ENVIRONMENTAL ASSESSMENT

MAMMAL DAMAGE MANAGEMENT IN THE STATE OF VERMONT

Prepared by:

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

In cooperation with:

VERMONT FISH AND WILDLIFE DEPARTMENT

VERMONT AGENCY OF AGRICULTURE FOOD AND MARKETS

VERMONT DEPARTMENT OF HEALTH

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ACRONYMS

AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
ATF	Bureau of Alcohol, Tobacco, Firearms and Explosives
AVMA	American Veterinary Medical Association
CDC	Center for Disease Control
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CSA	Cooperative Service Agreement
DEA	Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FMD	Foot and Mouth Disease
FMIA	Federal Meat Inspection Act
FONSI	Finding of No Significant Impact
FY	Fiscal Year (October 1, XXXX – September 30, XXXX)
IWDM	Integrated Wildlife Damage Management
MDM	Mammal Damage Management
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	Natural Historic Preservation Act
NOA	Notices of Availability
NRCS	Natural Resources Conservation Service
NWP	Nationwide Permit
NWRC	National Wildlife Research Center
ORV	Oral Rabies Vaccination
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Department of the Interior, Fish and Wildlife Service
VAAFM	Vermont Agency of Agriculture, Food & Markets
VTrans	Vermont Agency of Transportation
VFWD	Vermont Fish and Wildlife Department
VDH	Vermont Department of Health
VTPID	VAAFM, Plant Industry Division
WS	Wildlife Services

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 Wildlife Services' involvement in mammal damage management in Vermont. 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. 8351-8352) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 8353)). 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[1]) 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, Memoranda of Understanding (MOUs), and partnership agreements 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 individual direct, indirect, and cumulative impacts. In addition, this EA has been prepared to evaluate a range of alternatives to meet the need for action while addressing the issues associated with mammal damage management (MDM). Pursuant to the National Environmental Policy Act (NEPA) and the Council on

[1] The WS Program Directives (https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_ws_program_directives/ct_ws_dir_ch2) provides guidance for WS personnel to conduct wildlife damage management activities. WS Directives referenced in this EA can be found in the manual or link provided but are not referenced in the Literature Cited Appendix.

Environmental Quality (CEQ) regulations, WS is preparing this EA to 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[2].

The WS-Vermont program continues to receive requests for assistance or anticipates receiving requests for assistance to resolve or prevent damage or threats associated with raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis)*, woodchucks (*Marmota monax*), white-tailed deer (*Odocoileus virginianus*), moose (*Alces alces)*, black bear (*Ursus americanus*), coyote (*Canais latrans*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), river otter (*Lutra canadensis*), mink (*Mustela vison*), fisher (*Martes pennanti*), American (pine) martin (*Martes Americana*), ermine (short-tailed weasel; *Mustela eminea*), long-tailed weasel (*Mustela frenata*), beaver (*Castor canadensis*), muskrats (*Ondatra zibethicus*), porcupine (*Erethizon dorsatum),* Virginia opossum (*Didelphus marsupialis*), gray squirrels (*Sciurus carolinensis*), red squirrels (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamias striatus*) northern flying squirrels (*Glaucomys sabrinus*), southern flying squirrels (*Glaucomys volans*), snowshoe hare (*Lepus americanus*), eastern cottontail (*Sylvilagus floridanus*), feral swine (*Sus scrofa*), feral cats (*Felis* spp.), and bats (order *Chiroptera*).

This EA will also address limited removal of miscellaneous small mammals, such as insectivores (shrews and moles) and rodents (mice, rats, and voles), such as deer mice (*Peromyscus maniculatus*), white-footed mice (*Peromyscus leucopus*), house mice (*Mus musculus*), meadow jumping mice (*Zapus hudsonius*), woodland jumping mice (*Napaeozapus insignis*), northern short-tailed shrews (*Blarina brevicauda*), masked shrews (*Sorex cinereus*), smoky shrews (*Sorex fumeus*), least shrews (*Crytotis parva*), hairy-tailed moles (*Parascalops breweri*), eastern moles (*Scalopus aquaticus*), star-nosed moles (*Condylura cristata*), southern red-backed voles (*Clethrionomys gapperi*), meadow voles (*Microtus pennsylvanicus*), and Norway rats (*Rattus norvegicus*).

Finally, this EA will address captive non-native cervids and elk, such as red deer (*Cervus elaphus*), fallow deer (*Dama dama*), elk (*Cervus elaphus*), bison (*Bison bison*), and sika deer (*Cervus nippon*).

The issues and alternatives associated with MDM were initially developed by WS with review by the cooperating and consulting agencies. Cooperating and consulting agencies assisted with the identification of additional issues and alternatives pertinent to managing damage. This EA will be made available to the public for review and comment prior to the issuance of a decision regarding the alternative to be implemented and its environmental impacts.

1.2 NEED FOR ACTION

Some species of wildlife have adapted to thrive in human altered habitats. Those species, in particular, are often responsible for the majority of conflicts between people and wildlife that lead to requests for assistance to reduce damage to resources and to reduce threats to the safety of people. Both sociological and biological carrying capacities must be applied to resolve wildlife damage problems. The wildlife acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations (Hardin

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

1986). Biological carrying capacity is the land or habitat's ability to support healthy populations of wildlife without degradation to the species' health or their environment during an extended period of time (Decker and Purdy 1988). These phenomena are especially important because they define the sensitivity of a person or community to a wildlife species. For any given damage situation, there are varying thresholds of tolerance exhibited by those people directly and indirectly affected by the species and any associated damage. This damage threshold determines the wildlife acceptance capacity. While the habitat may have a biological carrying capacity to support higher populations of wildlife, in many cases the wildlife acceptance capacity is lower or has been met (Hardin 1986). Once the wildlife acceptance capacity is met or exceeded, people begin to implement population or damage management to alleviate damage or address threats to human health and safety.

The alleviation of damage or other problems caused by or related to the behavior of wildlife is termed wildlife damage management and is recognized as an integral component of wildlife management (Leopold 1933, Berryman 1991, The Wildlife Society 2010). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated and the need for damage management is derived from the specific threats to resources. The need for action to manage damage and threats associated with mammals arises from requests for assistance[1] received by WS to reduce and prevent damage associated with mammals from occurring to four major categories: agricultural resources, natural resources, property, and threats to human health and safety. WS has identified those mammal species most likely to be responsible for causing damage to those four categories based on previous requests for assistance. Table 1.1 lists WS' technical assistance consultations involving mammal damage or threats of damage to those four major resource types from the federal fiscal year[2] (FY) 2012 through FY 2016. Technical assistance is provided by WS to those persons requesting assistance with resolving damage or the threat of damage by providing information and recommendations on mammal damage management activities that can be conducted by the requestor without WS' direct involvement in managing or preventing the damage. WS' technical assistance activities will be discussed further in Chapter 2 of this EA. Table 1.1 does not include direct operational assistance projects where WS was requested to provide assistance through the direct application of methods.

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

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

Table 1.1 - WS' Technical assistance consultations conducted in Vermont, FY 2012-FY 2016.

Species	Projects	Species	Projects
Bats (all)	1,234	Mammal unidentified	5
Beaver	137	Mice/Rats	89
Black Bear	64	Minks	13
Bobcat	14	Moles (all)	32
Chipmunk	40	Moose	9
Coyote	61	Muskrats	10
European Ferret	3	Porcupines	101
Feral Cat	264	Rabbits/Hares	69
Feral Cattle	14	Raccoon	1,651
Feral Dog	285	River Otter	6
Feral Goat	2	Striped Skunk	997
Feral Horse	5	Squirrels (all)	214
Feral Sheep	5	Virginia Opossum	99
Feral swine	22	Voles (all)	15
Fisher	52	Weasel (all)	46
Fox, Gray	154	White-tailed Deer	55
Fox, Red	538	Woodchuck (Marmot)	354
Lions, Mountain (Cougar)	1	Totals:	6,661
Lynx	1		

*Feral swine and Norway rat are introduced invasive species.

Table 1.2 lists the resource types to which mammal species can cause damage. Many of the mammal species can cause damage to or pose threats to a variety of resources. Most requests for assistance received by WS are associated with those mammal species causing damage or threats of damage to property and human health and safety. For example, many of those mammal species listed in Table 1.2 are potential vectors for zoonotic diseases or can damage property, such as houses, lawns, and businesses or damage infrastructure, such as dams, through digging and burrowing. For human safety, requests for WS' assistance have often been received to reduce the threat of disease transmission and the threat of aircraft striking mammals at airports.

Table 1.2 - Mammal species addressed in the EA with WS requests for technical assistance received and the resource type damage by those species, from 2012 to 2016. Resource types: A=Agriculture, N=Natural Resources, P=Property, H=Human Health and Safety.

Species	Resource				Species	Resource			
	A	N	P	H		A	N	P	H
Bats (all)	X	X	X	X	Lynx				X
Beaver	X	X	X	X	Mammal unidentified			X	X
Black Bear	X		X	X	Mice/Rats			X	X
Bobcat	X		X	X	Minks	X		X	X
Chipmunk			X	X	Moles (all)			X	X
Coyote	X		X	X	Moose	X		X	X
European Ferret			X	X	Muskrats			X	X
Feral Cat	X	X	X	X	Porcupines	X	X	X	X
Feral Cattle			X	X	Rabbits/Hares			X	X
Feral Dog		X	X	X	Raccoon	X	X	X	X
Feral Goat	X			X	River Otter	X	X	X	X
Feral Horse				X	Striped Skunk	X	X	X	X
Feral Sheep	X			X	Squirrels (all)	X	X	X	X
Feral swine*	X		X	X	Virginia Opossum	X	X	X	X
Fisher	X		X	X	Voles (all)			X	X
Fox, Gray	X		X	X	Weasel (all)	X	X	X	X
Fox, Red	X	X	X	X	White-tailed Deer	X	X	X	X
Lions, Mountain (Cougar)				X	Woodchuck (Marmot)	X		X	X

*Feral swine are introduced invasive species.

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

Need for Mammal Damage Management to Protect Human Health and Safety

Human health and safety concerns and problems associated with mammals include, but are not limited to, the potential for transmission of zoonotic diseases to humans, mammal hazards at airports, and risks and actual instances of mammals injuring humans. Although rare, attacks to humans by mammal species can occur and are always a concern. Bears and coyotes are two species that pose the largest threat to physically harm humans. Incidences usually occur when the animal becomes accustomed to human behaviors or has easy access to a human-generated food source. Attacks can also occur from animals that suffer from diseases such as distemper or rabies, which often causes the animal to lose their fear of humans.

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

Table 1.3 - Wildlife diseases in the Eastern United States that pose potential health risks through transmission to humans (Beran 1994, Davidson 2006 and Miller et al. 2013).[*]

Disease	Causative Agent	Hosts[†]	Human Exposure
Anthrax	*Bacillus antracis*	cats	inhalation, ingestion
Tetanus	*Clostridium tetani*	mammals	direct contact
Dermatophilosis	*Dermatophilus congolensis*	mammals	direct contact
Pasteurellaceae	*Haemophilus influenzae*	mammals	bite or scratch
Salmonellosis	*Salmonella* spp.	mammals	ingestion
Yersinosis	*Yersinia* spp.	cats	ingestion
Chlamydioses	*Chlamydophilia felis*	cats	inhalation, direct contact
Typhus	*Rickettsia prowazekii*	opossums	inhalation, ticks, fleas
Sarcoptic mange	*Sarcoptes scabiei*	red fox, coyotes	direct contact
Trichinosis	*Trichinella spiralis*	raccoons, fox	ingestion, direct contact
Rabies	Rhabidovirus	mammals	direct contact
Visceral larval	*Baylisascaris procyonis*	raccoons, skunks	ingestion, direct contact
Leptospirosis	*Leptospira interrogans*	mammals	ingestion, direct contact
Echinococcus	*Echinococcus multilocularis*	fox, coyotes	ingestion, direct contact
Toxoplasmosis	*Toxoplasma ondii*	cats, mammals	ingestion, direct contact
Spirometra	*Spirometra mansonoides*	bobcats, raccoons, fox	ingestion, direct contact
Giardiasis	*Giardia lamblia, G. Duodenalis*	beaver, coyotes, cats	ingestion, direct contact
Lyme disease	*Borellia burgdorferi*	mammals	tick bite (vectored by deer)
Tularemia	*Francisella tularensis*	rodents, rabbits	direct contact, ingestion, inhalation
Hantavirus	Hantaviruses	rodents	direct contact, ingestion, inhalation

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

† The host species provided for each zoonosis includes only those mammalian species addressed in this EA unless the zoonoses listed potentially infects a broad range of mammalian wildlife.

Zoonoses can infect varies mammals including humans. The diseases listed do not necessarily infect only those mammalian species covered under this EA but likely infect several species of mammals or groups of mammals. For a complete discussion of the more prevalent diseases in free-ranging mammals, please refer to Beran (1994), Davidson (2006) and Miller (2013).

Individuals or property owners that request assistance with mammals frequently are concerned about potential disease risks but are unaware of the types of diseases that can be transmitted by those animals. In those types of situations, assistance is requested because of a perceived risk to human health or safety associated with wild animals living in close association with humans, from animals acting out of character, or from animals showing no fear when humans are present.

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

- Potential exposure of residents to rabies due to the presence of bats in residential homes and publicly owned buildings such as schools.
- Potential exposure of humans to rabies posed by skunks denning and foraging in a residential community or from companion animals coming in contact with infected skunks.
- Concern about the threat of histoplasmosis from the disturbance of a large deposit of guano in an attic or other confined space where a large colony of bats routinely roosts or raise young.
- Accumulated droppings from denning or foraging raccoons and subsequent exposure to raccoon roundworm in fecal deposits in a suburban community or at an industrial site where humans work or live in areas of accumulation.

Beaver damming activity creates conditions favorable to certain types of mosquitoes and can hinder mosquito control efforts or result in population increases of these insects (Wade and Ramsey 1986). While the presence of these insects is largely a nuisance, mosquitoes can transmit diseases such as West Nile Virus (WNV) and eastern equine encephalitis (EEE) (Mallis 1982) (Lindsey et al. 2014) (Center for Disease Control (CDC) 2000). WNV was first identified in the United States in New York City in 1999. WNV has been found in all fourteen counties in Vermont (VDH 2017). Since 2000, there have been a total of 17 reported human cases. In 2017, 4,288 mosquito pools were tested and 89 tested positive (VDH 2017). Eastern equine encephalitis is much less common but has been present in mosquitoes throughout the state (VDH 2017). It was first detected in 2011 when several emus were infected. There have been two cases of EEE in humans reported in Vermont since 2007, with the most recent case reported in 2012 (Natalie Kwit, per communication 2018). In 2013, two horses in Franklin County died that were infected with the virus.

Additionally, beavers are potential carriers of the intestinal parasite *Giardia lamblia,* which can contaminate human water supplies and cause outbreaks of the disease Giardiasis in humans (Woodward 1983, Beach and McCulloch 1985, Wade and Ramsey 1986, Miller and Yarrow 1994). The CDC has recorded at least 41 outbreaks of waterborne Giardiasis, affecting more than 15,000 people. Beavers are also known carriers of tularemia, a bacterial disease that is transmittable to humans through bites by

arthropod vectors or infected animals or by handling animals or carcasses which are infected (Wade and Ramsey 1986). Feng et al. 2007 reported that beavers tested positive for a Crytosporidium (a parasite that causes diarrheal diseases) genotype that has also been found in humans, thus creating the possibility of transmission. Lastly, on rare occasions, beavers may contract the rabies virus and attack humans. In June 2014, a beaver attacked and wounded a kayaker in Monroe County New York. A bystander killed the beaver with a paddle and submitted it for rabies testing. September 2012, a beaver attacked an 83 year old women in Fairfax County, Virginia (Washington Examiner 2012).

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

In addition to rabies, feral/free ranging (domestic) cats can carry other zoonoses including cat scratch disease (fever) (*Bartonella henselae*), Salmonella (*Salmonella* spp.), murie typhus (*Rickettseia typhi*), plague (*Yersinia pestis*), tularemia (*Francisella tularensis*), toxoplasmosis (*Toxoplasma gondii*), hookworm (*Uncinaria sterocephala*, *Ancylostoma tubaeforme*, *Ancylostoma braziliense*, *Ancylostoma ceylanicum*), and raccoon roundworm (*Baylisascaris procyonis*) (Gerhold and Jessup 2012). People that are highly susceptible to these zoonoses are children under the age of five, pregnant women, adults over 65, and persons with weakened immune systems (*e.g.*, cancer patients undergoing chemotherapy) (CDC 2016).

The following section includes some additional 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 zoonoses for which WS could provide assistance.

Tick Borne Diseases: There are numerous tick borne diseases that have been documented as occurring in Vermont including Lyme disease, babesiosis, ehrlichiosis, and Rocky Mountain spotted fever. Between 2005– 2015, a total of 3,909 cases of Lyme disease were confirmed in Vermont with an additional 78.4 cases probable in 2015 (CDC 2015). The tick infests a wide variety of animals, but is most commonly found on meadow voles, mice, and deer.

Tularemia: Tularemia, also known as rabbit fever, is a disease caused by the bacterium *Fracisella tularensis*. Tularemia typically infects animals such as rodents, rabbits, and hares. Usually, people become infected through the bite of infected ticks or tabanid flies, by handling infected sick or dead animals, by eating or drinking contaminated food or water, or by inhaling airborne bacteria. About 200 human cases of tularemia are reported each year in the U.S., and two cases have been confirmed in Vermont between 2005 and 2015 (CDC 2016).

Raccoon Roundworm (*Baylisascaris procyonis*, BP): Roundworms are a common parasite that can be found in the small intestine of raccoons which causes severe or fatal encephalitis in a variety of birds and mammals, including humans (CDC 2011). BP also causes eye and organ damage in humans. Humans become infected with BP by ingesting soil or other materials (*e.g.*, bark or wood chips) contaminated with raccoon feces containing BP eggs. Young children are at particular risk for infection because they are likely to place potentially contaminated fingers and objects like toys into their mouths and ingest the

parasite (CDC 2011). Raccoons are the primary host for the roundworm, but other animals including birds and small mammals can also be infected. Predator animals including dogs may also become infected by eating animals that are infected. In some dogs, *BP* may develop to adult worms and pass eggs in the dogs' feces (CDC 2011). Despite the prevalence of infection in raccoons, infection of humans is rare and less than 25 cases have been documented in the U.S. Cases have been reported in California, Illinois, Louisiana, Massachusetts, Michigan, Minnesota, Missouri, New York, and Pennsylvania. As of 2008, there were 15 reported human neurological cases in the US; five of the infected persons died (CDC 2011).

Rabies: 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. In 2017 there were 40 cases of rabid mammals documented in Vermont (VDH 2017). Raccoons, Big Brown Bats and Striped Skunks made up the majority of positively tested animals with 52.5%, 15% and 12.5% respectively. Infected animals often lose their wariness of humans and therefore show more aggressive behavior towards people, posing a threat to human health and safety. More information pertaining to rabies can be found through WS' National Rabies Management Program (https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nrmp/ct_rabies).

Disease Surveillance and Monitoring

Public awareness of health risks associated with zoonoses have increased in recent years. Several zoonotic diseases associated with mammals are addressed in this EA. Zoonotic diseases remain a concern and continue to pose threats to human health and safety where people encounter mammals. WS has received requests to assist with reducing damage and threats associated with several mammal species and could conduct or assist with disease monitoring or surveillance activities for any of the mammal species addressed in this EA. Most disease sampling occurs ancillary to other wildlife damage management activities (*i.e.*, disease sampling occurs after wildlife have been captured or lethally removed for other purposes). For example, WS may collect blood samples from beavers that were lethally removed to alleviate damage occurring to property to test for tularemia.

