does not pose an environmental risk when used according to the label (EPA 1994). Sodium cyanide is supplied by the manufacturer to the applicator in sealed single dose capsules which are inserted directly into the M-44 device. Requirements for the storage, transport and application of these capsules eliminates the likelihood that non-targets would encounter sodium cyanide in the environment. Should a sodium cyanide capsule leak or be damaged, contact with moisture would cause the formation of hydrogen cyanide which would diffuse into the air and degrade into carbon dioxide and ammonia (Schafer 1990, EPA 1994). Sodium cyanide is soluble in water but use restrictions prohibit, "application within 200 feet of any lake, stream, or other body of water" (WS Directive 2.415). In soil, sodium cyanide is degraded by microorganisms into carbon dioxide and ammonia (USFWS 1975, EPA 1994). Thus, a potential impact to non-target animals including threatened and endangered species from environmental exposure is minimal to non-existent.

**Gas Cartridges (EPA Reg. No. 56228-2, 56228-61, others), and Large Gas Cartridges (EPA Reg. No. 56228-21, and 56228-62):** Gas cartridges are composed of sodium nitrate and charcoal, both naturally occurring substances (EPA 1991). When ignited, gas cartridges produce carbon monoxide, a poisonous gas. Application involves igniting the cartridge, inserting it into an active woodchuck burrow (gas cartridge) or coyote or red fox den (large gas cartridge) and then plugging the den's entrance. In unventilated spaces, exposure to carbon monoxide causes a depletion of oxygen in the blood and death from respiratory failure. Carbon monoxide is recognized by the AVMA as an acceptable method of euthanasia (AVMA 2001). Gas cartridges are registered for use in burrows being actively used by woodchucks. Large gas cartridges are registered for use in dens being actively used by coyotes and red foxes. Gas cartridges are non-restricted use pesticides and therefore would be available under any of the alternatives.

A common concern regarding the use of chemicals is the risk to humans, non-target animals and the environment. Gas cartridges would be used by WS in accordance with the label directions and SOPs which reduces risks to human health and safety. These requirements include but are not limited to;

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<sup>6</sup> An LD50 is the dosage in milligrams of material per kilogram of body weight required to cause death in 50% of a test population of a species.

training in the application of the method, the use of appropriate personal protective equipment, the use of caution during application to avoid burns to the skin or ignition of clothing or other materials; proper storage and disposal. Human exposure would be limited to applicators (EPA 1991). Risk to applicators would be negligible when used in accordance with the label (EPA 1991). Following label requirements eliminates the risk to non-target animals. Burrows or dens must be checked for non-target animals prior to application. Application is not permitted if non-target species are present. Finally, when used as a fumigant carbon monoxide would eventually diffuse through den openings or into the soil (EPA 1991). Sodium nitrate, charcoal, and carbon monoxide are naturally occurring substances and the nature of the application makes the likelihood of any negative impacts to the environment negligible to nonexistent. Euthanasia conducted by WS would be done in accordance with WS Directive 2.505.

**Sodium Pentobarbital (Beuthanasia®-D, Fatal-Plus®, etc.):** Sodium pentobarbital is a type of anesthetic (a barbiturate) that causes death by respiratory failure. WS would only administer sodium pentobarbital via direct injection after target animals were captured using live capture devices and immobilized (see **Live Capture Devices** and **Chemical Immobilization Drugs** above). This method is recognized by the AVMA as an acceptable method of euthanasia (AVMA 2013). The use of sodium pentobarbital is restricted. WS personnel that possess or use these substances would be trained and certified in accordance with WS Directive 2.430. WS personnel that use these drugs or substances would be required to wear appropriate PPE they are provided with (WS Directive 2.601). Additionally, “*the acquisition, storage, and use of ... (these substances would be) ... in compliance with applicable program, Federal, State, and local law and regulations*” (WS Directive 2.430). Euthanasia conducted by WS would be done in accordance with WS Directive 2.505. Euthanized animals would be disposed of in accordance with WS Directives 2.515 and 2.430 to prevent exposure to non-target animals.