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

Several known diseases that are infectious to humans, including rabies, have been found in feral cats. Another common zoonosis found in cats is ringworm. Ringworm (*Tinea* spp.) is a contagious fungal disease contracted through direct interactions with an infected person, animal, or soil. Other common zoonosis of cats are pasteurella, salmonella, cat scratch disease, and numerous parasitic diseases, including roundworms, tapeworms, and toxoplasmosis (Gerhold 2011).

Most of the zoonoses known to infect cats that are infectious to humans are not life-threatening if diagnosed and treated early. However, certain societal segments are at higher risk if exposed. Gerhold (2011) and Gerhold and Jessup (2012) reviewed many of the risks that feral cats pose to human populations. It is well documented that women who are pregnant, people receiving chemotherapy for immunologic diseases and organ transplants, and those with weakened immune systems are at increased risk of clinical disease if exposed to toxoplasmosis (AVMA 2004).

Feral swine are potential reservoirs for at least 30 viral and bacterial pathogens (Davidson 2006, Samuel et al. 2001, Williams and Barker 2001) and 37 parasites (Forrester 1991) that are transmissible to humans. Brucellosis, salmonellosis, toxoplasmosis, trichinosis, tuberculosis, and tularemia are some of the common diseases that can be carried by feral swine that are also known to infect humans (Stevens 1996, Hubalek et al. 2002, Seward et al. 2004). Infection may result from direct exposure to swine by handling carcasses (CDC 2009b), through contamination of food crops (California Food Emergency Response Team 2007), or through secondary infection of a third host (West et al. 2009). When diseases are transmitted through a third host, feral swine transmit the diseases to other wild mammals, birds, and reptiles, which in turn may transmit them to domestic livestock or humans. Feral swine can pose a threat to human safety from disease transmission, from aggressive behavior, and from being struck by vehicles and aircraft. Feral swine may act as reassortment vessels for such viruses as the highly pathogenic H5N1 influenza virus found throughout Europe, Asia, Africa and the Middle East (Hutton et al 2006). The reassortment of viruses could lead to new strains of influenza viruses that would become easily transferrable from mammals to humans (Brown 2004). Hutton et al. (2006) stated that feral swine can 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 if left untreated.

Need for Mammal Damage Management at Airports

Airports provide ideal conditions for many wildlife species due to the large grassy areas adjacent which includes brushy, forested habitat used as noise barriers. Airports are also often located within or adjacent to significantly urbanized environments. Access to most airport properties is restricted so wildlife living within airport boundaries are protected during hunting and trapping seasons and are insulated from many other human disturbances.

The civil and military aviation communities have acknowledged that the threat to human safety from aircraft collisions with wildlife is increasing (Dolbeer et al. 2016). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety (Thorpe 1996), result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Robinson 1996). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995).

Between 1990 and 2015 in the United States, 3,572 aircraft strikes were reported involving terrestrial mammals and 1,581 involved bats (Dolbeer et al. 2016). The number of mammal strikes actually occurring is likely to be much greater, since an estimated 80% of civil wildlife strikes go unreported (Cleary et al. 2000) and terrestrial mammal species with body masses less than one kilogram (2.2 pounds) are excluded from the database (Dolbeer et al. 2015). Civil and military aircraft have collided with a reported 65 mammal species (43 terrestrial and 22 bat) from 1990 through 2015 (Dolbeer et al. 2016).

Vermont has 87 total registered airports, including 22 heliports and five seaports (https://www.faa.gov/airports/airport_safety/airportdata_5010/menu/#datadownloads). Certificated airports are subject to Federal Aviation Administration (FAA) Federal Aviation Regulations Part 139. Airports that are certificated under Part 139 are designated based on the size of passenger aircraft that use the airport. This more typically includes larger airports with commercial service. Part 139 airports are held to a much higher standard to reduce wildlife strikes to be able to maintain their certification. Although a greater number of wildlife strikes with aircraft involve birds, mammals are also considered serious hazards. Deer have been found to be the most significant mammal hazard at airports, while numerous other mammal species also pose threats to safety and aviation (Dolbeer et al. 2012). Animals such as foxes, skunks, opossums, and raccoons often venture onto airfields and become a direct threat to planes both landing and taking off. Although rare visitors, more rural airfields may deal with black bears and moose which pose a strike risk or risk to human safety if encountered by airport personnel. Other mammals which pose hazards to aircraft and public safety include woodchucks, muskrat, and beavers, which can pose a direct strike hazard, modify habitats attracting other strike risk species, or damage equipment at the airport. Species such as rabbits and small rodents (mice and voles) can also damage equipment or serve as prey for mammalian and avian predators compounding strike risks.
WS commonly follows procedures recommended in the "Wildlife Hazard Management at Airports: a Manual for Airport Personnel" (Cleary et al 2005). WS-Vermont has assisted 11 airports between 2002 and 2016 in the management of mammal threats to aviation. This includes, but is not limited to the removal of skunks, raccoons, opossum and rabbits from hangers, fence lines and around buildings, removal of fox, coyote and deer that have crossed runways and taxiways, reduction in flooding caused by beaver, and removal of woodchucks that are digging around airfield equipment. Airports throughout Vermont have reported a total of 15 mammal strikes from 1990-2016, involving seven different species of mammals (FAA Wildlife Strike Database 2018, VAOT Communications) (Table 1.4). It is estimated that only 39% of all bird strikes are reported in the U.S., and it's likely that mammal strikes are also underreported, especially if they involve smaller mammal species. Consequently, the number of mammal strikes is most likely much higher than FAA records indicate.

In April 2004, an Air National Guard F-16 struck a coyote during take-off at the Burlington International Airport which resulted in the replacement of a brake assembly costing $17,000 (Personal Communications, United States Air Force). Morrisville-Stowe State Airport in Morrisville, VT reported a deer strike in 1998, but no estimate of damage was reported (WS Wildlife Hazard Assessment, May 2002). In October 1999 at the William H. Morse State Airport in Bennington, an aircraft hit a deer resulting in approximately $120,000 worth of damage (English, aircraft accident reporting form, 1999). In autumn of 2001, an aircraft struck a deer at Hartness State Airport in Springfield causing $2,000 in damages (WS Wildlife Hazard Assessment, May 2002), and in August 2006, an aircraft struck a deer at the same airport causing $6,174 in repairs (FAA Wildlife Strike Database 2018). In March, 2012 an aircraft struck a coyote at Rutland Regional State Airport resulting in minor engine damage (FAA Wildlife Strike Database 2018).

Table 1.4 - Mammal species reported struck by aircraft in Vermont from 1/1/2000 - 5/1/2016.

Species	# Reports	Species	# Reports
Bats (all)	4	Striped Skunk	3
Coyote	2	White-tailed Deer	4
Red Fox	2		
TOTAL	15		

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

Example of WS Technical Assistance and Direct MDM in Vermont

Burlington International Airport (BTV) and the Vermont Air National Guard (VTANG) entered into a Cooperative Service Agreement with WS for the purpose of assessing, managing, and monitoring wildlife-related public safety and aviation hazards. Small mammals such as rabbits, woodchucks and other small prey-base mammals have attracted raptors which are a significant strike threat. Woodchucks, fox, coyote, raccoons and skunks also dig holes in the airfield, under structures, and damage equipment causing safety concerns, surface degradation, and monetary damage. WS implemented an Integrated Wildlife Damage Management (IWDM) approach consisting of technical assistance and direct damage management components including: WS review of airport development, construction, and landscaping plans, habitat management recommendations, hazard mitigation, as well as providing training to BTV and VTANG personnel on hazardous mammal species population management, reporting, and exclusion. WS involvement with BIA considerably reduced or prevented strikes with hazardous mammal species and avian predators at the airport.

Other Mammal Hazards to Public Health and Safety

In addition to the threat from disease transmission, requests are also received for assistance from a perceived threat of physical harm from wildlife, especially from predatory wildlife (Conover 2002, Adams et al. 2006). WS may be requested to provide assistance with reduction of risk of bites and injuries from animals that appear to have lost their fear of humans and/or are behaving aggressively toward people.

Human encroachment into wildlife habitat increases the likelihood of human-wildlife interactions. Several predatory and omnivorous wildlife species thrive in urban habitat due to the availability of food, water, and shelter. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting it in several species (deer, moose, and bear). The constant presence of human food scrapes, readily available water supplies, and abundant rodent populations found in urban areas often increases the survival rates and carrying capacity of wildlife species that are adaptable to those habitats (Adams et al. 2006). Often the only factor that limits wildlife populations in and around urban areas is the prevalence of diseases, which can be confounded by the overabundance of wildlife

congregated into a small area that can be created by the seemingly unlimited amount of food, water, and shelter found within urban habitats.

As people are increasingly living with wildlife, the lack of harassing and threatening behavior by humans toward many species of wildlife, especially around urban areas, has led to a decline in the fear wildlife have toward humans. When wildlife species begin to habituate to the presence of humans and human activity, a loss of apprehension occurs that can lead to threatening behavior toward humans. Threatening behavior can be in the form of aggressive posturing, a general lack of apprehension toward humans, or abnormal behavior. The concern that wildlife will attack or exhibit aggressive behavior towards pets is a topic that is common in many areas of Vermont, both urban and rural. In many cases the perception that there is a danger of attack is simply because the public is seeing a species that are unfamiliar.

Emergency Response Efforts

Both large-scale natural disasters (e.g., hurricanes, tornadoes, and floods) and small-scale localized emergencies (e.g., release of exotic animals, oil spills, traffic accidents involving animal transport vehicles) may occur in which WS' personnel could be requested to assist federal, state, and local governments in charge of responding to those situations. Those requests for assistance would be on extremely short notice and rare emergencies that would be coordinated by federal, state, and local emergency management agencies. For example, WS' personnel may be requested to participate in the lethal removal of swine that were injured or were released from their transport vehicle at the scene of an accident to prevent those animals from endangering other drivers. In another example, WS' personnel may be requested to assist local and state law enforcement in immobilization or lethal control of exotic animals that have escaped due to unforeseen circumstances. WS may also be requested to assist state and federal agencies in immobilization of native wildlife species (deer, bear, moose, bobcat, lynx, etc.,) to protect human health and safety, reduce damage or to protect the mammal.

Need for Mammal Damage Management to Protect Agricultural Resources

WS receives requests for assistance from agricultural producers experiencing damage problems from mammals including, but not limited to: predation of livestock, including poultry, by coyotes and foxes; damage to crops and stored feed by woodchucks, raccoons and rodents; and risk of pathogen transmission. Vermont is an agricultural state with 7,338 farms and over 1.25 million acres in farm production (NASS 2013). In the 2016 State Agriculture Overview, there were 260,000 cattle and calves in livestock inventory and 4,000 hogs and pigs. Vermont cash receipts from farm marketing's totaled $699 million in 2012, contributing substantially to the state's economy. Vermont had cash receipts over $500 million in milk production, $69.9 million in cattle cash receipts, $28 million in fruits and vegetables, $26 million in maple syrup, $24 million in greenhouse and nursery and $28 million in "other crops" as well as $21.9 million in other livestock and poultry (NASS 2012). The state produces agricultural commodities that are in the top twenty ranking for production in the nation such as apples (ranked 14), corn silage (ranked 18) and cut Christmas trees (ranked 18). Maple syrup production in Vermont ranked number one in the Northeast (USDA, NASS, New England Field Office 2012) producing 40.6% of the nation's maple syrup.

WS receives requests for assistance from citizens experiencing agricultural damage caused by mammals, including, but not limited to the following: 1) predation on livestock (including poultry) by black bears, coyote, raccoons and foxes; 2) threat and occurrence of damage to crops and stored feed by feral swine, black bear, raccoons and rodents; and 3) risk of pathogen transmission. WS could conduct and assist in

management efforts with various mammals, coordinated by or with the VFWD and/or VAAFM, APHIS Veterinary Services (VS) and/or other federal, state, and local agencies, to study, monitor and/or control the occurrence and spread of animal diseases to protect livestock and other agricultural resources. WS may also be asked to assist with management of animals housed at enclosed hunting facilities that pose a threat to agricultural resources.

Damage to Crops

Damage to crops by mammal species is a major concern to the agricultural community. Species such as raccoons, black bear, skunks, fox, groundhog, deer and feral swine can cause significant damage to crops. Black bear and woodchucks (commonly referred to as groundhogs) are routinely reported to cause damage to field crops such as row and forage crops, orchards, nursery plants, and commercial gardens. Cottontails and voles are reported to damage orchard trees by gnawing at the base of the tree. Trees are badly damaged or the bark is girdled and trees die when feeding by rabbits and voles is severe. Similar damage occurs in nurseries, which grow landscape ornamentals and shrubs.

Raccoons commonly feed on a variety of garden and agricultural crops. DeVault et al. (2007) reported 87% of the crop depredation in northern Indiana was attributed to raccoons. The majority of raccoon damage to corn crops occurs during the milk stage of maturity as the plants are pulled down and the ears are fed upon. Cornfields are frequently interspersed among forests and waterways which make them more susceptible to raccoon depredation as fields adjacent to wooded and riparian areas often sustain higher rates of damages from raccoons (Beasley and Rhodes 2008). Damage also occurs to stored crops, such as corn silage, when raccoons tear open silage bags and/or burrow into silos resulting in losses from spoilage, and contamination with feces.

Feral swine are responsible for large scale destruction of crops, hay meadows, and pasture primarily by rooting and wallowing. Rooting is a common activity and is done year-round in search of food (Stevens 1996). Feral swine's rooting and wallowing activities damage pastures and hay meadows, spoil watering holes and can severely damage riparian habitats. Damage to crops results from direct consumption of crops and feeding related activities (i.e., trampling and rooting).

Voles, squirrels and rabbits damage orchard trees by gnawing on bark and small branches. Trees are badly damaged or the bark is girdled and trees die when feeding is severe. Similar damage occurs in nurseries which grow landscape ornamentals and shrubs and to maple sugar operations by gnawed tubing.

Risk of Disease Transmission

Several diseases including pseudorabies, tuberculosis, rabies, leptospirosis, salmonellosis, and tularemia affect domestic animals and wildlife. Surveillance for these pathogens and then subsequent containment if found can help protect agricultural and natural resource interests, and could include wildlife damage management activities conducted by WS in cooperation with the VS program, VFWD, or other governmental agencies. Surveillance conducted by WS can serve to establish important baseline data on the presence or absence of diseases in the state and can help identify areas where cooperators can focus disease management efforts.

Toxoplasmosis. The domestic cat has been found to 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 known to allow for the completion of the life cycle for *T. gondii* (Dubey 1973; Teutsch et al.

1979). Both feral and domesticated cats may be infected by this protozoan, but this infection is more common in stray cats. Fitzgerald et al. (1984) documented that feral and free-ranging cats transmitted *T. gondii* to sheep in New Zealand, resulting in abortion in ewes. Dubey et al. (1986) found cats to be a major reservoir of *T. gondii* on swine farms in Illinois. The main sources for infecting cats are thought to be birds and mice.

Disease Risks from Feral Swine. Feral swine are potential reservoirs for 30 viral and bacterial diseases as well as 37 parasites that threaten the health of livestock and humans (Hutton et al. 2006). Of greatest concern is infection of swine production facilities with diseases like swine brucellosis and pseudorabies. A study (Corn et al. 1986) conducted in Texas found that feral swine represent a reservoir of diseases transmissible to livestock. Swine harvested in this study tested positive for pseudorabies, brucellosis, and leptospirosis. Other diseases carried by feral swine include hog cholera, tuberculosis, bubonic plague, and anthrax (Beach 1993). A study in Oklahoma (Saliki et al. 1998) found samples also positive for antibodies against porcine parvovirus, swine influenza and porcine reproductive and respiratory syndrome virus. Porcine reproductive and respiratory syndrome is a highly infectious virus, requiring only a few viral particles to initiate infection (Henry 2003). Trichinosis, is another diseases that can be transmitted between livestock and feral swine. Disease transmission is likely to occur where domestic livestock and feral swine have a common interface, such as at water sources and livestock feeding areas. WS could conduct disease surveillance in the feral swine population as part of the National Wildlife Disease Surveillance Program or other research surveillance projects.

Pseudorabies (PRV) is a disease of swine that can also affect cattle, dogs, cats, sheep, and goats; and is often fatal in these other species. The disease is caused by the pseudorabies virus, an extremely contagious herpes virus that causes reproductive problems, including abortion, stillbirths, and even occasional death in breeding and finishing hogs. The United States is one of the world's largest producers of pork and is the second largest exporter of pork (Workman. 2019). U.S. pork production accounts for about 10 percent of the total world supply. The retail value of pork sold to consumers exceeds $30 billion annually. In addition, the pork industry supports about 550,000 jobs (NPPC. 2018). In 2004, domestic swine in all 50 states had attained Stage V pseudorabies free status.

A feral swine tested positive for PRV antibodies in Sullivan County, the first documented infection in New Hampshire (Musante et al., 2014). As a follow-up, VS and the New Hampshire Department of Agriculture, Markets & Food surveyed four local farms maintaining domestic swine within a 16-km radius of the collection site for the positive feral swine sample. All local domestic swine tested were antibody negative (Nicole Giguere, USDA/VS, pers. comm.). This was not surprising because there has been no known contact between free-ranging feral swine and the domestic herds at the facilities where testing was conducted. Because of the small populations resulting in limited sampling of feral swine in New Hampshire, the prevalence of PRV infection is unknown; however, feral swine are considered to be persistent reservoirs of PRV and therefore represent a potential avenue for infection of domestic swine (Corn et al. 2004). Although currently absent in commercial swine herds in the U.S., PRV circulates among feral swine in at least 27 states (Pedersen et al. 2013). While there is not a substantial commercial swine industry in New Hampshire, there are backyard operations and small-scale facilities where a higher biosecurity risk exists. PRV presents a threat to domestic swine, other livestock, domestic animals, and native wildlife such as black bears.

Similar to pseudorabies, the USDA has been involved in a multi-year, multi-million dollar effort to eradicate brucellosis in swine and cattle and the presence of infected feral swine may complicate and

delay the final success of that program (Hutton et al. 2006). Brucellosis is a bacterial disease that can also cause abortions in swine. Pederson et al. (2012) summarized surveillance studies of feral swine populations in the U.S. and reported infection rates of 0-53% for swine brucellosis. Feral swine serve as a reservoir for pathogens that have been eliminated from domestic swine and have the potential to be reintroduced which poses a threat to the progress of disease eradication programs in domestic livestock.

Foreign Animal Diseases. International trade and travel and the popularity of exotic pets have resulted in an ongoing risk of foreign animal disease introduction. Introduction of a disease such as Classical Swine Fever, Foot and Mouth Disease, or other foreign animal disease could have tremendous adverse impacts on the American livestock industry. State and federal agriculture and animal health agencies, and state wildlife agencies would have primary responsibility. However, these agencies may request WS assistance in conducting surveillance for the disease in wildlife populations, and/or capture and removal of animals in order to aid in management of the disease outbreak.