**Potassium Chloride:** Potassium chloride causes death by cardiac arrest. WS would only administer potassium chloride via direct injection after target animals were captured using live capture devices and immobilized (see **Live Capture Devices** and **Chemical Immobilization Drugs** above). This method is recognized by the AVMA as an acceptable method of euthanasia (AVMA 2013). The use of potassium chloride is not restricted. WS personnel that use these drugs or substances would be required to wear appropriate PPE they are provided with (WS Directive 2.601). Euthanasia conducted by WS would be done in accordance with WS Directive 2.505. Euthanized animals would be disposed of in accordance with WS Directives 2.515 and 2.430.

**Carbon Dioxide (CO<sub>2</sub>):** Carbon dioxide is sometimes used to euthanize mammals which are captured in live capture devices (see **Live Capture Devices** above). Live animals are placed in a container such as a plastic five gallon bucket or chamber which is then sealed. CO<sub>2</sub> gas is released into the bucket or chamber and the animals quickly die after inhaling the gas. This method is approved as a euthanizing agent by the AVMA (AVMA 2001). CO<sub>2</sub> gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO<sub>2</sub> by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society. Euthanasia conducted by WS would be done in accordance with WS Directive 2.505. CO<sub>2</sub> would not be used to euthanize companion animals in compliance with the Code of Virginia (§3.2-6505).

## **RODENTICIDES**

Rodenticides are pesticides that kill rodents. They are categorized according to how they work. Rodenticides which interfere with normal blood clotting are called anticoagulants. Rodenticides that work in other ways are called non-anticoagulants. Rodenticide products which are not restricted-use chemicals and therefore available for use by persons without a certified pesticide applicator’s license contain rodenticides from both of these groups (EPA 2016). Under the proposed action/no action

alternative, WS would only provide direct operational assistance with small mammals to manage damage or threats to agriculture, natural resources or to property and human health and safety relative to aviation safety. When recommending these methods, WS would caution those persons against their misuse.

**Anticoagulants:** Anticoagulants interfere with blood clotting and cause death from excessive bleeding. First-generation anticoagulants require several doses to cause death (e.g., chlorophacinone, diphacinone and warfarin). Second-generation anticoagulants are more likely to cause death after a single dose (e.g., brodifacoum, bromadiolone, difenacoum, and difethialone). Anticoagulants would be used by WS in accordance with the label (EPA 1998a, EPA 2008, EPA 2013b), WS directives and SOPs to reduce risks to humans, non-target animals and the environment.

**Non-Anticoagulants:** Non-anticoagulants may include the active ingredients bromethalin, cholecalciferol and zinc phosphide (EPA 2016). Both bromethalin and cholecalciferol are active ingredients in rodenticides available for use without a certified applicators license. Zinc phosphide is only available for use to certified applicators. Non-anticoagulants would be used by WS in accordance with the label (EPA 1998a, EPA 1998b, EPA 2008, EPA 2013b), WS directives and SOPs to reduce risks to humans, non-target animals and the environment.

***Zinc Phosphide (EPA Reg. No. 56228-3, 56228-6, others):*** Zinc phosphide is a restricted use pesticide and would therefore be available to persons with a certified applicators license under any of the alternatives. When ingested, zinc phosphide comes into contact with stomach acid and water producing phosphine gas which is absorbed through the stomach lining (EPA 1998b, Proudfoot 2009). Death by circulatory failure occurs because phosphine inhibits cellular respiration (EPA 1998b, Proudfoot 2009). Different formulations of zinc phosphide are registered for use with a variety of rodents.

A common concern regarding the use of chemicals is the risk to humans, non-target animals and the environment. Zinc phosphide would be used by WS in accordance with label directions, WS Directives and SOPs which reduces risks to human health and safety. These requirements include but are not limited to; training in the application of the method, the use of appropriate personal protective equipment, the use of caution during application; proper storage and disposal. Risk to applicators would be mitigated when used in accordance with the label (e.g., wearing long-sleeve shirt and long pants, shoes and sox, chemical-resistant gloves etc.) (EPA 1998b). Following label requirements also mitigates risks to the public, non-target animals and the environment (EPA 1998b, EPA 2008). For example, label requirements specify that bait stations (devices which must meet specified criteria confirmed by testing to restrict access) must be used where children or non-target animals may be exposed (EPA 1998b, EPA 2008). Euthanized animals would be disposed of in accordance with WS Directives 2.515 and 2.430 to prevent exposure to non-target animals.

## APPENDIX C: SPECIES LISTED BY THE U.S. FISH AND WILDLIFE SERVICE<sup>1</sup>

<sup>1</sup>List obtained from U.S. Fish and Wildlife Service, Virginia Field Office, Ecological Services on 2 May 2016

### Endangered Species Act Species List

There are a total of 71 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Amphibians	Status	Has Critical Habitat	Condition(s)
Shenandoah salamander ( <i>Plethodon shenandoah</i> ) Population: Entire	Endangered		
<b>Arachnids</b>			
Spruce-Fir Moss spider ( <i>Microhexura montivaga</i> )	Endangered	Final designated	
<b>Birds</b>			
Piping Plover ( <i>Charadrius melodus</i> ) Population: except Great Lakes watershed	Threatened	Final designated	
Red Knot ( <i>Calidris canutus rufa</i> )	Threatened		
Red-Cockaded woodpecker ( <i>Picoides borealis</i> ) Population: Entire	Endangered		
Roseate tern ( <i>Sterna dougallii dougallii</i> ) Population: northeast U.S. nesting pop.	Threatened		
<b>Clams</b>			
Appalachian monkeyface ( <i>Quadrula sparsa</i> )	Endangered		
birdwing pearlymussel ( <i>Lemiox rimosus</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered		
Cracking pearlymussel ( <i>Hemistena lata</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered		
Cumberland bean ( <i>Villosa trabalis</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered		
Cumberland monkeyface ( <i>Quadrula intermedia</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered		
Cumberlandian combshell ( <i>Epioblasma brevidens</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered	Final designated	
Dromedary pearlymussel ( <i>Dromus dromas</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered		
Dwarf wedgemussel ( <i>Alasmidonta heterodon</i> )	Endangered		

Population: Entire			
fanshell ( <i>Cyprogenia stegaria</i> )	Endangered		
Finerayed pigtoe ( <i>Fusconaia cuneolus</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered		
Fluted kidneyshell ( <i>Ptychobranchus subtentum</i> )	Endangered	Final designated	
Green blossom ( <i>Epioblasma torulosa gubernaculum</i> ) Population: Entire	Endangered		
James spiny mussel ( <i>Pleurobema collina</i> ) Population: Entire	Endangered		
Littlewing pearly mussel ( <i>Pegias fabula</i> ) Population: Entire	Endangered		
Oyster mussel ( <i>Epioblasma capsaeformis</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered	Final designated	
Pink mucket ( <i>Lampsilis abrupta</i> ) Population: Entire	Endangered		
Purple bean ( <i>Villosa perpurpurea</i> )	Endangered	Final designated	
Rough pigtoe ( <i>Pleurobema plenum</i> )	Endangered		
Rough rabbitsfoot ( <i>Quadrula cylindrica strigillata</i> )	Endangered	Final designated	
Sheepnose Mussel ( <i>Plethobasus cyphus</i> )	Endangered		
Shiny pigtoe ( <i>Fusconaia cor</i> ) Population: Wherever found; Except where listed as Experimental Populations	Endangered		
Slabside Pearly mussel ( <i>Pleuronaia dolabelloides</i> )	Endangered	Final designated	
Snuffbox mussel ( <i>Epioblasma triquetra</i> )	Endangered		
Spectaclecase (mussel) ( <i>Cumberlandia monodonta</i> )	Endangered		
Tan riffleshell ( <i>Epioblasma florentina walkeri</i> (=e. <i>walkeri</i> )) Population: Entire	Endangered		
<b>Crustaceans</b>			
Big Sandy crayfish ( <i>Cambarus callainus</i> )	Proposed Endangered		
Lee County Cave isopod ( <i>Lirceus usdagalum</i> ) Population: Entire	Endangered		
Madison Cave isopod ( <i>Antrolana lira</i> ) Population: Entire	Threatened		
<b>Fishes</b>			
Blackside dace ( <i>Phoxinus cumberlandensis</i> ) Population: Entire	Threatened		
Duskytail darter ( <i>Etheostoma percnum</i> ) Population: Entire	Endangered		
Roanoke logperch ( <i>Percina rex</i> ) Population: Entire	Endangered		