Predation and Livestock

Predation by medium sized mammals is common at smaller farms, especially related to poultry which may be penned or free-ranging and raised for meat or egg production. Species such as red fox, raccoons, fisher, mink, skunks, coyotes, bears and bobcats have all been identified as livestock predator threats through requests for assistance. A variety of trout and salmon species and other types of fish are raised for both commercial purposes and for conservation /restoration. River otter, mink, bear, fisher, and to a lesser extent raccoons may prey on fish and other cultured species at hatcheries and aquaculture facilities (Bevan et al. 2002). Vermont has a long history of raising sheep for wool and meat. In 2007, the total value for sheep, goats, and their products sold and distributed in Vermont was more than 3.8 million dollars (NASS 2007).

Need for Mammal Damage Management to Protect Natural Resources, Including T&E Species

Natural resources may be described as those assets belonging to the public which are usually managed and held in trust by government agencies for citizens. Such resources may be plants, animals and their habitats, including threatened and endangered species and historic properties. Examples of natural resources include the USFWS Missisquoi National Fish and Wildlife Refuge, the USFWS Silvio O. Conte National Wildlife Refuge, USDA Forest Service, Green Mountain National Forest, Vermont State Parks, historic structures and places, parks and recreation areas, natural areas, including unique habitats or topographic features, threatened and endangered plants or animals, and any plant or animal populations which have been identified by the public as a natural resource.

One example of mammal damage to natural resources is ground-nesting game bird populations with low and/or declining productivity and survivorship because of predation by raccoons, skunks, or foxes. Raccoons are considered a major predator of ground-nesting upland bird nests and poults (Speake 1980, Speake et al. 1985, Speake et al. 1969). Balser et al. (1968) recommended that predator damage management programs target the entire predator complex or compensatory predation may occur by a species not under control, a phenomena also observed by Greenwood (1986). Trautman et al. (1974) concluded that a single species predator damage management program showed some promise for enhancing ring-necked pheasant (*Phasianus colchicus*) populations. Avian species considered threatened or species of special concern may be impacted by mammalian predators through direct predation or predation of eggs and chicks. Nest predation on reptiles is a common problem associated with raccoons

and other medium sized predators (Marchland et al. 2002, Wirsing et al. 2012). WS assists the VFWD with predator control on nesting beaches of Vermont's T&E species, spiny soft-shelled turtles, by removing skunks, raccoons, and red foxes. In addition, WS could be asked to reduce productivity or remove depredating mammal species to protect other nesting bird species such as upland sandpiper (*Bartramia longicauda*, state endangered), and common tern (*Sterna hirundo*, state endangered). WS could also be asked to protect beds of the dwarf wedgemussel (*Alasmidonta heterodon,* state and federally endangered*)* from beaver flooding.

Some of the species listed as threatened or endangered under the Endangered Species Act of 1973 and Vermont's state endangered species law (Title 10, Chapter 123) may be impacted by predation or competition from a wide range of mammal species. These endangered and threated species are protected by Vermont state rule (Title 10, Appendix 10). Raccoons, opossums, striped skunks, red fox, weasels, mink and other mammals are known to prey on birds, eat eggs, and cause disturbances at nesting sites, impacting ground and shrub nesting species (National Biological Survey 1990, Melvin et al. 1992, Messmer et al. 1997). Species of special concern in Vermont are the eastern spiny soft shell turtles (*Apalone spinifera,* state endanagered*)*, sedge wren (*Cistothorus platensis*, state endangered), upland sandpiper (*Bartramia longicauda*, state endangered), black tern (*Childonias niger*, state endangered), and common tern (*Sterna hirundo*, state endangered) may be negatively affected by increased predation or disturbance.

Wallowing and foraging by feral swine can significantly damage wetlands riparian areas, which may be important for threatened and endangered (T&E) species, as well as other sensitive species such as fish and mussels (Campbell and Long 2009, West et al. 2009). In Louisiana, feral swine have been implicated as the cause of elevated waterborne bacteria levels in streams, including levels which exceeded thresholds for the protection of human health (Kaller et al. 2007). Results from DNA fingerprinting indicated that feral swine were the primary source of the *Escherichia coli* bacteria in the stream. Freshwater mussel and insects declined in stream reaches with swine activity. There is one federally listed mussel and several state-listed mussels along with numerous reptiles and amphibians in Vermont.

Public awareness and health risks associated with zoonoses (i.e., diseases of animals that can be transmitted to humans) have increased in recent years. Concerns for zoonotic diseases were addressed in section 1.2.1 of the EA and many continue to pose threats to human safety where people encounter mammals (USDA 2005a). As part of the activities conducted to alleviate damage or threats of damage associated with those mammal species, WS also receives requests for assistance with conducting disease monitoring and surveillance activities as part of those activities. Most disease sampling occurs ancillary to other wildlife damage management activities (i.e., disease sampling occurs after wildlife have been captured or lethally taken for other purposes). For example, WS may sample deer that were harvested during the annual hunting season for Chronic Wasting Disease (CWD). WS could also be requested to collect ticks from moose that were harvested during the regulated hunting season. Although CWD has not been identified in cervid populations in Vermont, WS could be requested to conduct surveillance activities for CWD, such as taking lymph node samples from cervids culled from captive herds, control operations, or hunter harvested animals when requested by the VFWD.

Scientists estimate that nationwide, cats kill hundreds of millions of birds (Loss et al. 2015) and more than a billion small mammals, such as rabbits, squirrels, and chipmunks, each year. The American Bird Conservancy (ABC) states that "*cats often kill common* [bird] *species such as cardinals, blue jays, and house wrens, as well as rare and endangered species such as piping plovers, Florida scrub-jays, and California least terns*" (ABC 2011). Some feral and free-ranging cats kill more than 100 animals each

year. For example, at a wildlife experiment station, a roaming, well-fed cat killed more than 1,600 animals over 18 months, primarily small mammals (ABC 2011). Researchers at the University of Wisconsin coupled their four-year cat predation study with the data from other studies, and estimated that rural feral and free-ranging cats kill at least 7.8 million and perhaps as many as 217 million birds a year in Wisconsin (Coleman et al. 1997). Most recently, Loss et al. (2015) estimated that free-ranging cats kill 1.4 to 3.7 billion birds and 6.9 to 20.7 billion mammals worldwide annually.

Many cat populations rely heavily on humans either for handouts and/or for garbage. A study on a southern Illinois farmstead concluded that well-fed cats preferred microtine rodents; however, they also consumed birds (George 1974). Microtine rodents are particularly susceptible to over harvest by cats and other predators (Pearson 1964). Pearson (1964) found rodents composed a large portion of a cat's diet. Some people view cat predation of rodents as beneficial, but native small mammals are important to maintaining biologically diverse ecosystems. Field mice and shrews are also important prey for birds, such as great horned owls and red-tailed hawks.

Muskrats, woodchucks, and other burrowing rodents can also damage natural resources by burrowing into earthen dams and dikes used to manage/retain ponds and riparian areas used by other wildlife species, by excessive foraging on riparian and wetland vegetation and cutting/girdling timber, seedlings, and other vegetation in natural areas, and parks, especially in riparian restoration sites.

Need for Mammal Damage Management to Protect Property

Table 1.1 illustrates how many species WS has received damage reports on in the past several years. The WS data only reflect a portion of the property damage issues in the state. The VFWD also receives requests from the public in situations where mammals are causing property damage.

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

Rooting by feral swine can cause damage to roadbeds, dikes, and other earthen structures. Feral swine have broken through livestock and game fences to consume animal feed and mineral supplements. In some areas, foraging swine have damaged landscaping, golf courses, and other ornamental plantings.

Large game complaints are often associated with increased human development, recreational activity, and agricultural expansion in Vermont, and included complaints about bears feeding on garbage (at residences, restaurants, and campgrounds), apiaries (beehives), crops, livestock and property damage, and general nuisance. The VFWD reimburses citizens for damage caused by bear, deer and moose when confirmed. In 2017, Vermont State Game Wardens responded to 160 bear damage complaints, 30 deer damage complaints, and eight moose damage complaints (George Scribner, Pers. Communication, 2018). There were several thousand more calls not related to reimbursement potential, primarily vehicle/big game collisions (3,258).

Need for Non-Damage Related Activities by WS Involving Mammals

Not all WS' activities related to mammals may involve traditional damage management or threats to human health and safety. WS may be requested to assist with or conduct research and monitoring activities such as live-capturing mammals for marking or telemetry research or collecting road killed specimens to determine species distribution. WS' personnel may be involved in species population enhancement activities, such as live capturing mammals for reintroduction to historical habitat or habitat improvement. WS may also be requested to conduct or assist in rescuing and translocating mammals in dangerous situations or to euthanize severely injured or sick mammals that do not involve damage or threats to human health and safety.

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. As the authority for the management of mammal populations in the state, the Vermont Fish and Wildlife Department (VFWD), Vermont Department of Health (VDH), and Vermont Agency of Agriculture, Food, and Markets (VAAFM) were involved in reviewing the EA and providing input throughout the EA preparation process to ensure an interdisciplinary approach according to the NEPA and agency mandates, policies, and regulations. The VFWD is responsible for managing wildlife in the state, including those mammalian species addressed in this EA, and establishes and enforces regulated hunting and trapping seasons. WS' activities to reduce and/or prevent mammal damage under the alternatives would be coordinated with the VFWD which would ensure WS' actions are incorporated into population objectives established for mammal species.

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

- How can WS-Vermont best respond to the need to reduce mammal damage?
- Do the alternatives have significant impacts meriting an Environmental Impact Statement (EIS)?

1.5 AFFECTED ENVIRONMENT

Mammals can be found across Vermont 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, state, tribal, and municipal lands in Vermont 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 that are currently being conducted under a MOU, CSA, or other comparable document with WS. This EA also addresses the potential impacts of MDM in Vermont where additional agreements may be signed in the future.

Federal, State, County, City, and Private Lands

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

Native American Lands and Tribes

The WS-Vermont 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 associated with mammals on federal, state, county, municipal, and private properties under the alternatives analyzed in this EA would be available for use to alleviate damage on Tribal properties when the use of those methods had been approved for use by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would

include those activities that would be employed on Native American lands, when requested and when agreed upon by the Tribe and WS.

Site Specificity

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

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

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

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

1.6 AGENCIES INVOVLED IN THIS ENVIRONMENTAL ASSESSMENT AND THEIR ROLES AND AUTHORITIES

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

WS' Legislative Authority

The primary statutory authority for the WS program is the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 8351-8352) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 8353). The

WS program is the lead federal authority in managing damage to agricultural resources, natural resources, property, and threats to human health and safety associated with wildlife. WS' Directives define program objectives and guide WS' activities in managing wildlife damage.

Additionally, MOU's between WS and other governmental agencies also define WS responsibilities in wildlife damage management. For example, a MOU between the Federal Aviation Administration (FAA) and WS recognizes WS' role and expertise in providing wildlife hazard management assistance to the aviation community.

Vermont Fish and Wildlife Department
The mission of the VFWD is to protect and conserve our fish, wildlife, plants and their habitats for the people of Vermont. The VFWD handles wildlife damage management problems involving most mammal species, including black bear, deer, moose, rabbit, bats, and fur-bearer species. The VFWD Non-game and Natural Heritage Program (NNP) administer and conduct management and education programs for endangered, threatened, and non-game wildlife species.

Vermont Agency of Agriculture, Food & Markets, Plant Industry Division
The VAAFM and the VTPID enforces state laws pertaining to the use and application of pesticides, including those related to the registration of pesticide products, licensing of private and commercial pesticide applicators, and licensing of pesticide businesses. The VTPID implements regulations found in V.S.A. Title 6 Chapter 87, Sections 1101-1112. Pesticide products for mammal damage control are registered through the PID by USDA APHIS WS and other entities (eg. pesticide manufacturers).

Vermont Department of Health
The Vermont Department of Health (VDH), VFWD, and VAAFM currently have a cooperative agreement with WS, which establishes a cooperative relationship between WS and the VDH, and outlines roles and responsibilities for resolving wildlife damage management situations when it concerns a rabies threat in Vermont and the oral rabies vaccination (ORV) program. The VDH provides technical guidance to WS on public health related issues and potential health problems associated with wildlife, and refers callers with wildlife damage related questions to WS.

United States Environmental Protection Agency (EPA)
The EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which regulates the registration and use of pesticides, 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 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), the Migratory Bird Treaty Act (16 USC 703-711), and the Bald and Golden Eagle Protection Act (16 USC 667). In Vermont, the USFWS administers two National Wildlife Refuges (Missisquoi NWR and Silvio O. Conte NWR, one

Law Enforcement Office (in Essex Jct., VT), and two National Fish Hatcheries (Pittsford and Bethel, VT).

Federal Aviation Administration (FAA)
The FAA is responsible for providing the safest and most efficient aerospace system in the world. The FAA regulates all aspects of civil aviation, including the construction and operation of airports, management of air traffic, and the certification of aircraft and personnel.

National Park Service (NPS)
The NPS is the federal agency responsible for managing all national parks in the United States, many American national monuments, and other conservation and historical properties. The NPS' role is to preserve the ecological and historical integrity of the places entrusted to its management while making them available to the public.

United States Food and Drug Administration (FDA)
The 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 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 USACE is responsible for regulating all waters of the U.S. under the Clean Water Act (CWA).

USDA, Forest Service
The Forest Service has the responsibility to manage the resources of federal lands for multiple uses including timber production, recreation and wildlife habitat, while recognizing the state's authority to manage wildlife populations. *Although the state has jurisdiction for general wildlife populations, the Forest Service has the responsibility for threatened and endangered species in concert with the US Fish and Wildlife Service, as provided for in the Endangered Species Act. The Forest Service also retains the responsibility for sensitive wildlife species for which population viability on National Forest System lands is a concern.* The Forest Service recognizes the importance of reducing wildlife damage on lands and resources under their jurisdiction, as integrated with their multiple use responsibilities. Occasionally, wildlife damage management actions may be taken on National Forest *System* lands to protect resources on adjacent properties. *Authorization must be granted by the Green Mountain and Finger Lakes National Forest Supervisor's office, Rutland Vermont, before any wildlife damage management or disease surveillance actions occur on National Forest System lands. Authorization may require additional environmental analysis under the National Environmental Policy Act at the project specific level.*

1.7 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

Environmental Impact Statement - Feral Swine Damage Management: A National Approach:
APHIS-WS 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*b*). 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.

Environmental Assessment - 2009 Oral Vaccination to Control Rabies Virus Variants: WS completed an EA concerning the Oral Rabies Vaccination (ORV) program in 28 states and the District of Columbia in 2009. This EA addressed the issues and associated alternatives to manage and contain the spread of the rabies virus. In depth analysis of the rabies virus or associated issues pertaining to the virus will not be addressed in this EA.

Environmental Assessment: Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Foxes, and Coyotes in the United States. Management of rabies in Vermont wildlife is included in the National EA (USDA 2010) and is not included in the Vermont mammal damage management EA. However, potential impacts on mammal species anticipated in the rabies management EA have been included in the Vermont mammal damage management EA to assess cumulative impacts of program actions.

Environmental Assessment: Field trial of an experimental rabies vaccine, human adenovirus type 5 vector in New Hampshire, New York, Ohio, Vermont, and West Virginia.: Management of rabies in Vermont wildlife with ONRAB baits is included in the National EA (USDA 2012) and is not included in the Vermont mammal damage management EA. However, potential impacts on mammal species anticipated in the rabies management EA have been included in the Vermont mammal damage management EA to assess cumulative impacts of program actions.

Supplement to the Environmental Assessment (USDA 2012): Field trial of an experimental rabies vaccine, human adenovirus type 5 vector in New Hampshire, New York, Ohio, Vermont, and West Virginia. Management of rabies in Vermont wildlife for ONRAB trials is included in the supplement to the National EA (USDA 2013) and is not included in the Vermont mammal damage management EA. However, potential impacts on mammal species anticipated in the rabies management EA have been included in the Vermont mammal damage management EA to assess cumulative impacts of program actions.

Environmental Assessment: Reducing Mammal Damage through an Integrated Wildlife Damage Management Program in the State of Vermont. WS had developed an EA in 2006 to address MDM activities. Changes in the need for action have prompted WS to initiate this new analysis. Since activities conducted under the previous EA have been re-evaluated under this EA to address the new need for action, the previous EA will be superseded by this analysis and the outcome of the Decision.

Proposal to Permit Take as provided under the Final Programmatic Environmental Impact Statement for the Eagle Rule Revision. Developed by the USFWS, this EIS 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 EIS evaluated the management on an eagle management unit level (similar to the migratory bird flyways) to establish limits on the amount of eagle take that the USFWS could authorize in order to maintain stable or increasing populations. This alternative further establishes a maximum duration for permits of 30 years with evaluations in five year increments (USFWS 2016*a*). A Record of Decision was

made for the preferred alternative in the EIS. The selected alternative revised the permit regulations for the "*take*" of eagles (see 50 CFR 22.26 as amended) and a provision to authorize the removal of eagle nests (see 50 CFR 22.27 as amended). The USFWS published a Final Rule on December 16, 2016 (81 FR 91551-91553).

1.8 SUMMARY OF PUBLIC INVOLVEMENT

Issues related to mammal damage management were initially developed by WS and stakeholder feedback/consultations. Issues were defined and preliminary alternatives were identified through the scoping process. As part of this process, and as required by the CEQ and APHIS' NEPA implementing regulations, this document is being noticed to the public through legal notices published in local print media, through direct mailings to parties that have requested to be notified or have been identified to have an interest in the reduction of threats and damage associated with mammals, and by posting the EA on the APHIS website at: http://www.aphis.usda.gov/wildlifedamage/nepa.

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

1.9 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 VFWD, the best available data for analysis is often based on statewide population dynamics. For example, an EA on the 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.

Environmental Status Quo

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

Most non-native invasive species are not protected under state or federal law. Most resident wildlife species are managed under state authority or law without any federal oversight or protection. Federal protection is provided for species through the ESA. In Vermont, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), unprotected wildlife species and

certain resident wildlife species are managed with little or no restrictions allowing them to be killed or taken by anyone at any time when they are committing damage. For mammal damage management, the VFWD has the authority to manage and authorize the taking of mammals for damage management purposes, with the exception of species protected under the ESA.

When a non-federal entity (*e.g.*, agricultural producers, municipalities, counties, private companies, individuals) takes a mammal damage management action, the action is not subject to compliance with the NEPA due to the lack of federal involvement in the action. Under such circumstances, the environmental baseline or status quo must be viewed as an environment that includes those resources as they are managed or impacted by non-federal entities in the absence of the federal action being proposed. Therefore, in those situations in which a non-federal entity has decided that a management action directed towards mammals should occur and even the particular methods that would be used, WS' involvement in the action would not affect the environmental status quo. Given that non-federal entities can receive authorization to use lethal MDM methods from the VFWD (depending on the species state classification), and since most methods for resolving damage are available to both WS and to non-federal entities, WS' decision-making ability is restricted to one of three alternatives: 1) WS can either take the action using the specific methods discussed in this EA upon request; 2) WS can provide nonlethal technical assistance only; 3) or WS can take no action, at which point the non-federal entity could take action anyway using the same methods during the hunting or trapping season, or through the issuance of a permit by the VFWD. Under those circumstances, WS would have virtually no ability to affect the environmental status quo because the action would likely occur in the absence of WS' direct involvement.

1.10 COMPLIANCE WITH LAWS AND STATUTES

Several laws and regulations pertaining to wildlife damage management activities, including activities that could be conducted in the state are discussed below. Those laws and regulations relevant to mammal damage management activities are addressed below. In addition, WS will comply with all local laws and ordinances.