Slender chub ( <i>Erimystax cahni</i> ) Population: Entire	Threatened	Final designated	
Spotfin Chub ( <i>Erimonax monachus</i> ) Population: Entire, except where listed as an experimental population	Threatened	Final designated	
Yellowfin madtom ( <i>Noturus flavipinnis</i> ) Population: Entire, except where EXPN	Threatened	Final designated	
Yellowfin madtom ( <i>Noturus flavipinnis</i> ) Population: Holston River, VA, TN	Experimental Population, Non-Essential		
<b>Flowering Plants</b>			
Eastern Prairie Fringed orchid ( <i>Platanthera leucophaea</i> )	Threatened		
harperella ( <i>Ptilimnium nodosum</i> )	Endangered		
Michaux's sumac ( <i>Rhus michauxii</i> )	Endangered		
Northeastern bulrush ( <i>Scirpus ancistrochaetus</i> )	Endangered		
Peter's Mountain mallow ( <i>Iliamna corei</i> )	Endangered		
Roan Mountain bluet ( <i>Hedyotis purpurea</i> var. <i>montana</i> )	Endangered		
Seabeach amaranth ( <i>Amaranthus pumilus</i> )	Threatened		
sensitive joint-vetch ( <i>Aeschynomene virginica</i> )	Threatened		
Shale barren rock cress ( <i>Arabis serotina</i> )	Endangered		
Small Whorled pogonia ( <i>Isotria medeoloides</i> )	Threatened		
Small-Anthered bittercress ( <i>Cardamine micranthera</i> )	Endangered		
Smooth coneflower ( <i>Echinacea laevigata</i> )	Endangered		
Swamp pink ( <i>Helonias bullata</i> )	Threatened		
Virginia Round-Leaf birch ( <i>Betula uber</i> )	Threatened		
Virginia sneezeweed ( <i>Helenium virginicum</i> )	Threatened		
Virginia spiraea ( <i>Spiraea virginiana</i> )	Threatened		
<b>Insects</b>			
Mitchell's Satyr Butterfly ( <i>Neonympha mitchellii mitchellii</i> ) Population: Entire	Endangered		
Northeastern beach tiger beetle ( <i>Cicindela dorsalis dorsalis</i> ) Population: Entire	Threatened		
<b>Lichens</b>			
Rock Gnome lichen ( <i>Gymnoderma lineare</i> )	Endangered		
<b>Mammals</b>			
Carolina Northern Flying squirrel ( <i>Glaucomys sabrinus coloratus</i> ) Population: Entire	Endangered		
Gray bat ( <i>Myotis grisescens</i> ) Population: Entire	Endangered		

Indiana bat ( <i>Myotis sodalis</i> ) Population: Entire	Endangered		
Northern long-eared Bat ( <i>Myotis septentrionalis</i> )	Threatened		
Virginia Big-Eared bat ( <i>Corynorhinus (=plecotus) townsendii virginianus</i> ) Population: Entire	Endangered	Final designated	
<b>Reptiles</b>			
Green sea turtle ( <i>Chelonia mydas</i> ) Population: Except where endangered	Threatened	Final designated	
Hawksbill sea turtle ( <i>Eretmochelys imbricata</i> ) Population: Entire	Endangered		
Kemp's Ridley sea turtle ( <i>Lepidochelys kempii</i> ) Population: Entire	Endangered	Final designated	
Leatherback sea turtle ( <i>Dermochelys coriacea</i> ) Population: Entire	Endangered	Final designated	
Loggerhead sea turtle ( <i>Caretta caretta</i> ) Population: Northwest Atlantic Ocean DPS	Threatened	Proposed, Final designated	
<b>Snails</b>			
Virginia Fringed Mountain snail ( <i>Polygyriscus virginianus</i> ) Population: Entire	Endangered		

### Critical habitats that lie within your project area

The following critical habitats lie fully or partially within your project area.