Vermont Wildlife Laws, Regulations and Policies Regarding Mammal Damage Management

Vermont Statutes Annotated (V.S.A.) Title 10 contains fish, game, and wildlife law for the State of Vermont.

1. Title 10 VSA 4138. Control of fish, game; powers of commissioner: (c) "Vermont Statutes Annotated (V.S.A.) Title 10 contains fish, game, and wildlife law for the State of Vermont. (c) Any measures which involve temporary pollution of waters shall be carried out in accordance with the provisions of chapter 50, section 1455 of this title. (d) The Commissioner shall cooperate with the Transportation Board in any proceeding brought under 19 V.S.A. § 37 to protect a highway, railroad, or public airport from impoundments of water created by beaver.

2. Title 10 VSA 4709. Importation, stocking wild animals; possession of wild boar. (a) A person shall not bring into the State or possess any live wild bird or animal of any kind, unless, upon application in writing therefor, the person obtains from the Commissioner a permit to do so.

3. Title 10 VSA 4826. Taking deer damaging crops. (a)" A person, including an authorized member of his family or his authorized regular on-premise employee, may take, on land owned or occupied by him, a deer which he can prove was doing damage to the following: (1) a tree which

is being grown in a plantation or being cultivated and from which he intends to harvest an annual or perennial crop or from which he intends to produce any marketable item; or (2) a crop bearing plant; or (3) a crop, except grass."

4. Title 10 VSA 4827 Black bear doing damage. (a)(1) Except as provided in subdivision (2) of this subsection and in subsection 4827a(b) of this title, a person, an authorized member of the person's family, or the person's authorized regular on-premise employee may, after attempting reasonable nonlethal measures to protect his or her property, take on land owned or occupied by the person a bear which he or she can prove was doing damage to the following: (A) livestock, a pet, or another domestic animal; (B) bees or bee hives; (C) a vehicle, building, shed, or any dwelling; or (D) a crop or crop-bearing plant other than grass. (2)(A) The requirements of subdivision (1) of this subsection shall not apply in exigent circumstances. As used in this subdivision, "exigent circumstances" means the need for immediate protection of a person, livestock, pet, domestic animal, or occupied dwelling. (B) Landowners or lessees subject to bear damage in unharvested cornfields shall be exempt from having to first use nonlethal control measures prior to taking a black bear doing damage under subdivision (a)(1) of this section.

5. Title 10 VSA 4828 Taking of rabbit or fur-bearing animals by landowner; selectboard; certificate; penalty. (a) The provisions of law or regulations of the Board relating to the taking of rabbits or fur-bearing animals shall not apply to an owner, the owner's employee, tenant, or caretaker of property protecting the property from damage by rabbits or fur-bearing animals, or to the selectboard of a town protecting public highways or bridges from such damage or submersion with the permission of the owner of lands affected. However, if required by rule of the board, an owner, employee, tenant, or caretaker, or the members of the select board, who desire to possess during the closed season the skins of any fur-bearing animals taken in defense of property, highways, or bridges shall notify the Commissioner or the Commissioner's representative within 84 hours after taking such animal, and shall hold such pelts for inspection by such authorized representatives. (b) Before disposing of such pelts, if required by rule of the Board, the property owner, employee, tenant, caretaker, or selectboard shall secure from the Commissioner or a designee a certificate describing the pelts, and showing that the pelts were legally taken during a closed season and in defense of property, highways, or bridges. In the event of storage, sale, or transfer, such certificates shall accompany the pelts described therein.

6. Title 10 VSA 4829 Person suffering damage by deer or black bear. (a) A person engaged in the business of farming who suffers damage by deer to the person's crops, fruit trees, or crop-bearing plants on land not posted against the hunting of deer, or a person engaged in the business of farming who suffers damage by black bear to the person's cattle, sheep, swine, poultry, or bees or bee hives on land not posted against hunting or trapping of black bear is entitled to reimbursement for the damage, and may apply to the Department of Fish and Wildlife within 72 hours of the occurrence of the damage for reimbursement for the damage. As used in this section, "post" means any signage that would lead a reasonable person to believe that hunting is prohibited on the land. (b) As used in this section, a person is "engaged in the business of farming" if he or she earns at least one-half of the farmer's annual gross income from the business of farming, as that term is defined in the Internal Revenue Code, 26 C.F.R. § 1.175-3.

7. Title 10 VSA 4833 Coyote control program. The commissioner shall develop a coyote control program for implementation in those areas of the state where he or she has determined that

predation by coyotes is posing a threat to domesticated animals, deer, and other wildlife. In no event shall the program use poison.

8. Title 10 V.S.A. § 4861. Fur-bearing animals, taking, possession. Fur-bearing animals shall not be taken except in accordance with the provisions of this part, and of rules of the Board. The fur or skins of fur-bearing animals may be possessed at any time unless otherwise provided by this part, rules of the Board, or orders of the Commissioner. (Added 1961, No. 119, § 1, eff. May 9, 1961; amended 1991, No. 230 (Adj. Sess.), § 26.).

9. Title 10 V.S.A. § 18. Governing the importation and possession of wild animals, excluding fish. 4.1 Except as otherwise provided by law, it is unlawful for any person to bring into or possess in the State of Vermont any live wild animal, or live ovum or semen thereof, of any kind, unless upon application in writing, the person obtains from the Commissioner a permit to do so; or the species of animal, ovum, or semen is listed as a domestic bird or animal, domestic pet, or unrestricted wild animal.
10. Title 10 V.S.A. § 44. Furbearing species. 4.8 A person shall not possess a living fur-bearing animal, except as provided by rules of the board or 10 V.S.A. part 4.

11. Title 10 VSA 5215(b) (b) Upon receipt of a fee of $50.00, the Commissioner may issue a permit to a person, organization, or group for the purpose of rehabilitating sick or injured wild animals. For the purposes of this subsection, rehabilitation means treating the sick or injured wild animal back to a sufficient state of health so that the animal may be returned to the wild. The Commissioner shall adopt rules to implement this subsection.

12. Under the Endangered Species Act of 1973 and Vermont's Endangered and Threatened Species Laws managed by the VFWD (Pursuant to 10 V.S.A. § 5408(a) the Secretary may, after receiving the advice of the Endangered Species Committee, grant permits for the taking and possession of an endangered or threatened species: for scientific purposes; to enhance the propagation of species; to prevent or mitigate economic hardship; for zoological exhibition; for educational purposes; or for special purpose consistent with the purpose of the Federal Endangered Species Act (see 16 U.S.C. § 1531(b)). (a) Authorized taking. Notwithstanding any provision of this chapter, after obtaining the advice of the Endangered Species Committee, the Secretary may permit, under such terms and conditions as the Secretary may require as necessary to carry out the purposes of this chapter the taking of a threatened or endangered species, the destruction of or adverse impact on critical habitat, or any act otherwise prohibited by this chapter if done for any of the following purposes: (1) scientific purposes; (2) to enhance the propagation or survival of a threatened or endangered species; (3) zoological exhibition; (4) educational purposes; (5) noncommercial cultural or ceremonial purposes; or (6) special purposes consistent with the purposes of the federal Endangered Species Act.

Vermont Pesticide Laws

Vermont's pesticide regulations, in accordance with V.S.A. Title 6 Chapter 87, Section I-XIII, are implemented and enforced by the VAAFM Agrichemical Program. These regulations include processes and requirements for licenses, certificates and permits issued by the VAAFM (Section II), restrictions on the use and application of pesticides (Section IV), Maintenance of records by certified applicators, licensed companies, licensed pesticide dealers and pesticide producing establishments (Section V), company license (Section VI), requirements for certified commercial and certified noncommercial applicators (Section VII), certification standards for commercial applicators and noncommercial

applicators using other than Class "C" pesticides (Section VIII), certification of private applicators (Section IX), classification of pesticides and limitations on sale (Section X), pesticide dealer licenses (Section XI), community right-to-know requirements and accident reporting (Section XII) and transportation, storage and disposal of pesticides (Section XIII).

In order for WS to apply a restricted use pesticide as part of mammal damage management in VT, the product must be registered with the VAAFM, the applicator must be certified, possess a VT pesticide applicator certificate and have a current permit. Additionally, label instructions, and all other pesticide and wildlife laws and regulations must be adhered to. Pesticide products are registered annually, and applicator certificates are obtained and maintained through completion of training courses and examinations conducted through the VAAFM Agrichemical Program.

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 81 FR 91551-91553, 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.
Additional information regarding the conservation needs to Vermont State's bald eagle population can be found in the "Vermont's Action Plan:"
http://www.vtfishandwildlife.com/common/pages/DisplayFile.aspx?itemId=111460

National Environmental Policy Act

All Federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). WS follows the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500 et seq.), USDA NEPA implementing regulations (7 CFR 1b), and the APHIS Implementing Procedures (7 CFR 372) as a part of the decision-making process. NEPA sets forth the requirement that Federal actions with the potential to significantly affect the human environment be evaluated in terms of their impacts for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are regulated, in part, by CEQ through regulations in

Title 40, Code of Federal Regulations, Parts 1500-1508. In accordance with CEQ and USDA regulations, APHIS NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

Pursuant to NEPA and CEQ regulations, this EA documents the analysis of a proposed Federal action's impact, informs decision-makers and the public of reasonable alternatives, and serves as a decision-aiding mechanism to ensure that the policies and goals of NEPA are infused into Federal agency planning and decision making. An EA is prepared by integrating as many of the natural and social sciences as may be warranted based on the potential effects of the proposed action. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

Endangered Species Act (ESA)

The 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. 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 to ensure that the agency's 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) of 1966, as amended

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

Noise-making methods, such as firearms, that are used at or in close proximity to historic or cultural sites for the purposes of hazing or removing wildlife have the potential for audible effects on the use and enjoyment of historic property. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage problem, which means such use would be

to the benefit of the historic property. A built-in 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.

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

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

Federal Meat Inspection Act
The Federal Meat Inspection Act (FMIA) applies to all meat or products obtained from any cattle, sheep, swine, goat, horse, mule, or other equines intended for distribution in commerce. Animals falling under jurisdiction of the FMIA must be inspected pre- and post- mortem. Animals that are killed before they reach a slaughter facility are classified as "adulterated meat", and cannot be used for human food per the FMIA. Feral swine fall under authority of the FMIA, and therefore could only be donated to charitable organizations for use as food by needy individuals if they are delivered alive to a USDA approved feral swine slaughter facility. Chapter 12, subchapter 1, section 623 of the FMIA provides an exemption for persons having animals of their own raising and game animals slaughtered for their own use without inspection. This provision allows landowners to utilize feral swine removed from their own property, with the understanding that meat derived from these feral swine will be consumed only by the farmer, his/her immediate family and/or nonpaying guests.

Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)
Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children. WS has considered the impacts that this proposal might have on children. The proposed activities would occur by using only legally available and approved methods where it would be 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 the proposed action or the alternatives. Additionally, since the proposed mammal damage management program is directed at reducing human health and safety risks

at locations where children are sometimes present, it is expected that health and safety risks to children posed by mammals would be reduced.

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

The Native American Graves and Repatriation Act of 1990
The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

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

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

Federal Insecticide, Fungicide, and Rodenticide Act
The FIFRA and its implementing regulations (Public Law 110-426) requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing FIFRA. All chemical methods integrated into the WS program in Vermont are registered with and regulated by the EPA and the Vermont Agency of Agriculture, Food & Markets, and would be used by WS in compliance with labeling procedures and requirements.

Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360)
This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration.

Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.)
This law requires an individual or agency to have a special registration number from the DEA to possess controlled substances, including those that are used in wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994
The Animal Medicinal Drug Use Clarification Act and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "*veterinarian-client-patient*" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under any alternative where WS could use those immobilizing and euthanasia drugs. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (*i.e.*, a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified. WS would establish procedures for administering drugs used in wildlife capture and handling that would be approved by state veterinary authorities in order to comply with this law.

Clean Water Act (Section 404)
Section 404 (33 U.S.C. 1344) of the Clean Water Act 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 in 33 CFR 330. The breaching of most beaver dams is covered by these regulations (33 CFR 323, 33 CFR 330).

Food Security Act
The Wetland Conservation provision (Swampbuster) of 1985 (16 USC 3801-3862), 1990 (as amended by PL 101-624), and 1996 (as amended by PL 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 as a result 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 5 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 Clean Water Act. The Natural Resource Conservation Service is responsible for certifying wetland determinations according to this Act.

CHAPTER 2: DEVELOPMENT OF ALTERNATIVES

Chapter 2 contains a discussion of the issues that have driven the development of standard operating procedures and alternatives to address mammal damage. This chapter also contains a description of the IWDM strategies that are typically used to manage wildlife damage, including a description of WS' operational, technical, and research assistance and the decision model used to resolve wildlife complaints. The issues, management strategies, and SOPs collectively formulated the alternatives. Chapter 2 also discusses alternatives considered but not analyzed in detail, with rationale.

2.1 ISSUES ADDRESSED IN THE ANALYSIS OF 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 and other issues associated with mammals in Vermont 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, are discussed in detail 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 wildlife are the potential impacts of management actions on the populations of target species. Methods used to resolve damage or threats to human safety can involve altering the behavior of target species and may require the use of lethal methods when appropriate. Nonlethal methods can disperse or otherwise make an area unattractive to target species causing damage which reduces the presence of those species at the site and potentially the immediate area around the site where nonlethal methods are employed. Lethal methods would be employed to remove a mammal or those mammals responsible for causing damage or posing threats to human safety. The use of lethal methods would therefore result in local population reductions in the area where damage or threats were occurring. The number of target species removed from the population using lethal methods under the alternatives would be dependent on the number of requests for assistance received, the number of individuals involved with the associated damage or threat, and the efficacy of methods employed.

The analysis for magnitude of impact on populations from the use of lethal methods would be based on a measure of the number of animals killed in relation to their abundance and/or legal status. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. WS' removal is monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would cause adverse impacts to the viability of native species populations. All lethal removal of mammals by WS would occur at the requests of a cooperator seeking assistance and only after the appropriate VFWD permit for the lethal take is obtained.

In addition, many of the mammal species addressed in this EA can be harvested during annual hunting and/or trapping seasons and can be addressed using available methods by other entities when those species cause damage or pose threats of damage when permitted by the VFWD. Therefore, any mammal

damage management activities conducted by WS under the alternatives addressed would be occurring along with other natural process and human-induced events such as natural mortality, human-induced mortality from private damage management activities, mortality from regulated harvest, and human-induced alterations of wildlife habitat.

Issue 2 - Effects of Damage Management on Nontarget Wildlife Species Populations, Including T&E Species

The issue of nontarget species effects, including effects on T&E species arises from the use of nonlethal and lethal methods identified in the alternatives. The use of nonlethal and lethal methods has the potential to inadvertently disperse, capture, or kill nontarget wildlife. Concerns have also been raised about the potential for adverse effects to occur to nontarget wildlife from the use of chemical methods. Chemical methods being considered for use to manage damage and threats associated with mammals are further discussed in Appendix B.

The ESA is federal legislation that makes it illegal for any person to '*take*' any listed endangered or threatened species or their critical habitat except through permit. 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 USFWS 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.

At the state level, the VFWD Endangered Species Program protects animal species listed as threatened or endangered in Vermont (see Appendix E). This list includes all species listed under the ESA that occur in Vermont, as well as other species that were once more prevalent in Vermont. The VFWD issues limited permits for harassment and incidental take of listed species for the purposes of research and protection of property, human safety, and agriculture.

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 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 discusses the potential for WS' activities to disturb eagles as defined by the Act.

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

An additional issue often raised is the potential risk to human safety associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human health and safety. WS' employees use and recommend only those methods that are legally available, selective for target species, and are effective at resolving the damage associated with wildlife. Still, some concerns exist regarding the safety of WS' methods despite their legality. As a result, WS will analyze the potential for proposed methods that pose a risk to members of the public or employees of WS. WS' employees are potentially exposed to damage management methods

as well as subject to workplace accidents. Selection of methods, as part of an integrated approach, includes consideration for public and employee safety.

The concern addressed here is that the absence of adequate MDM would result in adverse effects on human health and safety because mammal damage would not be curtailed or reduced to the minimum levels possible and practical. The potential impacts of not conducting such work could lead to increased incidence of injuries, illness, or loss of human lives. Airport managers and air safety officials are concerned that the absence of a WS MDM program could lead to a failure to adequately address complex wildlife hazard problems faced by the aviation community.

Safety of Chemical Methods Employed

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

The issue of the potential for drugs used in animal capture, handling, and euthanasia to cause adverse health effects in humans that hunt and consume the species involved has been raised. This issue is expected to only be of concern for wildlife which are hunted and sometimes consumed by people as food. All harvestable wildlife that has been exposed to drugs by WS will be properly marked with instruction to "do not eat." Chemicals proposed for use under the relevant alternatives are regulated by the EPA through FIFRA, and by state laws, the DEA, the FDA, and WS' Directives.

Safety of Non-Chemical Methods Employed

Non-chemical methods employed to reduce damage and threats to safety caused by mammals, if misused, could potentially be hazardous to human safety. Non-chemical methods may include but are not limited to firearms, live-traps, exclusion, body-gripping traps, pyrotechnics, and other scaring devices. A complete list of non-chemical methods available to alleviate damage associated with mammals is provided in Appendix B of this EA. The cooperator requesting assistance would be made aware through a MOU, CSA, or a similar document that those devices agreed upon could potentially be used on property owned or managed by the cooperator; thereby, making the cooperator aware of the use of those methods on property they own or manage to identify any risks to human safety associated with the use of those methods.

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

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

According to the American Veterinary Medical Association (AVMA), suffering is described 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 a time frame, a case could be made for *"…little or no suffering where death comes immediately…"* (California Department of Fish and Game 1991). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals, but assessing pain experienced by animals can be challenging (AVMA 2013, California Department of Fish and Game 1991). The AVMA defines pain as being, "*that sensation* (perception) *that results from nerve impulses reaching the cerebral cortex via ascending neural pathways*" (AVMA 2013). The key component of this definition is the perception of pain. The AVMA (2013) notes that "pain" should not be used for stimuli, receptors, reflexes, or pathways because these factors may be active without pain perception. For pain to be experienced, the cerebral cortex and subcortical structures must be functional. If the cerebral cortex is nonfunctional because of tissue destruction, hypoxia, depression by drugs, electric shock, or concussion, pain is not experienced.

Stress has been defined as the effect of physical, physiologic, or emotional factors (stressors) that induce an alteration in an animal's base or adaptive state. Responses to stimuli vary among animals based on the animals' experiences, age, species and current condition. Not all forms of stress result in adverse consequences for the animal and some forms of stress serve a positive, adaptive function for the animal. Eustress describes the response of animals to harmless stimuli which initiate responses that are beneficial to the animal. Neutral stress is the term for response to stimuli that have neither harmful nor beneficial effects to the animal. Distress results when an animal's response to stimuli interferes with its well-being and comfort (AVMA 2013).

Analysis of this issue must consider not only the welfare of the animals captured, but also the welfare of humans, pets, livestock, and T&E species if damage management methods are not used. For example, some individuals may perceive techniques used to remove a predator that is killing or injuring pets or livestock as inhumane, while others may believe it is equally or more inhumane to permit pets and livestock that depend upon humans for protection to be injured or killed by predators.