<b>Clams</b>	<b>Critical Habitat Type</b>
Cumberlandian combshell ( <i>Epioblasma brevidens</i> ) Population: Wherever found; Except where listed as Experimental Populations	Final designated
Fluted kidneyshell ( <i>Ptychobranthus subtentum</i> )	Final designated
Oyster mussel ( <i>Epioblasma capsaeformis</i> ) Population: Wherever found; Except where listed as Experimental Populations	Final designated
Purple bean ( <i>Villosa perpurpurea</i> )	Final designated
Rough rabbitsfoot ( <i>Quadrula cylindrica strigillata</i> )	Final designated
Slabside Pearlymussel ( <i>Pleuronaia dolabelloides</i> )	Final designated
<b>Fishes</b>	
Slender chub ( <i>Erimystax cahni</i> ) Population: Entire	Final designated
Spotfin Chub ( <i>Erimonax monachus</i> ) Population: Entire, except where listed as an experimental population	Final designated
Yellowfin madtom ( <i>Noturus flavipinnis</i> ) Population: Entire, except where EXPN	Final designated

**APPENDIX D: SPECIES LISTED BY THE COMMONWEALTH OF VIRGINIA<sup>1</sup>**

<sup>1</sup>List obtained from < <http://www.dgif.virginia.gov/wildlife/virginiatescspecies.pdf> > on 25 April 2016, Townsend 2016, The Virginia Administrative Code 2 VAC 5-320-10, Code of Virginia § 3.2-1007 and § 3.2-1009.

Common Name	Scientific Name	Status
<b>Amphibians</b>		
Mabee's Salamander	<i>Ambystoma mabeei</i>	LT
Tiger Salamander	<i>Ambystoma tigrinum</i>	LE
Barking Treefrog	<i>Hyla gratiosa</i>	LT
Shenandoah Salamander	<i>Plethodon shenandoah</i>	LE
<b>Arachnida (spiders and pseudoscorpions)</b>		
Spruce-fir moss spider	<i>Microhexura montivaga</i>	LE
<b>Birds</b>		
Henslow's Sparrow	<i>Ammodramus henslowii</i>	LT
Piping Plover	<i>Charadrius melodus</i>	LT
Wilson's Plover	<i>Charadrius wilsonia</i>	LE
Peregrine Falcon	<i>Falco peregrinus</i>	LT
Gull-billed Tern	<i>Gelochelidon nilotica</i>	LT
Roseate tern	<i>Sterna dougallii dougallii</i>	LE
Loggerhead Shrike	<i>Lanius ludovicianus</i>	LT
Black Rail	<i>Laterallus jamaicensis</i>	LE
Bachman's Sparrow	<i>Peucaea aestivalis</i>	LT
Red-cockaded Woodpecker	<i>Picoides borealis</i>	LE
Appalachian Bewick's Wren	<i>Thryomanes bewickii altus</i>	LE
Bachman's warbler (=wood)	<i>Vermivora bachmanii</i>	LE
Kirtland's warbler (=wood)	<i>Dendroica kirtlandii</i>	LE
Red Knot	<i>Calidris canutus rufa</i>	LT
<b>Bivalvia (mussels)</b>		
Dwarf Wedgemussel	<i>Alasmidonta heterodon</i>	LE
Brook Floater	<i>Alasmidonta varicosa</i>	LE
Slippershell Mussel	<i>Alasmidonta viridis</i>	LE
Spectaclecase	<i>Cumberlandia monodonta</i>	LE
Fanshell	<i>Cyrogenia stegaria</i>	LE
Dromedary Pearlymussel	<i>Dromus dromas</i>	LE
Elephant Ear	<i>Elliptio crassidens</i>	LE
Cumberland Combshell	<i>Epioblasma brevidens</i>	LE
Oyster Mussel	<i>Epioblasma capsaeformis</i>	LE
Tan Riffleshell	<i>Epioblasma florentina aureola</i>	LE
Green-blossom Pearlymussel	<i>Epioblasma torulosa gubernaculum</i>	LE
Snuffbox	<i>Epioblasma triquetra</i>	LE
Shiny Pigtoe	<i>Fusconaia cor</i>	LE
Fine-rayed Pigtoe	<i>Fusconaia cuneolus</i>	LE
Atlantic Pigtoe	<i>Fusconaia masoni</i>	LT
Cracking Pearlymussel	<i>Hemistena lata</i>	LE
Pink Mucket	<i>Lampsilis abrupta</i>	LE