2.2 DAMAGE MANAGEMENT STRATEGIES AVAILABLE FOR ALTERNATIVES

Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in the most cost-effective manner while minimizing the potentially harmful effects on humans, target and nontarget 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 Damage Management Assistance

Direct damage management assistance includes damage management activities that are directly conducted or supervised by WS personnel. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and when a *Work Initiation Document for Wildlife Damage Management* or other comparable instruments 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. The professional skills of WS personnel are often required to effectively resolve problems, especially if restricted-use pesticides are necessary or if the problems are complex.

Technical Assistance Recommendations

Technical assistance as used herein is 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. In some cases, WS provides supplies or materials that are of limited availability for use by non-WS entities. 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 information provided to the requestor by WS results in tolerance/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.

From FY 2012 through FY 2016, WS logged 6,661 technical assistance entries related to species covered in this EA. A summary of the types of damage situations WS helped to address through technical assistance is provided in Table 1.1.

Examples of WS Technical Assistance and Direct MDM in Vermont

WS has been requested to assist with mammal damage and conflicts throughout Vermont. The following are examples of past and ongoing WS mammal damage management projects to provide a sample of the types of requests for assistance that WS receives in Vermont.

- To enhance the survival of a state listed species, the VFWD entered into a Cooperative Service Agreement with WS to remove mammalian predators that were depredating the eggs/nests of state threatened eastern spiny soft shell turtles.

- To alleviate human health and safety threats to the flying public, the Newport State Airport entered into a Cooperative Service Agreement with WS to remove beavers to prevent flooding of property

and to reduce the accumulation of standing water. The standing water was serving as a waterfowl attractant, and therefore, was a bird-aircraft strike threat to incoming and departing aircraft.

- To eliminate property damage, the Vermont State Buildings and Grounds Services entered into a Cooperative Service Agreement with WS to remove beavers from the Chittenden County Correctional Facility in 2004.

- To alleviate human health risks and property damage, the Vermont Department of Forests, Parks and Recreation entered into a Cooperative Service Agreement with WS to remove beavers from a Wildlife Management Area. Flooding caused by beavers was saturating septic systems on private properties adjacent to a wildlife management area.

- A Lamoille County livestock producer entered into a Cooperative Service Agreement with WS to trap and remove coyotes in order to reduce sheep losses on his property.

- WS has entered into a Cooperative Service Agreements at a landfill to conduct wildlife damage management on site and at adjacent properties that may be experiencing wildlife damage by animals attracted to the landfill. This has included trapping skunks and raccoons that cause damage to property or are a disease concern both on and off site. WS also provides recommendations to these facilities on habitat management that may reduce the attractiveness of the site, or the ability of mammals to damage equipment or sensitive structures.

Educational Efforts

Education is an important element of WS program activities 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. WS routinely disseminates recommendations and information to individuals sustaining damage. Additionally, WS provides lectures, courses, and demonstrations to producers, homeowners, state and county agents, colleges and universities, and other interested groups related to wildlife damage management and disease issues. WS frequently cooperates with other agencies in education and public information efforts including cooperative presentations or publications. Technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are periodically updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

Research and Development

The National Wildlife Research Center (NWRC) functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. NWRC scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate wildlife damage management techniques. NWRC scientists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

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 2.1). WS personnel are frequently contacted after requesters have tried or considered nonlethal methods and found them to be impractical, too costly, or inadequate to reduce damage. WS personnel assess the problem then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (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 documentation process, but a mental problem-solving process common to most, if not all, professions.

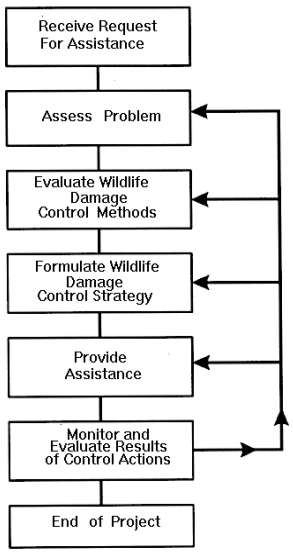

Figure 2.1 WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflicts.

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 nonlethal 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 health and 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 MDM activities. This process allows decisions on MDM 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

SOPs improve the safety, selectivity, and efficacy of wildlife damage management activities. The WS program uses many such SOPs. Those SOPs would be incorporated into activities conducted by WS when addressing mammal damage and threats.

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

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

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

- All chemical methods used by WS or recommended by WS would be registered with the EPA, DEA, FDA, and the Vermont Agency of Agriculture, Food & Markets, as appropriate.

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

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

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

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

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

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

- Live-traps would be placed so that captured animals would not be readily visible from any road or public area.

2.4 ADDITIONAL STANDARD OPERATING PROCEDURES SPECIFIC TO THE ISSUES

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

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

- Lethal take of mammals by WS would be reported and monitored by WS and the VFWD to help evaluate population trends and the magnitude of WS' take of mammals and ensure activities do not adversely affect mammal populations.

- The take of mammals under the alternatives would only occur under conditions permitted by the VFWD, USFWS, and local ordinances when applicable, and only at levels authorized.

- Management actions would be directed toward localized populations or groups of target species and/or an individual of those species. Generalized population suppression across major portions of Vermont would not be conducted with the exception of exotic and/or invasive species.

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

- Where applicable, annual WS take will be considered with the statewide "total harvest" (e.g., WS take and other licensed harvest) when estimating the impact on wildlife species.

Issue 2 - Effects of Damage Management on Nontarget Wildlife Species Populations, Including T&E Species

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

- Personnel would be present during the use of live-capture methods or live-traps would be checked at least every 24 hours to ensure nontarget and T&E species are released immediately or are prevented from being captured.

- Carcasses of mammals retrieved after damage management activities have been conducted would be disposed of in accordance with WS Directive 2.515. In addition, select species, such as New England cottontail, would be given to VFWD to facilitate research efforts.

- Nontarget animals captured in traps would be released unless it is determined by WS that the animal would not survive and/or that the animal cannot be released safely. Nontargets captured on airports would be removed from premises regardless of condition to reduce the threat to airport property and human health and safety.

- WS personnel are trained and experienced to select the most appropriate method for taking problem animals and excluding nontarget species.

- WS has consulted with the USFWS and VFWD regarding potential impacts of the proposed alternatives on state and federally-listed T&E species. Reasonable and prudent measures or other

provisions identified through consultation with the USFWS and VFWD will be implemented to avoid adverse effects on T&E species (Appendix D).

- WS would initiate informal consultation with the USFWS following any incidental take of T&E species.

- In the event that WS recommends habitat modification (e.g., modifying a wetland) as a damage management practice for the landowner/manager, WS will advise the landowner/manager that they are responsible for checking with state and federal authorities regarding regulations and endangered species protections that may be applicable to the proposed project.

- Foothold trap pan tension devices will be used to reduce hazards to nontarget species that weigh less than the target species.

- WS will follow the SOP's of the 2018 Programmatic Biological Opinion on Lynx to minimize possibly capturing a Canada lynx.

- Traps and snares will not be set within 30 feet of exposed animal carcasses (excluding bear) to prevent the capture of scavenging birds.

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

- As appropriate, 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). As appropriate, WS would use signage and other means of notification to ensure the public is aware of trapping applications or applications sites.

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

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

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

- Material Safety Data Sheets for pesticides and controlled substances are provided to all WS' personnel involved with specific MDM activities.

- Damage management projects conducted on public lands would be coordinated with the management agency.

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

- Personnel would be well trained in the latest and most humane devices/methods for removing mammals causing damage.
- WS' use of euthanasia methods would follow those recommended by WS' Directives (WS Directive 2.505, WS Directive 2.430) and AVMA guidelines (AVMA 2013).
- WS' use of all traps, cable restraints, and other capture devices would comply with WS Directive 2.450.
- Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.
- Where practical, euthanasia procedures approved by the AVMA that cause minimal pain would be used.
- Use of newly-developed, proven, nonlethal methods would be encouraged when appropriate.

2.5 ALTERNATIVES

Alternatives were developed for consideration based on the need for action and issues using the WS Decision model (Slate et al. 1992). The alternatives will receive detailed environmental impacts analysis in Chapter 3 (Environmental Consequences). The following alternatives were developed to meet the need for action and address the identified issues associated with managing damage caused by mammals in Vermont.

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

The no action/proposed action alternative would continue the current implementation of an adaptive integrated approach utilizing nonlethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by mammals. WS, in consultation with the VFWD, would continue to respond to requests for assistance with, at a minimum, technical assistance, or when funding is available, operational damage management. Funding could occur through federal appropriations or from cooperative funding.

The adaptive approach to managing damage associated with mammals would integrate the use of the most practical and effective methods to resolve a request for damage management as determined by site-specific evaluation to reduce damage or threats to human safety for each request. City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate nonlethal and lethal techniques. WS would work with those persons experiencing mammal damage in addressing those mammals responsible for causing damage as expeditiously as possible. To be most effective, damage management activities should begin as soon as mammals begin to cause damage. Mammal damage that has been ongoing can be difficult to resolve using available methods since mammals could be conditioned to an area and are familiar with a particular

location. Subsequently, making that area unattractive through the use of available methods can be difficult to achieve once damage has been ongoing. WS would work closely with those entities requesting assistance to identify situations where damage could occur and begin to implement damage management activities under this alternative as early as possible to increase the likelihood of those methods achieving the level of damage reduction requested by the cooperating entity.

Under this alternative, WS would respond to requests for assistance by: 1) taking no action if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by mammals, or 3) provide technical assistance and direct operational assistance to a property owner or manager experiencing damage. The removal of many of the mammal species native to Vermont or designated game species can only legally occur through regulated hunting and trapping seasons or through the issuance of a permit or license by the VFWD and only at levels specified in the permit. Activities conducted under this alternative would occur in compliance and in coordination with the VFWD.

Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical nonlethal and lethal techniques under this alternative. Property owners or managers may choose to implement WS' recommendations on their own (*i.e.*, technical assistance), use contractual services of private businesses, use volunteer services of private organizations, use the services of WS (*i.e.*, direct operational assistance), take the management action themselves without consulting another private or governmental agency, or take no action.

Mammals could be euthanized by close range gunshot once live-captured, which is a method of euthanasia considered appropriate by the AVMA for free-ranging wildlife, when administered appropriately (AVMA 2013). On occasion, euthanasia of live-captured mammals may occur through the use of euthanasia drugs or carbon dioxide once the animal was captured using other methods. Euthanasia drugs are an acceptable form of euthanasia for free-ranging wildlife while carbon dioxide is a conditionally acceptable[3] method of euthanasia (AVMA 2013).

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

Nonlethal methods can disperse or otherwise make an area unattractive to mammals; thereby, reducing the presence of mammals at the site and potentially the immediate area around the site where nonlethal methods are employed. Nonlethal methods would be given priority when addressing requests for assistance (WS Directive 2.101) and include methods of exclusions, harassment, habitat modification, and live trap and translocation. However, nonlethal methods would not necessarily be employed to resolve every request for assistance if deemed inappropriate by WS' personnel using the WS Decision Model, especially when the requesting entity has used nonlethal methods previously and found those methods to be inadequate in resolving the damage or threats of damage. When effective, nonlethal methods would disperse mammals from the area resulting in a reduction in the presence of those mammals at the site. For any management methods employed, the proper timing is essential in effectively dispersing those mammals causing damage. Employing methods soon after damage begins or soon after threats are identified increases the likelihood that those damage management activities would achieve success in

[3]The AVMA (2013) defines conditional acceptable as "...[methods] *that by the nature of the technique or because of greater potential for operator error or safety hazards might not consistently produce humane death or are methods not well documented in the scientific literature".*

addressing damage. Therefore, coordination and timing of methods is necessary to be effective in achieving expedient resolution of mammal damage.

Lethal methods would be employed to resolve damage associated with those mammal species identified by WS as responsible for causing damage or threats to property, agricultural resources, natural resources, and human health and safety only after receiving a request for the use of those methods. The use of lethal methods may result in local population reductions in the area where damage or threats were occurring since mammals would be removed from the population. Lethal methods are often employed to reinforce nonlethal methods and to remove mammals that have been identified as causing damage or posing a threat to cause damage. 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, whether negative impacts are sufficiently reduced to protect property or human health and safety, and the efficacy of methods employed.

WS may recommend mammals be harvested during the regulated hunting and/or trapping season for those species in an attempt to reduce the number of mammals causing damage. Managing mammal populations over broad areas could lead to a decrease in the number of mammals causing damage, however population management is not the goal of WS' technical assistance or direct operational assistance. Establishing hunting or trapping seasons and managing wildlife populations is the responsibility of the VFWD. WS' main responsibility focuses on animal damage management. Additionally, WS will comply with all permitting required to carry out the work involved.

Alternative 2 - Nonlethal Mammal Damage Management Only by WS

Under this alternative, WS would be restricted to only using or recommending nonlethal methods to resolve damage caused by mammals (Appendix B). These nonlethal methods include exclusions, habitat management, animal behavioral modifications (*e.g.* human effigies, harassment), and live capture and translocation. Lethal methods could continue to be used under this alternative by those persons experiencing damage from mammals without involvement by WS. In situations where nonlethal methods were impractical or ineffective to alleviate damage, WS could refer requests for information regarding lethal methods to the VFWD, local animal control agencies, or private businesses or organizations. Property owners or managers might choose to implement WS' nonlethal recommendations on their own or with the assistance of WS, implement lethal methods on their own, or request assistance (nonlethal or lethal) from a private or public entity other than WS.

Alternative 3 - No Mammal Damage Management Conducted by WS

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

Despite no involvement by WS in resolving damage and threats associated with mammals, those persons experiencing damage caused by mammals could continue to resolve damage by employing those methods legally available; therefore, the lethal removal of mammals to alleviate damage or threats could occur despite the lack of involvement by WS. The lethal removal of mammals could occur through the issuance of permits by the VFWD, when required, and during the hunting or trapping seasons for regulated game species. All methods described in Appendix B would be available for use by those persons experiencing

damage or threats except for the use of immobilizing drugs and euthanasia chemicals. Immobilizing drugs and euthanasia chemicals can only be used by WS or appropriately licensed veterinarians.

2.6 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

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

Nonlethal Methods Implemented Before Lethal Methods

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

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

Use of Lethal Methods Only by WS

This alternative would require the use of lethal methods only to reduce threats and damage associated with mammals. However, nonlethal methods can be effective in preventing damage in certain instances. Under WS Directive 2.101, WS must consider the use of nonlethal methods before lethal methods. Nonlethal methods have been effective in alleviating mammal damage. In those situations where damage could be alleviated using nonlethal methods deemed effective, those methods would be employed or recommended as determined by the WS Decision Model. Therefore, this alternative was not considered in detail.

Trap and Translocate Mammals Only

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Mammals would be live-captured using immobilizing drugs, live-traps, or nets (*e.g.*, cannon nets, rocket nets, or drop nets). All mammals live-captured through direct operational assistance by WS would be translocated.

Translocation sites would be identified and have to be pre-approved by the VFWD and the property owner where the translocated mammals would be placed prior to live-capture and translocation. Live-

capture and translocation could be conducted as part of the alternatives analyzed in detail. When requested by the VFWD, WS could translocate mammals or recommend translocation under any of the alternatives analyzed in detail, except under the no involvement by WS alternative (Alternative 3). Since WS does not have the authority to translocate mammals unless permitted by the VFWD, this alternative was not analyzed in detail. In addition, the translocation of mammals by WS could occur under any of the alternatives analyzed in detail, except Alternative 3. However, translocation by other entities could occur under Alternative 3.

The translocation of mammals that have caused damage to other areas following live-capture generally would not be effective or cost-effective (Beringer et al. 2002). Translocation is generally ineffective because problem mammal species are highly mobile and can easily return to damage sites from long distances, habitats in other areas are generally already occupied, and translocation would most likely result in mammal damage problems at the new location. In a study in north-central Illinois, raccoons were trapped and relocated, then monitored (Mosillo et al. 1999). The study found that translocated raccoons left the release site very quickly (hours to days) and dispersed into the surrounding environment. Many of them denned near human residences after dispersal, potentially creating new conflicts with landowners. Also, hundreds of mammals would need to be captured and translocated to solve some damage problems; therefore, translocation would be unrealistic.

Translocation of wildlife is also discouraged by WS policy (WS Directive 2.501) because of the stress to the translocated animal, poor survival rates, and the difficulties that translocated wildlife have with adapting to new locations or habitats (Nielsen 1988). There is also a concern of spreading diseases by moving wildlife from one location to another. Particularly in Vermont, species that are vectors of the rabies virus (bats, raccoons, fox, woodchucks, and skunks) cannot be translocated.

Trap-Neuter-Release Program for Feral and Free-Ranging (Domestic) Cats

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

Theoretically, TNR would work if all animals of one sex or both were sterilized. However, the probability of controlling free-ranging/feral cat breeds in the wild with this technique is not currently reasonable, especially with many animals being self-sufficient and not relying on humans to survive. There is also a chance of natural or artificial immigration to occur with cats that can help sustain the population. In addition, some individuals within a population can be trap-shy. Capturing or removing trap-shy individuals often requires implementing other methods.

Of major concern are the potential for diseases and parasites transmission to humans either from direct contact during sterilization or the risk of exposure after the animal is released. Once live-captured, performing sterilization procedures during field operations on anesthetized feral cats would be difficult. Sanitary conditions are difficult to maintain when performing surgical procedures in field conditions. To perform operations under appropriate conditions, live-captured animals would need to be transported from the capture site to an appropriate facility, which increases the threat from handling and transporting. A mobile facility could be used but would still require additional handling and transporting of the live-captured animals to the facility. Once the surgical procedure was completed, the animal would have to be held to ensure recovery and transported back to the area where capture occurred. These surgical field

operations are not within the level of expertise for WS-Vermont, hence rendering TNR programs to be considered an unreasonable damage management strategy.

Furthermore, TNR programs are often not as successful as desired and needed to reduce immediate threats posed by wildlife, especially when human safety is a concern (Barrows 2004, Levy and Crawford 2004, Jessup 2004, Winter 2004). Animals subjected to TNR would continue to cause the same problems[4] they caused before the TNR program was initiated because of slow attrition. TNR programs can take a decade or longer to reduce target species populations (Barrows 2004, Winter 2004) especially when acute issues need rapid solutions (Levy and Crawford 2004, Stoskopf and Nutter 2004). Several studies report that target species populations often remain stable or increase following TNR programs due to immigration and reproduction from other members of the groups (Castillo and Clarke 2003, Levy and Crawford 2004, Winter 2004) with little to no resolution of threats to human safety or damages (Barrows 2004, Slater 2004, Winter 2004).

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

Compensation for Mammal Damage Only

Reimbursement provides producers monetary compensation for losses, it does not remove the problem nor does it assist with reducing future losses. The compensation only alternative would require the establishment of a system to reimburse persons impacted by mammal damage. This alternative was eliminated from further analysis because it is not financially feasible or practical to provide compensation for all mammal damage. There is not any federal law that authorizes compensation to address mammal damage in Vermont. Vermont state law reads, *VSA 10:113 sec. 4829 Person suffering damage by deer or black bear. A person who suffers damage by deer to the person's crops, fruit trees, or crop-bearing plants on land not posted against the hunting of deer, or a person who suffers damage by black bear to the person's cattle, sheep, swine, poultry or bees or bee hives on land not posted against hunting or trapping of black bear is entitled to reimbursement for the damage, and may apply to the department of fish and wildlife within seventy-two hours of the occurrence of the damage for reimbursement for the damage.*

Reimbursement provides producers monetary compensation for losses; it does not remove the problem nor does it assist with reducing future losses. The compensation only alternative would require the establishment of a system to reimburse persons impacted by mammal damage. Under such an alternative, WS would not provide any technical assistance or direct damage management. Aside from lack of legal authority, analysis of this alternative indicates that the concept has many drawbacks (Wagner et al. 1997):

- It would require larger expenditures of money and labor to investigate and validate all damage claims to determine and administer appropriate compensation.

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

- Based on historical instances, compensation would most likely be less than full market value.

- In the case of predation on livestock or pets, compensation may not be a satisfactory solution for individuals who feel responsible for the well-being of their livestock or in situations where there is an emotional attachment to the animal.

- Compensation would give little incentive to resource owners to limit damage through improved cultural, husbandry, or other practices and management strategies.

- Not all resource owners would rely completely on a compensation program and lethal control would most likely continue as permitted by state law.

- Compensation would not be practical for reducing threats to human health and safety.

This alternative was eliminated from further analysis because it is not financially feasible or practical to provide compensation for all mammal damage.

Bounties

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

Technical Assistance Only

This alternative would restrict WS to only providing technical assistance (advice) on MDM. Producers, property owners, agency personnel, or others could obtain permits from the VFWD as needed and could conduct mammal damage management using any of the legally available nonlethal and lethal techniques. Technical assistance information is also readily available from entities other than WS such as the USFWS, universities, extension agents, FAA, and private individual and organizations. Consequently, environmental impacts of this alternative are likely to be similar to Alternative 3 – No WS Mammal Damage Management Program. Consequently, the agencies have determined that detailed analysis of this alternative would not contribute substantive new information to the understanding of environmental impacts of damage management alternatives and have chosen to not analyze this alternative in detail.

CHAPTER 3: ENVIRONMENTAL CONSEQUENCES

Chapter 3 provides information needed for making informed decisions in selecting the appropriate alternative to address the need for action described in Chapter 1 and the issues described in Chapter 2.

This chapter analyzes the environmental consequences of each alternative in relation to the issues identified. 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 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 are later in time or farther 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 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

The proposed action/no action alternative (Alternative 1) serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration mandates, directives, and the procedures of WS and the VFWD.

Issue 1: Effects of Damage Management on Populations of Target Mammal Species

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

A common issue is whether damage management actions would adversely affect the populations of target mammal species, especially when lethal methods are employed. Alternative 1 addresses requests for assistance received by WS through technical and direct operational assistance where an integrated approach to methods would be employed and/or recommended. Nonlethal methods can disperse or otherwise make an area unattractive to mammals causing damage; thereby, reducing the presence of mammals at the site and potentially the immediate area around the site where nonlethal methods are employed.

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

nonlethal methods would not have adverse impacts on mammal populations under any of the alternatives. When permitted or requested by VFWD, WS could translocate or recommend translocation of target mammals as a nonlethal method of wildlife damage management.

The use of IWDM approved lethal methods, listed in Appendix B, could result in local population reductions in the area where damage or threats were occurring since mammals would be removed from the population. The number of mammals removed from the population using lethal methods would be dependent on the number of requests for assistance received, the number of mammals involved with the associated damage or threat (*i.e.,* the number of animals that WS believes necessary to effectively and measurably reduce damage), the number approved by the regulatory agency that manages the species in question, and the efficacy of methods employed.

WS may recommend mammals be harvested during the regulated hunting and/or trapping season for those species in an attempt to reduce the number of mammals causing damage. Managing mammal populations over broad areas could lead to a decrease in the number of mammals causing damage. Establishing hunting and trapping seasons and the allowed harvest during those seasons is the responsibility of the VFWD. WS does not have the authority to establish hunting or trapping seasons or to set allowed harvest numbers during those seasons. However, the harvest of those mammals with hunting and/or trapping seasons would be occurring in addition to any lethal removal that could occur by WS under the alternatives or recommended by WS.

Generally, WS only conducts damage management on species whose populations at the state level are high or are concentrated at the local level and usually only after they have caused damage. Table 3.1 identifies average annual lethal removal of animals by WS, proposed maximum annual WS removal, estimated annual harvest by hunters and trappers, and the percent of WS proposed removal compared to the average annual harvest estimates. No indirect effects were identified for this issue.

Table 3.1 Quantitative impacts of lethal removal for selected species in Vermont.

Species	Average Annual WS Take (5yr)[i]	Maximum Proposed WS Annual Take	VT Statewide Average Annual Estimated Season Harvest 2012-2016[ii]	Minimum Estimated Population	% Cumulative Take from Minimum Population Est.
American Black Bear	0	30	619.6	4,500	14.4
Bobcat	0	30	33.6	2,500	2.5
Coyote	2.2	200	266.2	4,807	9.7
Moose	0	10	161	1,850	10.3
White-tailed Deer	2	300	14,084.2	130,000	11.1
Beaver	9.6	500	571.4	7,900	13.6
North American Porcupine	0.2	50	N/A*	N/A*	N/A*
Raccoon	121.2	1,000	374.8	71,875	1.9
Virginia Opossum	11	200	53.4	5,070	5.0
Woodchuck	29	1,000	N/A*	488,327	0.2
Gray Fox	1.2	30	43.6	N/A	N/A
Red Fox	4.6	200	104.2	5,085	6.0

Eastern Cottontail	17.8	1,000	N/A*	244,164	0.4
Muskrat	0.4	500	2,482.6	N/A*	N/A*
Eastern Chipmunk	1	100	N/A*	N/A*	N/A*
Eastern Gray Squirrel	1.4	200	N/A*	N/A*	N/A*
Red Squirrel	0	200	N/A*	N/A*	N/A*
Mink	0	50	254	N/A*	N/A*
Ermine (Short-tailed weasel)	0	50	N/A*	N/A*	N/A*
Fisher	0.2	30	171.4	N/A	N/A*
Long-tailed Weasel	0	50	N/A*	N/A*	N/A*
Striped Skunk	68.4	1,000	123.8	32,500	3.5
Pine Martin	0	10	N/A*	N/A*	N/A*
Snowshoe Hare	0	50	N/A*	N/A*	N/A*
Northern Flying Squirrel	0	50	N/A*	N/A*	N/A*
Southern Flying Squirrel	0	50	N/A*	N/A*	N/A*
Feral Swine	0	500	N/A*	N/A*	N/A*
Feral cats	0	50	N/A*	N/A*	N/A*
River Otter	0	30	59.6	N/A*	N/A*
Norway rat	0	500	N/A*	N/A*	N/A*
Misc. mice, shrews, moles & voles	6.8	1,000 combined	N/A*	N/A*	N/A*

Includes only lethal take

[ii] VFWD's data from annual fur dealer and harvest reports (2017 data unavailable)

* Information is currently not available (N/A)

Eastern Cottontail

The Eastern cottontail rabbit is considered a game species and can be found throughout a large portion of Vermont. Cottontail rabbits can be harvested during an annual hunting season, which allows an unlimited number of rabbits to be harvested during the length of the season. The number of rabbits harvested annually during the hunting season is currently unknown. Cottontails do not distribute themselves evenly across the landscape, but tend to concentrate in favorable habitats such as brushy fence rows or field edges, gullies filled with debris, brush piles, areas of dense briars, or landscaped backyards where food and cover are suitable. Cottontails are rarely found in dense forest or open grasslands, but fallow crop fields may provide suitable habitat. Within these habitats, cottontails spend their entire lives in an area of 10 acres or less. Occasionally they may move a mile or so from a summer range to winter cover or to a new food supply. In suburban areas, cottontails are numerous and mobile enough to fill voids when cottontails are removed from an area. Population densities vary with habitat quality, but one cottontail per 0.4 hectares (1 acre) is a reasonable average (Craven 1994). Cottontails live only 12 to 15 months, yet make the most of time available reproductively. They can raise as many as six litters per year of one to nine young (usually four to six), having a gestation period of 28 to 32 days. If no young were lost, a single pair together with their offspring could produce five million cottontails in five years (Sullivan and Hilbert 2014).

There are no population or trend estimates available for Eastern cottontails; however, they are believed to be common throughout southern and western Vermont. Based on the cropland area of Vermont, there are over 488,327 acres of cropland (2012 Census of Agriculture, State Data Table 8). Using the conservative assumption that 50% of the land area of the state's agricultural land has sufficient habitat to support rabbits, home ranges of rabbits do not overlap, and rabbit densities average one rabbit per acre (Craven 1994), a statewide rabbit population could be estimated at 244,164 rabbits. The population of rabbits is likely higher than 244,164 rabbits given that rabbits can occur at higher densities. Therefore, the population estimated at 244,164 rabbits would be considered a minimum population estimate.

Direct, Indirect, and Cumulative Effects:
Based on surveys at airports, up to 1,000 rabbits could be lethally removed by WS to reduce densities and discourage the presence of other wildlife that may be attracted to airports by high rabbit densities. The take of 1,000 Eastern cottontails would represent 0.4% of the estimated statewide population. Based on this low level of take and no take limit during the annual hunting season, WS' lethal management activities are not expected to have any significant cumulative adverse effects on Eastern cottontail populations in Vermont. The permitting of take by VFWD ensures any take by WS occurs within allowable harvest levels.

Woodchucks

Woodchucks (also known as groundhogs) are found throughout much of the eastern and midwestern U.S., with distribution across Vermont. They use a variety of open habitat types including agricultural areas, old fields, forest edges, fencerows, urban, and suburban settings. One limiting factor in the occurrence of woodchucks is soil types which allow for burrowing activities. Woodchucks have one litter a year that ranges from two to six young. Woodchucks breed at age one and live four to five years. Only one litter a year is produced with an average of five kits (Merritt 1987, Armitage 2003). Woodchuck densities vary from area to area, depending on food availability, soil type, hunting pressure and predation. Populations with up to six or seven individuals per acre have been documented. However, a population of four per acre is considered abundant, and the average is probably closer to one per acre of farmland (Fergus 2001).

The VFWD is responsible for the management of the states woodchuck population but does not conduct population census for woodchucks or estimate hunter harvest. The season for groundhogs is year round with no limit on the number that can be taken. Woodchucks may also be taken if the animals are causing damage on private property, causing a human health and safety issues, and legally hunted. VFWD has no annual reporting requirements for woodchucks (VFWD 2017). Woodchuck population trends are unknown.

To analyze potential impacts of WS' activities on woodchuck populations, the best available information will be used to estimate a state-wide population. There are over 488,327 acres of currently active farmland in the state (2012 Census of Agriculture, State Data Table 8). Based on Fergus (2001), there may be an average of one woodchuck per acre of farmland. Using a modest estimate of one woodchuck for every acre of farmland, a conservative statewide woodchuck population could be estimated at approximately 488,327 individuals. Considering woodchucks are likely to inhabit more than the active farmland of the state, and may exist at much higher densities, an estimate of 488,327 woodchucks is likely low.

Direct, Indirect, and Cumulative Effects:
Gas cartridges could be employed to fumigate woodchuck burrows in areas where damages were occurring. Gas cartridges act as a fumigant by producing carbon monoxide when ignited. The cartridges contain sodium nitrate, which when burnt, produces carbon monoxide gas. The cartridges would be placed inside active burrows at the entrance, the cartridge would be ignited, and the entrance to the burrow would be sealed with dirt, which allows the burrow to fill with carbon monoxide. Carbon monoxide is a method of euthanasia considered conditionally acceptable by the American Veterinary Medical Association (AVMA) for free-ranging mammal species (AVMA 2013).

The number of entrances to burrows used by woodchucks varies. Twichell (1939) found the number of entrances to burrow systems used by woodchucks ranged from two to six entrances in Missouri with the average number being 2.8 entrances. Other studies note the number of entrances per burrow system ranged from one to five entrances (Grizzell, Jr. 1955) to high of 11 entrances per system (Merriam 1971). Merriam (1971) found the mean number of entrances per burrow system was 2.98 entrances. Based on the mean number of entrances per burrow system of approximately three entrances (Twichel 1939, Merriam 1971) and each burrow system occupied by a male and a female (Swihart 1992, Armitage 2003), the number woodchucks that could be lethally taken using gas cartridges could be estimated at approximately 333 woodchucks if 500 entrances were treated (500 borrow entrances / 3 entrances per borrow system = number of borrow systems x 2 individuals' per borrow system). The take of woodchucks would also occur using other methods, such as shooting, live traps, cable restraints and body-gripping traps. WS responded to 355 requests (average = 71/yr.) for assistance with woodchuck damage during FY 2012-2016. Resources affected included human health and safety, general property, residential and non-residential buildings, and landscaping. Damage also included burrowing/digging, nuisance, rabies threats, and other threats. WS' average five year take, excluding the use of gas cartridges, was 29 animals annually (table 4.1). The average number of burrows treated using gas cartridges was 50 with an estimated 33 animals euthanized per year using the above mentioned calculation.

Woodchuck damage management activities would target single animals or local populations of the species at sites where their presence was causing unacceptable damage to agriculture, human health or safety, natural resources, or property. Some local populations may be temporarily reduced as a result of MDM projects aimed at reducing damage at a local site. Based upon an anticipated increase in woodchuck damage management activities in the future, it is unlikely that WS would kill more than 1,000 woodchucks per year in all MDM activities in Vermont.

The proposed take of 1,000 by WS would represent 0.2% of the minimum statewide populations and have no adverse impacts on overall woodchuck populations in Vermont. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of the woodchuck population in the state of Vermont (M. Scott, pers. comm. 2018).

Other Rodents and Insectivores

Native Species: Rodents (mice, voles, etc.) and insectivores (shrews and moles) are taken by WS during wildlife hazard management, assessments, and monitoring at airports and airbases because these species serve as attractants to birds such as raptors which create direct hazards to aircraft. Additionally, these species may be taken in orchards and other cultivated areas to reduce damage to agricultural resources,

such as apple trees and in or near parks, residences, and other structures to protect human health and safety, property, or natural resources.

Native rodents which may be the target of WS activities at airports and other locations include moles, voles and shrews such as the meadow vole, deer mouse, and white-footed mouse. Insectivores which may be the target of WS activities at airports and other locations include Eastern mole and short-tailed shrews. Most rodent species are very prolific: meadow vole (up to 17 liters annually, typically 4-5 young per litter), white-footed mouse (multiple litters, five young each), deer mice (3-4 litters, 4-6 young each), and short-tailed shrews (two to three litters with five to seven young each) (Merritt 1987). Eastern moles have one or two litters per year with two to five young each. Large population fluctuations are characteristic of many small rodent populations.

Direct, Indirect, and Cumulative Effects:
Methods of lethal take for these species by WS would include trapping and use of chemical products such as zinc phosphide (ZP). Determination of numbers of rodents killed by MDM actions is difficult when lethal chemical methods such as ZP treatments are employed. This is because most animals killed by these methods die underground. Removal of these species by WS would be done at specific isolated sites (e.g., airports, orchards, etc.). Impacts of these activities to rodent and insectivore populations would be minimal due to the species' relatively high reproductive rates and because rodent/insectivore damage management recommended and conducted by WS would be at a limited number of specific local sites with the use of legal methods. Based upon the above information, WS limited lethal take of small rodents may cause temporary reductions at the specific local sites where WS works, but would have no adverse impacts on overall populations of the species in Vermont.

There are five shrew and vole species that are classified by the VFWD as "species of concern." Nongame species in Vermont are managed by the Wildlife Diversity Program of the VFWD. Any incidental take of these species must be reported to the Wildlife Diversity Program as a stipulation under WS current Scientific Collecting Permit issued by the VFWD (VFWD 2017).

Small mammals such as shrews, voles, moles, and mice would primarily be taken during wildlife hazard assessments conducted at airports to obtain information on densities of small mammals. Higher densities of shrews and other small mammals often attract higher numbers of raptors and other predatory wildlife to airports, which increase strike risks. Therefore, as part of a comprehensive wildlife hazard assessment conducted at airports to identify strike risks, small mammal surveys are often conducted using live-traps or body-grip style quick-kill traps (e.g., snap trap). Based on previous assessments conducted, and in anticipation of conducting additional surveys at airports, WS could lethally take up to 200 individuals of each species addressed in this EA. The limited proposed take by WS of up to 200 individuals of each of the shrew, vole, and mole addressed in this EA would not reach a magnitude where adverse effects to the populations of those species would occur.

Non-native Rodent Species: Norway Rats, black (roof) rats, and house mice are not native to North America and were accidentally released into this country. In the wild, the impact of these species is seen by many as entirely detrimental (Burt and Grossenheider 1980). These species eat anything digestible and may prey on eggs or offspring of native species and compete with native species for resources. Executive Order 13112 Invasive Species directs federal agencies to use their programs and authorities to prevent the spread of or to control populations of invasive species that cause economic or environmental harm, or harm to human health. Although removal of these species up to and including extirpation could be seen as desirable, because of the productivity and distribution of these species and the limited nature of

WS work, WS is unlikely to ever do more than limit populations at the specific local sites where WS works. Based on the above information and WS limited lethal take of rodents in Vermont, WS should have minimal effects on local or statewide non-native rodent populations.

Feral Swine

Feral swine have no legal game status in Vermont but are considered escaped private property and may only be hunted with permission by the property owner. Historically, feral swine populations in Vermont have been either Eurasian wild boar or hybrids. Reports of feral swine have been documented as early as 1895 and continue today and are primarily found in Orange and Windsor Counties. Although it is difficult to estimate the number of feral swine in the state, the number of damage complaints and sightings has increased. The current population of feral swine in the state is currently unknown (Scott. Darling, VFWD, pers. communication).

Feral swine utilize a variety of habitats such as forests, thick shrubby areas, mountains, valleys, grasslands, and agricultural lands. Swine are extremely opportunistic and will eat almost any kind of plant or animal matter that is available, such as nuts, grains, berries, leaves, fungi, roots, small mammals, carrion, birds, eggs, snails, amphibians, reptiles, insects, and worms (Sweeney et al. 2003). Swine can breed throughout the year, typically producing one litter of three to eight piglets a year, but are capable of producing two litters a year (West et al. 2009).

WS would manage damage and threats associated with feral swine when a request for assistance is received and a cooperative service agreement, MOU, or comparable document has been signed by a cooperating agency or agencies and the property owner or property manager. Although the VFWD does not regulate the take of feral swine, any reduction in the feral swine population in Vermont would be a collaborative effort.
Although harvest records are not kept in the state, opportunistic hunters are thought to be hunting escaped animals around facilities which house feral swine (Scott. Darling, per communication, 2014). In addition to those feral swine lethally removed from high fence facilities, WS has also been requested by VFWD to investigate reported feral swine damage and sightings' throughout the state.

Direct, Indirect, and Cumulative Effects:
To assist VFWD with maintaining a zero population status, WS could remove up to 500 feral swine annually. Any reduction in feral swine populations would be considered beneficial to Vermont. All activities to manage feral swine in Vermont would be conducted by working with property owners and from the direction of the VFWD and the Vermont Department of Agriculture, Markets and Foods, as well as additional affected cooperators. Executive Order 13112 states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations, provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education on invasive species. WS' take of feral swine would comply with Executive Oder 13112. While elimination of feral swine would be beneficial to the environment, the removal of 500 feral swine annually would not pose any significant direct or cumulative impacts to the population throughout the Eastern U.S.