Tennessee Heelsplitter	<i>Lasmigona holstonia</i>	LE
Green Floater	<i>Lasmigona subviridis</i>	LT
Birdwing Pearlymussel	<i>Lemiox rimosus</i>	LE
Fragile Papershell	<i>Leptodea fragilis</i>	LT
Black Sandshell	<i>Ligumia recta</i>	LT
Little-winged Pearlymussel	<i>Pegias fabula</i>	LE
Sheepnose	<i>Plethobasus cyphus</i>	LE
James Spiny mussel	<i>Pleurobema collina</i>	LE
Ohio Pigtoe	<i>Pleurobema cordatum</i>	LE
Rough Pigtoe	<i>Pleurobema plenum</i>	LE
Pyramid Pigtoe	<i>Pleurobema rubrum</i>	LE
Slabside Pearlymussel	<i>Pleurobema dolabelloides</i>	LE
Fluted kidneyshell	<i>Ptychobranhus subtentum</i>	LE
Rough Rabbits Foot	<i>Quadrula cylindrica strigillata</i>	LE
Cumberland Monkeyface	<i>Quadrula intermedia</i>	LE
Pimple Back	<i>Quadrula pustulosa</i>	LT
Appalachian Monkeyface	<i>Quadrula sparsa</i>	LE
Purple Liliput	<i>Toxolasma lividum</i>	LE
Deertoe	<i>Truncilla truncata</i>	LE
Purple Bean	<i>Villosa perpurpurea</i>	LE
Cumberland Bean	<i>Villosa trabalis</i>	LE
Pistolgrip	<i>Tritogonia verrucosa</i>	LT
Rayed Bean	<i>Villosa fabalis</i>	LE
<b>Coleoptera (beetles)</b>		
Northeastern Beach Tiger Beetle	<i>Cicindela dorsalis dorsalis</i>	LT
Holsinger's Cave Beetle	<i>Pseudanophthalmus holsingeri</i>	LE
Thomas' Cave Beetle	<i>Pseudanophthalmus holsingeri</i>	LE
American Buring Beetle	<i>Nicrophorus americanus</i>	LE
<b>Crustacea (Amphipods, Isopods, and decapods)</b>		
Madison Cave Isopod	<i>Antrolana lira</i>	LT
Big Sandy Crayfish	<i>Cambarus veteranus</i>	LE
Lee County Cave Isopod	<i>Lirceus usdagalun</i>	LE
Madison Cave Amphipod	<i>Stygobromus stegerorum</i>	LT
<b>Diplopoda (millipedes)</b>		
Ellett Valley Pseudotremia Millipede	<i>Pseudotremia cavernarum</i>	LT
Laurel Creek Xystodesmid Millipede	<i>Sigmoria whiteheadi</i>	LT
<b>Fish</b>		
Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	LE
Western Sand Darter	<i>Ammocrypta clara</i>	LT
Blackside Dace	<i>Chrosomus cumberlandensis</i>	LT
Tennessee Dace	<i>Chrosomus tennesseensis</i>	LE
Steelcolor Shiner	<i>Cyprinella whipplei</i>	LT
Blackbanded Sunfish	<i>Enneacanthus chaetodon</i>	LE
Turquoise Shiner (Spotfin chub)	<i>Erimonax monachus</i>	LT