Feral Cats

The lowest estimate of the feral cat population in the United States is 70 million, and in urban areas there may be hundreds of cats per square mile (Mott 2004). Free ranging/feral cats are believed to prey on common bird species, such as cardinals, blue jays, and house wrens, as well as rare and endangered species, such as piping plovers. Some experts estimate that each year domestic and feral cats kill hundreds of millions of birds, and more than a billion small mammals, such as rabbits, squirrels, and chipmunks. No estimates of the feral cat population in Vermont are currently available. Feral cats are not viewed as furbearers in the state, nor are their populations managed by the VFWD. Feral cats are considered a nonnative species that often have adverse effects on native wildlife.

Direct, Indirect, and Cumulative Effects:
Feral cats that are live-captured would be relinquished to the animal shelter and made available for adoption, if appropriate. Feral cats would only be euthanized by WS if live-captured feral cats are visibly sick, injured, or a local animal control office cannot be located or is unwilling to accept the feral cats. Therefore, limited lethal take would occur and would not reach a magnitude where a decline in the feral cat population in the state would occur. The limited live-removal of up to 50 feral cats would be unlikely to adversely affect the cat population on Vermont. Executive Order 13112 states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations, provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education on invasive species. WS' take of feral cats would comply with Executive Oder 13112.

Raccoons

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

Absolute raccoon population densities are difficult or impossible to determine because of the difficulty in knowing what percentage of the population has been counted or estimated and the additional difficulty of knowing how large an area the raccoons are using (Sanderson 1987). Due to their adaptability, raccoon densities reach higher levels in urban areas than that of rural areas. Density studies conducted by WS for three consecutive years (2001-2003) in Highgate, Vermont, Franklin County ranged from 18.4 to 23.3 raccoons per square mile in non-mountainous agricultural habitat (Cooperative Rabies Management Program National Report, 2003). A WS raccoon density study conducted in 1997 in St. Albans City, Franklin County, Vermont showed the density to be 25.9 raccoons per square mile. In 1997, raccoon density by WS conducted on Jay Peak, Vermont (elevation 730 meters) was determined to be 6.5 raccoons per square mile (Kathleen. Nelson, pers. comm., 2006).

Raccoon population trends in Vermont appear to be stable to slightly increasing since 2000 (Chris. Bernier, pers. comm., 2014). No statewide population estimates were available for raccoons in Vermont at the time of this EA's publication. Therefore, the best available information was used to estimate statewide populations. There are over five million acres of rural land in Vermont, with approximately 488,327 acres considered cropland (2012 Census of Agriculture, State Data Table 8). Based on the assumptions that 50% of the rural lands throughout the state have sufficient habitat to support raccoons, raccoons are only found in rural habitat, and raccoon densities average a conservative 18.4 raccoon per square mile, a conservative statewide raccoon population could be estimated at 71,875 raccoons.

Raccoons are protected furbearers in Vermont with no limit on the number that may be harvested. According to the Vermont Trapper Mail Survey, 1,874 raccoons were harvested between 2012 and 2016 (Kim. Royar, pers. comm., 2017).

Direct, Indirect, and Cumulative Effects:
Raccoon damage management activities would target single animals or local populations of the species at sites where their presence was causing unacceptable damage to agriculture, human health or safety, natural resources, or property. Some local populations may be temporarily reduced as a result of MDM projects aimed at reducing damage at a local site. Based upon an anticipated increase for requests for WS assistance, it is unlikely that WS would kill more than 1,000 raccoons each year in MDM activities throughout Vermont.

Using the minimum population estimate of 71,875 individuals, WS' lethal take of 1,000 raccoons would impact 1.4% of the population. If hunter harvest continues to average 375 individuals per year, the cumulative take would represent 1.9% of the statewide population. Based upon the above information, WS limited lethal take of raccoon would have no adverse impacts on overall raccoon populations in Vermont. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of the raccoon populations in the state (Mark. Scott, pers. comm. 2018).

Red Fox

Red foxes are considered widespread and very common throughout most of the state. Red fox are a protected furbearer in Vermont with no limit on the number that may be harvested. From 2012-2016, 521 red foxes were harvested in Vermont according to the Vermont Trapper Mail Survey (K. Royar, pers. comm., 2017). Also, a landowner or their agent may kill or have killed foxes that are causing property damage, threating pets, depredating livestock, or are causing human health and safety concerns. In good habitat, up to three red fox can be found per square mile. Coyotes and red fox compete for food resources and habitat; in areas of high coyote populations, foxes can select more urban landscapes to avoid interactions with coyotes (Gosselink et al. 2003). This perpetuates higher potential for human/fox interaction and conflicts.

There are no population or trend estimates available for red fox in Vermont; however, they are believed to be common and abundant throughout the state. Based on the cropland area of Vermont, there are over 1,251,713 acres of farmland (2012 Census of Agriculture, State Data Table 8). Using the conservative assumption that 50% of the land area of the state's agricultural land has sufficient habitat to support red fox, home ranges of fox do not overlap, and fox densities average 2.6 per square mile, a statewide red fox population could be estimated at 5,085 fox. The population of fox is likely much higher given that higher

densities can occur. Therefore, the population estimated at 5,085 red fox would be considered a minimum population estimate.

Direct, Indirect, and Cumulative Effects:
WS personnel killed 23 red foxes during all MDM programs in Vermont during FY 2012-2016. Based upon current and an anticipated increase in requests for red fox damage management assistance in the future, it is unlikely that WS would kill more than 200 red foxes each year while conducting MDM activities throughout Vermont.

The WS take of 200 red fox would represent 4.0% of the estimated statewide population. WS' take combined with the average sportsman harvest of 104 would represent 6.0% of the statewide population. Based on this low level of take and no take limit during the annual hunting season, WS' lethal management activities are not expected to have any cumulative adverse effects on red fox populations in Vermont. The permitting of take by VFWD ensures any take by WS occurs within allowable harvest levels. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of the red fox populations in the state of Vermont (Mark. Scott, Pers. Comm. 2018).

Striped Skunk

Skunk densities vary widely according to season, food sources and geographic area. Densities have been reported to range from one skunk per 77 acres to one per 10 acres (Rosatte 1987). The highest numbers of skunks are in hilly rural areas and in habitats that include a mixture of farmland, pastureland and timber. In some urban areas skunks are abundant, especially along railroads or high-tension power lines because these features provide travel ways and denning sites. Skunks are susceptible to infection with diseases such as rabies and distemper. These outbreaks can cause a skunk population to decline sharply. Skunks may be less common now than they were 50 years ago because small farming operations have given way to larger, less diverse crop farms.

No population estimates were available for striped skunks in Vermont at the time of this publication. Therefore the best available information was used to estimate statewide populations. There are over five million acres of rural land in Vermont, with approximately 488,327 acres considered cropland (2012 Census of Agriculture, State Data Table 8). Using the assumption that 50% of the rural lands throughout the state have sufficient habitat to support striped skunks, skunks are only found in rural habitat, and skunk densities average one skunk per 77 acres, a minimum statewide striped skunk population could be estimated as approximately 32,500 skunks. The population is likely much higher given that higher densities occur. Therefore, the population estimated at 32,500 skunks would be considered a minimum population estimate.

Direct, Indirect, and Cumulative Effects:
The VFWD has established year round harvest season on striped skunks with no bag or possession limits. According to the Vermont Trapper Mail Survey, 619 skunks were harvested between 2012 and 2016 (Kim. Royar, pers. comm., 2017). WS killed 343 striped skunks (average = 68.6/yr.) in all MDM programs in Vermont during FY 2012-2016. Based upon current and an anticipated increase in requests for striped skunk damage management assistance in the future, it is unlikely that WS would kill more than 1,000 striped skunks per year in all MDM activities in Vermont.

Skunk populations in Vermont appear to be stable (Mark. Scott, Pers. Comm. 2018). The WS take of 1,000 skunks would represent 3.1% of the estimated statewide population. WS' take combined with the average sportsman harvest of 124 would represent 3.5% of the statewide population. Based on this low level of take and no limit during the annual hunting season, WS' lethal management activities are not expected to have any cumulative adverse effects on skunk populations in Vermont. The permitting of take by VFWD ensures any take by WS occurs within allowable harvest levels. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of striped skunk populations in the state of Vermont (M. Scott, Pers. Comm. 2018).

Virginia Opossum

Since 2000, Virginia opossums have become common throughout Vermont. Opossums live for only one to two years, with as few as 8% of a population of those animals surviving into the second year according to a study conducted by Seidensticker et al. (1987) in Virginia. In that five-year study, it was also observed that there was a wide variation in opossum numbers, in what was considered excellent habitat for the species. However, the mean density during the study was 10.1 opossum per square mile with a range of 1.3 opossum per square mile to 20.2 opossum per square mile (Seidensticker et al. 1987). This was comparable to other opossum population densities in similar habitats in Virginia. Verts (1963) found a density estimate of 10.1 opossum per square mile in farmland areas in Illinois while Wiseman and Hendrickson (1950) found a density of 6.0 opossum per square mile in mixed pasture and woodlands in Iowa. However, VanDruff (1971) found opossum densities in waterfowl nesting habitat as high as 259 opossum per square mile.

Opossum are common throughout Vermont where appropriate habitat conditions exist; however, no population estimates are available for opossum in the state. Therefore, a population estimate will be derived based on the best available information for opossum to provide an indication of the magnitude of take proposed by WS to alleviate damage and threats of damage. The rural land area of Vermont covers five million acres (U.S. Census Bureau 2012). If opossum were only found on 50% of the rural land area using a mean density of 10.1 opossum per square mile found by Seidensticker et al. (1987) in Virginia, the population would be estimated at nearly 31,600 opossum. Using the range of opossum found by Seidensticker et al. (1987) estimated at 1.3 opossum per square mile to 20.2 opossum per square mile and only 50% of the rural land area of the state being occupied by opossum, the statewide population would range from a low of 5,070 opossum to a high of 78,900 opossum. Opossum can be found in a variety of habitats, including urban areas, so opossum occupying only 50% of the rural land area is unlikely since opossum can be found almost statewide. However, opossum occupying only 50% of the rural land area was used to provide a minimum population estimate to determine the magnitude of the proposed take by WS to alleviate or prevent damage.

Opossum are considered a furbearing species in the state and can be harvested during annual hunting and trapping seasons. Opossum can be harvested during hunting and trapping season with no limit on the number that could be taken during those seasons. In addition, opossum can be lethally taken when causing damage or posing a threat of damage without the need for a permit from the VFWD. However, the number of opossum lethally taken to alleviate damage and the number of opossum harvested during the annual harvest seasons is currently unknown.

Direct, Indirect, and Cumulative Effects:

Based on previous requests for assistance received by WS and in anticipation of additional requests for assistance, WS could lethally remove up to 200 opossum annually as part of efforts to reduce damage and threats of damage. Given the range of population estimates mentioned above, the take of 200 opossum by WS annually would represent from 0.3% to 3.9% of the estimated statewide population, if the overall population remains at least stable.

The VFWD has established year round harvest season on Virginia opossums with no bag or possession limits, which provides an indication the population is not likely to decline from overharvest. Permitting by the VFWD ensures take would occur within population objectives established by the VFWD. Although the number of opossum lethally taken during the annual harvest seasons and for damage management is unknown, the cumulative take of opossum, including the proposed take of up to 200 opossum annually by WS, would be of a low magnitude when compared to the actual statewide opossum population.

Beaver

Beavers were trapped extensively during the 19th and part of the 20th century, and as a result, disappeared from much of their range (Novak 1987). Now re-established over most of the continent, and protected from overexploitation, the beaver has become a pest in some regions. Beaver abundance has been reported in terms of families per kilometer of stream or per square kilometer of habitat. Novak (1987) summarized reported beaver family abundance as ranging from 0.31 to 1.5 families per kilometer of stream, which converts to 0.5 - 2.4 families per mile of stream. Densities in terms of families per square mile have been reported to range from 0.39 to 10.1 (Novak 1987). Beaver are present in all 14 Vermont counties, and their population is considered increasing across the state (Mark. Scott, Pers. Comm. 2018). No population estimates were available for beavers in Vermont. Therefore the best available information was used to estimate statewide populations. There are over 220,000 acres of wetlands in Vermont (VTDEC 1999) including an estimated minimum of 5,261 miles of streams (MacArdle, J.J. 1996). Using the conservative estimate of three beavers per family group and an abundance of 0.5 families per stream mile provided by Novak (1987), the minimum statewide beaver minimum population estimate for Vermont could be estimated at 7,900 beavers. The population is likely much higher given that higher densities can occur. Therefore, the population estimated at 7,900 beavers would be considered a minimum population estimate.

Beavers are a protected furbearer with no limit on the number that may be harvested. From 2012-2016, 2,857 beavers were harvested in Vermont according to the Vermont Trapper Mail Survey (Kim. Royar, pers. comm., 2017). During FY 2012-2016 WS removed 48 beavers in Vermont during all damage management projects.

Direct, Indirect, and Cumulative Effects:
Based upon current and an anticipated increase in requests for beaver damage management assistance in the future, it is unlikely that WS would remove more than 500 beavers per year in all MDM activities in Vermont.

The WS take of 500 beaver would represent 6.3% of the estimated statewide population. WS' take combined with the average sportsman harvest of 571 would represent 13.6% of the statewide population. Based on this low level of take and no take limit during the annual hunting season, WS' lethal

management activities are not expected to have any cumulative adverse effects on beaver populations in Vermont. The permitting of take by VFWD ensures any take by WS occurs within allowable harvest levels. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of the beaver population in the state of Vermont (Mark. Scott, Pers. Comm. 2018).

Muskrat

Muskrats occur throughout most of North America and can be found throughout Vermont. This species is considered widespread and very common throughout most of the state. Muskrats occupy a variety of aquatic habitats including ponds, lakes, and streams and prefer areas of dense vegetation, particularly cattails. Muskrat populations can fluctuate greatly from year to year depending on weather condition, disease outbreaks, habitat loss, and predation intensity. However, muskrats are highly prolific and produce two to three litters per year that average four to seven young per litter, which makes them relatively immune to overharvest (Boutin and Birkenholz 1987).

Muskrats are managed by the VFWD as a furbearer species with a trapping season that occurs from late October to March 31 and by hunting from March 20 to April 19 with no daily or season take limit. In situations where muskrats are causing damage, property owners, dwelling occupants, farmers, and their agents, may take muskrats via lawful procedures to alleviate damage to property, human health and safety and other resources. Sportsmen in Vermont have harvested an average of 2,483 muskrats annually from 2012-2016 (Table 4.1). WS removes an average of four muskrats per year in response to damage complaints.

Direct, Indirect, and Cumulative Effects:
Based on previous requests for assistance received by WS, the take of muskrats by WS would not exceed 500 muskrats annually. Using the average annual harvest data to assess WS' impacts to the muskrat population, WS' take of 500 muskrats would represent 5% of the sportsman harvest (Table 4.1). This level of take is considered to be a very low magnitude. Given that the actual population is much higher than the annual harvest, WS' take is an even lower magnitude of the statewide population.

The unlimited harvest levels allowed by the VFWD during the length of the trapping season provides an indication that cumulative take, including take for damage management, would not reach a level where overharvest of the muskrat population would occur resulting in an undesired population decline. The VFWD has regulatory authority over the management of wildlife, including muskrats, and all take by WS has occurred and would continue to occur only after authorization by the VFWD and only at the levels authorized. The VFWD's oversight of WS and annual trapping seasons take would ensure that the cumulative take would not have a negative impact on the overall muskrat population.

Coyotes

Prior to 1900, the distribution of the coyotes was mainly limited to the short grass prairie region of the western United States (Parker 1995). Two separate colonization events occurred on a northern and southern front as coyotes expanded their range into the eastern United States (Parker 1995 and Moore and Parker 1992). Coyotes are now found in every Vermont county. During FY 2012-2016, WS responded to 62 (average = 12.4/yr.) requests for assistance regarding coyotes.

A reliable estimate of the current coyote population in Vermont is unknown. Because determinations of absolute coyote densities are frequently unknown (Knowlton 1972), many researchers have estimated coyote populations using various methods (Clark 1972, Knowlton 1972, Camenzind 1978, USDI 1979, Pyrah 1984).

Although coyote densities vary considerably between habitat types and vary based on numerous environmental variables, Knowlton (1972) estimated that an average population density was likely between 0.5 and 1.0 coyote/mi^2 over the entire range in the United States. Coyote densities range from 0.2/mi^2 when populations are low (pre-whelping) to 3.6 coyotes/mi^2 when populations are high (post-whelping) (USDI 1979, Knowlton 1972). Knowlton (1972) concluded that coyote densities may approach a high of 5-6 coyotes/mi^2 under extremely favorable conditions with densities of 0.5 to 1.0/mi^2 possible throughout much of their range. Such an estimate is speculative but represents some the best available information for estimating coyote populations. Using a coyote population density of 0.5 to 1.0 coyote/mi^2 and the total area of Vermont of 9,615 mi^2 (U.S. Census Bureau 2012), an estimate of the statewide population is between 4,807 to 9,615 coyotes.

To provide for a reasonable margin of error, the impact analysis for this document will use a population density of the lowest estimated population density determined by Knowlton (1972). Using the lowest estimated population (0.5 coyotes/mi^2) the statewide coyote population would be estimated at 4,807 coyotes. The VFWD has no closed hunting season on coyotes with no bag or possession limits, which provides an indication the population of coyote is not likely to decline from overharvest. The permitting of the take by the VFWD ensures take would occur within population objectives established by the Department.

Direct, Indirect, and Cumulative Effects:
Although the number of coyotes lethally taken in the state during the annual hunting season and for damage management is unknown, 266 coyotes are removed annually through trapping. WS proposes to take up to 200 coyotes annually to alleviate damage. WS' take combined with the average sportsman harvest of 266 would represent 9.7% of the statewide population. Coyote populations can withstand a harvest of up to 70% of the population annually (Connolly and Longhurst 1975). The proposed take by WS and other entities are not likely to adversely affect coyote populations. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of the coyote population in the state of Vermont (Mark. Scott, Pers. Comm. 2018).

White-tailed Deer

White-tailed deer range throughout most of the United States, except the far southwest, and inhabit the southern half of the southern tier of Canadian Provinces. This species inhabits farmlands, brushy areas, forests, suburbs, and gardens. Rural areas containing a matrix of forest and agricultural crops can contain the highest deer densities (Roseberry and Woolf 1998). Biologists and resource managers in Vermont have been challenged with managing the state deer population. As deer populations increase, there is an increasing occurrence of damage from white-tailed deer to agricultural crops (DeVault et al. 2007), increasing incidences of Lyme disease (Fernandez 2008), a rise in deer-vehicle collisions (Conover et al. 1995), and a disruption in forest health, regeneration, and forest dependent species (Tilghman 1989). Additionally, white-tailed deer are ranked as one of the most hazardous species to aviation according to the percentage of strikes that caused damage from 1990 through 2012 (Dolbeer et al. 2013).

The VFWD estimated the statewide deer population at around 130,000 deer in 2017 (VFWD 2017). White-tailed deer are classified as a big game animal in Vermont with annual hunting seasons. The primary tool for the management of deer populations in Vermont is through adjusting the allowed lethal removal during the deer harvest season. The number of deer the VFWD allows to be harvested by individual hunters during the length of the hunting season varies. During the 2016 hunting season, VFWD reported that 16,220 deer were harvested and 70,421 deer have been harvested by hunters between 2012 and 2016. Mortality can also occur from vehicle collisions, dogs, illegal take, tangling in fences, disease, and other causes (Crum 2003). Annual deer mortality in Vermont from other sources (e.g., illegal take, disease, and predation) is currently unknown.