Slender Chub	<i>Erimystax cahni</i>	LT
Sharphead Darter	<i>Etheostoma acuticeps</i>	LE
Greenfin Darter	<i>Etheostoma chlorbranchium</i>	LT
Carolina Darter	<i>Etheostoma collis</i>	LT
Golden Darter	<i>Etheostoma denoncourti</i>	LT
Duskytail Darter	<i>Etheostoma percnurum</i>	LE
Whitemouth Shiner	<i>Notropis alborus</i>	LT
Emerald Shiner	<i>Notropis atherinoides</i>	LT
Yellowfin Madtom	<i>Noturus flavipinnis</i>	LT
Orangefin Madtom	<i>Noturus gilberti</i>	LT
Roanoke Logperch	<i>Percina rex</i>	LE
Sickle darter	<i>Percina williamsi</i>	LT
Paddlefish	<i>Polyodon spathula</i>	LT
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	LE
Variegated darter	<i>Etheostoma variatum</i>	LE
<b>Gastropoda (snails)</b>		
Appalachian Springsnail	<i>Fontigens bottimeri</i>	LE
Virginia Springsnail	<i>Fontigens morrisoni</i>	LE
Shaggy Coil	<i>Helicodiscus diadema</i>	LE
Rubble Coil	<i>Helicodiscus lirellus</i>	LE
Thankless ghostsnail	<i>Holsingeria unthinksensis</i>	LE
Spiny Riversnail	<i>Io fluvialis</i>	LT
Spirit Supercoil	<i>Paravitrea hera</i>	LE
Brown Supercoil	<i>Paravitrea septadens</i>	LT
Virginia Fringed Mountain Snail (=Virginia coil)	<i>Polygyriscus virginianus</i>	LE
Spider elimia	<i>Elimia arachnoidea</i>	LE
<b>Heteroptera (true bugs)</b>		
Virginia Piedmont Water Boatman	<i>Sigara depressa</i>	LE
<b>Homoptera (cicadas and leaf hoppers)</b>		
Buffalo Mountain mealybug	<i>Puto kosztarabi</i>	LE
<b>Lepidoptera (butterflies and moths)</b>		
Mitchell's satyr	<i>Neonympha mitchellii</i>	LE
Appalachian grizzled skipper	<i>Pyrgus centaureae wyandot</i>	LT
<b>Mammals</b>		
Eastern Big-eared Bat	<i>Corynorhinus rafinesquii macrotis</i>	LE
Virginia Big-eared Bat	<i>Corynorhinus townsendii virginianus</i>	LE
Carolina Northern Flying Squirrel	<i>Glaucomys sabrinus coloratus</i>	LE
Snowshoe Hare	<i>Lepus americanus</i>	LE
Southern Rock Vole	<i>Microtus chrotorrhinus carolinensis</i>	LE
Gray Bat	<i>Myotis grisescens</i>	LE
Indiana Bat	<i>Myotis sodalis</i>	LE
Little Brown Bat	<i>Myotis lucifugus</i>	LE
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	LT
Tri-colored Bat	<i>Perimyotis subflavus</i>	LE

American Water Shrew	<i>Sorex palustris</i>	LE
Eastern puma	<i>Puma (Felis) concolor cougar</i>	LE
Gray wolf	<i>Canis lupus</i>	LE
Blue whale	<i>Balaenoptera musculus</i>	LE
Finback whale	<i>Balaenoptera physalus</i>	LE
Humpback whale	<i>Meagaptera novaeangliae</i>	LE
North Atlantic Right whale	<i>Eubalaena glacialis</i>	LE
Sei whale	<i>Balaenoptera borealis</i>	LE
Sperm whale	<i>Physeter catodon (=macrocephalus)</i>	LE
West Indian manatee	<i>Trichechus manatus</i>	LE
<b>Reptiles</b>		
Loggerhead (Sea Turtle)	<i>Caretta caretta</i>	LT
Canebrake Rattlesnake	<i>Crotalus horridus [Coastal Plain population]</i>	LE
Chicken Turtle	<i>Deirochelys reticularia</i>	LE
Wood Turtle	<i>Glyptemys insculpta</i>	LT
Bog Turtle	<i>Glyptemys muhlenbergii</i>	LE
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>	LT
Green sea turtle	<i>Chelonia mydas</i>	LT
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	LE
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	LE
Leatherback sea turtle	<i>Dermochelys coriacea</i>	LE
<b>Vascular Plants</b>		
Sensitive Joint-vetch	<i>Aeschynomene virginica</i>	LT
Sea-beach amaranth	<i>Amaranthus pumilus</i>	LT
Virginia Roundleaf birch	<i>Betula lenta var. uber</i>	LE
Shale barren rock cress	<i>Boechera serotina</i>	LT
Valley Doll's – daisy	<i>Boltonia montana</i>	LE
Small-anthered Bittercress	<i>Cardamine micranthera</i>	LE
Juniper sedge	<i>Carex juniperorum</i>	LE
Millboro leatherflower	<i>Clematis viticantis</i>	LT
Bentley's coralroot	<i>Corallorhiza bentleyi</i>	LE
Smooth Coneflower	<i>Echinacea laevigata</i>	LT
Harper's fimbry	<i>Fimbristylis perpusilla</i>	LE
Harperella	<i>Harperella nodosa</i>	LE
Virginia Sneezeweed	<i>Helenium virginicum</i>	LE
Swamp-pink	<i>Helonias bullata</i>	LE
Long-stalked Holly	<i>Ilex collina</i>	LE
Peters Mountain mallow	<i>Iliamna corei</i>	LE
Virginia quillwort	<i>Isoetes virginica</i>	LE
Small Whorled Pogonia	<i>Isotria medeoloides</i>	LE
New Jersey Rush	<i>Juncus caesariensis</i>	LT
Narrow-leaved Spatterdock	<i>Nuphar sagittifolia</i>	LT
Ginseng	<i>Panax quinquefolius L.</i>	LT
Prairie fringed orchid	<i>Platanthera leucophaea</i>	LT

Michaux's Sumac	<i>Rhus michauxii</i>	LT
Northeastern Bulrush	<i>Scirpus ancistrochaetus</i>	LE
Reclining Bulrush	<i>Scirpus flaccidifolius</i>	LT
Virginia Spiraea	<i>Spiraea virginiana</i>	LE
Running Glade Clover	<i>Trifolium calcaricum</i>	LE
Northern Prostrate Clubmoss	<i>Lycopodiella marqueritiae</i>	LT

<sup>2</sup> In the Commonwealth of Virginia, plants and insects fall under one authority while amphibians, wild birds, mussels, fish, gastropods, mammals and reptiles fall under the jurisdiction of another authority. Each authority, as outlined below, has different definitions for listing status.

**Plant and Insect Status Codes and Definitions:**

Code of Virginia, Title 3.2, Chapter 10, sections 1000–1011. This section of the Code gives the Virginia Department of Agriculture and Consumer Services legislative authority over the listing, protection and taking of threatened and endangered plant and insect species in the Commonwealth.

*LE (Endangered):* Any species or variety of plant life or insect life determined by the Board to be in danger of extinction throughout all or a significant part of its range other than a species determined by the Commissioner not to be in the best interest of the welfare of man.

*LT (Threatened):* Any species determined by the Board to be likely to become an endangered species within the foreseeable future throughout all or a significant portion of its native range.

**Fish and Wildlife Status Codes and Definitions:**

Code of Virginia, Title 29.1, Chapter 5, sections 563–568. This section of the Code gives the Virginia Department of Game and Inland Fisheries legislative authority over the listing, protection and taking of threatened and endangered fish and wildlife species in the Commonwealth.

*LE (Endangered):* Any species which is in danger of extinction throughout all or a significant portion of its range.

*LT (Threatened):* Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.