Direct, Indirect, and Cumulative Effects:
After review of previous activities conducted by WS and in anticipation of additional efforts, WS could lethally remove up to 300 deer annually. Deer will generally be removed from airfields, from captive facilities where deer were confined inside a perimeter fence, in damage situations, to protect agriculture, to protect human health and safety, and as permitted or requested by VFWD to assist with control or sampling and managing the spread of diseases found in free-ranging and/or captive deer populations. If a disease outbreak occurred, WS could be requested to remove white-tailed deer for sampling and/or to prevent further spread of diseases. However, WS' total annual removal would not exceed 300 deer annually under the proposed action.

With a population estimated at 130,000 individuals, WS' possible take of 300 deer would represent 0.2% of the estimated population. Additional take of deer during the regulated harvest season resulted in 16,220 deer being harvested (VFWD 2016). If WS' possible take is combined with the estimated take of deer during the regulated hunting seasons, take would represent 12.7% of the estimated deer population in Vermont. However, WS' take would only represent 2.0% of the total take of deer in Vermont.
With oversight of the VFWD, the magnitude of removal of deer by WS annually to resolve damage and threats would be low. The proposed take of up to 300 deer by WS and the take of deer by other entities are not likely to adversely affect the statewide deer populations. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of the deer populations in the state of Vermont (Mark. Scott, Pers. Comm. 2018).

WS-Vermont could assist with controlling disease outbreaks such as Chronic Wasting Disease (CWD) if requested and permitted by VFWD. All removal activities, including disposal requirements and take limits, would be undertaken according to relevant laws, regulations, and policies. The VFWD have determined that these actions would help prevent the spread of cervid diseases.

Captive non-native ungulates

Red deer, fallow deer, elk, bison, and sika deer are not native to Vermont and were brought into the state as part of farming/hunting facilities. These ungulates do not have established wild populations, and their interaction with native white-tailed deer after escaping an enclosure may increase risks associated with disease transfer. Therefore, any removal of red deer, fallow deer, elk, bison and sika deer could be seen as providing some benefits to the natural environment by eliminating potential disease vectors or disease transfer to native wildlife populations. Activities to manage threats associated with exotic ungulates would be permitted by either VFWD or VAAFM.

Direct, Indirect, and Cumulative Effects:
WS anticipates that up to 50 exotic ungulates could be removed following escape from enclosed facilities or to prevent the spread of disease. No adverse effects to the environment are expected since there are no natural established populations for these species. Executive Order 13112 states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations, provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education on invasive species. WS' take of exotic ungulates would comply with Executive Oder 13112.

Other Target Species

WS may be requested to remove small numbers of various other species mentioned in this EA. The numbers of removed individuals is usually so minimal that population impacts are negligible. To illustrate this, one of the more sensitive species, the bobcat, has been analyzed below to demonstrate the negligible impacts.

Bobcats are common in areas of Vermont with suitable habitat. The current statewide population of bobcats in Vermont has been estimated at 2,500 bobcats (Chris. Bernier, per. Communication, 2018). Bobcats are classified as furbearers in Vermont, with a regulated annual hunting and trapping seasons. During the annual hunting and trapping season, there is no daily or possession limit for bobcats. The average number of bobcats harvested in the state annually is approximately 34. Between FY 2012 and FY 2016, WS has not lethally removed any bobcats during all damage management and ORV activities. However, WS has live-captured and released one bobcat during that time frame. Based on previous requests for assistance received by WS and in anticipation of additional efforts to address damage, it is possible that WS could kill up to 30 bobcats annually during all damage management activities in Vermont.

Based on a population estimated at 2,500 bobcats, WS' take of up to 30 bobcats annually would represent 1.2% of the estimated statewide population, if the population remains stable. WS' take combined with the average annual sportsman harvest of 33.6 represents only 2.5% of the population. With oversight of the VFWD, the magnitude of removal of bobcats by WS annually to resolve damage and threats would be low. The proposed take of up to 30 bobcats by WS and the take of bobcats by other entities are not likely to adversely affect the statewide bobcat population. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of the bobcat population in the state of Vermont (Mark. Scott, pers. comm. 2018).

Based on the analysis of bobcats, a highly regulated species in Vermont, the take of other target species could be lethally taken in small numbers by WS with no significant impact. Therefore, WS could lethally remove the following species not to annually exceed the number associated with each species: black bear (30), gray fox (30), mink (50), weasels (all species, 100 total), river otters (30), fishers (30), snowshoe hares (50), feral/domestic rabbits (15), squirrels (gray/red, 100 each), porcupine (50), southern flying squirrel (50), northern flying squirrels (50), moose (30), America martin (10), and eastern chipmunks (100). None of these mammal species are expected to be taken by WS at any level that would adversely affect overall statewide mammal populations. Additionally, WS may be requested to capture, immobilize, release and/or relocate them to protect human health and safety, reduce damage, assist with

research or at the request of the managing agency. Damage management activities would target single animals or local populations at sites where their presence was causing unacceptable damage to agriculture, human health or safety, natural resources, or property. Some local populations may be temporarily reduced as a result of removal activities to reduce damage at a local site. The estimated WS take would be of low magnitude when compared to the number of those game species harvested each year, and would be of extremely low magnitude when compared to the statewide population of those species. Those species are not considered to be of low densities in the state. The VFWD has determined that there is no evidence to suggest that human mediated mortality resulting from regulated harvest and damage management, including removal by WS, will be detrimental to the survival of these "other target mammal species" populations in the state of Vermont (Mark. Scott, Pers. Comm. 2018).

Wildlife Disease Surveillance and Monitoring

The ability to efficiently conduct surveillance for and detect pathogens is dependent upon rapid detection of the pathogen if it is introduced. Effective implementation of a surveillance system will facilitate planning and execution at regional and state levels, and coordination of surveillance data for risk assessment. It will also facilitate partnerships between public and private interests, including efforts by federal, state, and local governments as well as non-governmental organizations, universities, and other interest groups. Data collected by organizations/agencies conducting research and monitoring will provide a broad species and geographic surveillance effort.

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

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

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

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

Under the disease sampling strategies listed above that could be implemented to detect or monitor mammalian diseases, WS' implementation of those sampling strategies would not adversely affect mammal populations in the state. Sampling strategies that could be employed involve sampling live-captured mammals that could be released on site after sampling occurs. The sampling (e.g., drawing

blood, hair sample, fecal sample) and the subsequent release of live-captured mammals would not result in adverse effects since those mammals are released unharmed on site. In addition, sampling of sick, dying, or hunter harvested mammals would not result in the additive lethal take of mammals that would not have already occurred in the absence of a disease sampling program. Therefore, the sampling of mammals for diseases would not adversely affect the populations of any of the mammal species addressed in this EA and would not result in any take of mammals that would not have already occurred in the absence of disease sampling (e.g., hunter harvest).

Summary

Evaluation of WS' activities relative to wildlife populations indicated that program activities will likely have no cumulative adverse effects on mammal populations. WS' actions would be occurring simultaneously, over time, with other natural processes and human-generated changes that are currently taking place. Those activities include, but are not limited to:

- Natural mortality of wildlife
- Human-induced mortality through private damage management activities
- Human and naturally induced alterations of wildlife habitat and populations
- Annual and perennial cycles in population densities

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

Alternative 2 - Nonlethal Mammal Damage Management Only by WS

Under this alternative, WS would not intentionally euthanize any target mammal species because no lethal methods would be used. Although the methods employed by WS would not be intended to result in the death of an animal, some methods, such as live-capture and anesthesia (i.e. during trap and translocate), can result in injury or death of target animals despite the training and best efforts of management personnel. This type of removal is likely to be limited to a few individuals and would not adversely impact populations of any species.

Direct, Indirect, and Cumulative Effects:

Although WS lethal removal of mammals would not occur, it is likely that without WS conducting some level of lethal MDM activities for these species, private MDM efforts would increase. Cumulative impacts on target species populations would be variable depending upon actions taken by affected landowners/resource managers and the level of training and experience of the individuals conducting the MDM. Some individuals experiencing damage may take illegal or unsafe action against the problem

species either unintentionally due to lack of training, or deliberately out of frustration of continued damage. In these instances, more target species may be lethally removed than with a professional MDM program (Alternative 1). Overall impacts on target species populations would be similar to or slightly more significant than Alternative 1 depending upon the extent to which resource managers use the assistance provided by WS. However, for the reasons presented in the population effects analysis in section 3.1, it is unlikely that target mammal populations would be adversely impacted by implementation of this alternative.

Alternative 3 - No Mammal Damage Management Conducted by WS

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

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

Since mammals would still be lethally removed under this alternative, the potential effects on the populations of those mammal species would be similar among all the alternatives for this issue. Any actions to resolve damage or reduce threats associated with mammals could occur by other entities despite WS' lack of involvement under this alternative. However, for the reasons presented in the population effects analysis in section 3.1, it is unlikely that target mammal populations would be adversely impacted by implementation of this alternative.

Issue 2 – Effects of Damage Management on Nontarget Wildlife Species Populations, Including T&E Species

A concern is often raised about the potential impacts to nontarget species, including T&E species, from the use of methods to resolve damage caused by mammals. The potential effects on the populations of nontarget wildlife species, including T&E species, are analyzed below.

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

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

WS personnel are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding nontarget species. To reduce the likelihood of capturing nontarget wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to nontargets. Management actions are directed towards specific animals or groups of animals responsible for causing damage or posing threats. WS consults with the USFWS and the VFWD to determine the potential risks to federally and state listed threatened and endangered species in accordance with the ESA and state laws. Nonlethal methods are given priority when addressing requests for assistance (WS Directive 2.101). Nontarget animals captured in traps are released unless it is determined by WS that the animal would not survive or that the animal cannot be safely released. When the appropriate situation arises and when permitted by the VFWD, WS can trap and translocate nontarget species. 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. SOPs to prevent and reduce any potential adverse impacts on nontargets are discussed in Chapter 2. Despite the best efforts to minimize nontarget lethal removal during program activities, the potential for adverse impacts to nontargets exists when applying both nonlethal and lethal methods to manage damage or reduce threats to safety.

Nonlethal Methods

Nonlethal methods have the potential to cause adverse effects to nontargets primarily though physical exclusion, frightening devices or deterrents (see Appendix B). Any exclusionary device erected to prevent access to resources could also potentially exclude nontarget species, therefore adversely impacting that species. The use of frightening devices or deterrents may also disperse nontarget species from the immediate area where they are employed.

Other nonlethal 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 nontargets. WS would monitor or recommend traps be monitored frequently so nontarget species can be released unharmed.

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 cable restraint within 50 feet of a carcass which may attract eagles).

All of the lethal methods listed in Appendix B could be available under this alternative. Some of these methods include:

Shooting - In cases where shooting was selected as an appropriate method, identification of an individual target would occur prior to application, eliminating risks to nontargets. Additionally, suppressed firearms would be used when appropriate to minimize noise impacts to nontargets.

Euthanasia - Nontarget species captured during the implementation of nonlethal capture methods can usually be released prior to euthanasia which occurs subsequent to live-capture.

Cable Restraints - WS would use cable restraints in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives to minimize risks to nontargets.

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 nontargets.

Rodenticides - A common concern regarding the use of rodenticides is the potential risk to nontarget 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 nontargets. Rodenticides will not be used in a manner that would contaminate drinking water supplies.

Fumigants - Only fumigants and toxicants registered with the EPA and the VFWD Division of Materials Management pursuant to the FIFRA would be recommended and used by WS under this alternative. Fumigants and toxicants, including restricted use toxicants, could be used by licensed

non-WS' pesticide applicators; therefore, WS' use of fumigants and toxicants would provide no additional negative impacts on nontarget species as these substances could be used in the absence of WS' involvement. WS personnel are trained and licensed in the safe and effective use of fumigants and toxicants as well as the behavior and biology of both target and nontarget wildlife species.

Direct, Indirect, and Cumulative Effects:
The persistent use of nonlethal methods would likely result in the dispersal or abandonment of those areas where nonlethal methods are employed of both target and nontarget species. Therefore, any use of nonlethal methods has similar results on both nontarget and target species. However, the potential impacts to nontargets, 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 nontarget populations would occur. Nonlethal methods are generally regarded as having minimal impacts on populations because individuals are unharmed. Therefore, nonlethal methods would not have any significant adverse impacts on nontarget populations of wildlife including threatened and endangered species under this alternative.

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

Mammals could still be lethally removed during the regulated harvest season, when causing damage, and through the issuance of permits by the VFWD under this alternative. WS would also employ and/or recommend lethal methods under the proposed action alternative to alleviate damage caused by target mammals. Lethal methods available for use to manage damage caused by mammals under this alternative would include shooting, body-gripping traps, cable restraints, snap traps, euthanasia after live-capture, and registered fumigants and toxicants.

The use of firearms is essentially selective for target species since animals are identified prior to application; therefore, no adverse impacts to nontargets are anticipated from use of this method.

WS personnel's pesticide training in combination with following label requirements presents a low risk of exposure of nontargets species to registered fumigants and toxicants. Additionally, WS personnel would follow all label directions during pesticide applications. As appropriate, WS would use signage and other means of notification to ensure the public is aware of fumigant or toxicant applications or applications sites, to ensure nontarget domestic species such as dogs are not exposed.

While every precaution is taken to safeguard against taking nontargets during operational use of methods and techniques for resolving damage and reducing threats caused by mammals, the use of such methods can result in the incidental lethal removal of unintended species. Those occurrences are infrequent and should not affect the overall populations of any species under the proposed action. WS' lethal removal of nontarget species during activities to reduce damage or threats to human safety associated with mammals is expected to be extremely low to non-existent. WS would monitor the lethal removal of nontarget species to ensure program activities or methodologies used in mammal damage management do not adversely impact nontargets. Methods available to resolve and prevent mammal damage or threats when employed by trained, knowledgeable personnel are selective for target species. WS would annually report to the VFWD any nontarget lethal removal to ensure lethal removal by WS is considered as part of

management objectives established. The potential impacts to nontargets are similar to the other alternatives and are considered to be minimal to non-existent.

The proposed MDM could benefit many other wildlife species that are impacted by predation, habitat modification or competition for resources. For example, fox often feed on the eggs, nestlings, and fledglings of ground nesting bird species. This alternative has the greatest possibility of successfully reducing mammal damage and conflicts to wildlife species since all available methods could possibly be implemented or recommended by WS.

T&E Species Effects

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. SOPs to avoid T&E effects are described in Chapter 2 of this EA.

Federally Listed Species –The current list of species designated as threatened and endangered in Vermont as determined by the USFWS was obtained and reviewed during the development of this EA. Appendix C contains the list of species currently listed in the state along with common and scientific names. Based on a review of those T&E species, WS has determined that activities conducted pursuant to the proposed action may affect Canada lynx and Atlantic salmon. Through the section 7 consultation process, the USFWS submitted a Programmatic Biological Opinion concurring that WS would have no adverse effects on Atlantic salmon, and the proposed action is not likely to jeopardize the continued existence of Canada lynx (Appendix D). For the remainder of the species listed, WS concluded a "no effect" determination.

State Listed Species – The current list of state listed species as determined by the VFWD was obtained and reviewed during the development of the EA (see Appendix E). Based on the review of species listed, WS has determined that the proposed activities would not adversely affect those species currently listed by the state. Any activity involving state-listed mammals being analyzed in this EA would require prior authorization by the VFWD through permitting or specific authorization. The VFWD has concurred with WS' determination for listed species.

Summary of Nontarget Animal Impact Analysis

WS continually monitors, evaluates and makes modifications as necessary to methods or strategies when providing direct operational assistance, to not only reduce damage but also to minimize potentially harmful effects to nontargets. Additionally, WS consults as required with the USFWS and the VFWD 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 state laws. WS annually reports to these entities to ensure that any nontarget lethal removal by WS is considered as part of management objectives. Furthermore, WS has partnered with VFWD and will provide biological samples or data for monitoring and research for both nontarget and target species (e.g. New England cottontail). Potential direct and cumulative impacts to nontargets, 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 - Nonlethal Mammal Damage Management Only by WS

Under this alternative, risks to nontarget species from WS actions would likely be limited to the use of frightening devices, exclusionary devices, and the risks of unintentional capture of a nontarget in a live-capture device as outlined under Alternative 1. Trap and translocation of nontarget species will be considered by WS when appropriate and when permitted by the VFWD. Although the availability of WS assistance with nonlethal MDM methods could decrease incentives for non-WS entities to use lethal MDM methods, non-WS efforts to reduce or prevent damage could result in less experienced persons implementing lethal MDM methods and lead to a greater removal of nontarget wildlife.

Direct, Indirect, and Cumulative Effects:
Under this alternative, WS' efforts to protect rare, threatened or endangered species would not be as effective as the preferred alternative (Alternative 1) because WS would be unable to access lethal techniques if nonlethal techniques are ineffective. Lethal efforts to protect these species would have to be conducted by other natural resource management entities. Capture and release (e.g., for disease monitoring) and capture and relocate would be allowed under this alternative. There is the remote chance that the capture devices could result in the death of a nontarget animal. However, given that these devices would be applied with provisions to keep the target animal alive, the risks to nontarget species are very low and would not result in adverse impacts on nontarget species populations.

A small number of nontarget animals have been captured and released by Vermont WS annually during live trapping for disease surveillance activities. These nontarget captures include mammals such as feral cats, snowshoe hare, Virginia opossums, muskrats, turtles, cottontails, fisher, porcupine and squirrels. This level of trapping is unlikely to adversely impact populations of these species. Some nontarget species have benefited by being captured during these activities; for example, some feral cats have been vaccinated against rabies before being released.

If mammal damage problems were not effectively resolved by nonlethal control methods, members of the public may resort to other means of lethal control such as the use of shooting or the use of pesticides. This could result in less experienced persons implementing control methods and could lead to greater risks to nontarget wildlife than the proposed action. For example, shooting by persons not proficient at mammal identification could lead to killing of nontarget mammals. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of chemical toxicants which could lead to unknown effects on local nontarget species populations, including T&E species. Hazards to raptors, including bald eagles, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals. While cumulative impacts would be variable, WS does not anticipate any significant cumulative impacts from this alternative.

T&E Species Effects

WS' impacts on T&E species would be similar to the nonlethal methods used under Alternative 1. Risks to T&E species from increased private efforts to address damage management problems will vary depending upon the training and level of experience of the individual conducting the MDM. As stated above, frustrated individuals may resort to use of unsafe or illegal methods like poisons which may increase risks to T&E species. Risks to T&E species may be lower with this alternative than with Alternative 3 because people would have ready access to assistance with nonlethal MDM techniques.

WS, with the assistance of VFWD, could advise individuals as to the potential presence of state and federally listed species in their area.

Alternative 3 - No Mammal Damage Management Conducted by WS

Under this alternative, WS would not be directly involved with mammal damage management activities. Therefore, no direct impacts to nontargets or T&E species would occur by WS under this alternative. Mammals would continue to be lethally removed under permits issued by the VFWD, harvest would continue to occur during the regulated season, and non-native mammal species could continue to be lethally removed without the need for a permit.

Direct, Indirect, and Cumulative Effects:

The ability to reduce damage and threats of damage caused by mammals to other wildlife species, including T&E species, and their habitats would be variable based upon the skills and abilities of the person implementing damage management actions under this alternative. The risks to nontargets and T&E species would be similar across the alternatives since most of those methods described in Appendix B would be available across the alternatives. If those methods available were applied as intended, direct, indirect, and cumulative effects to nontargets would be minimal to non-existent. If methods available were applied incorrectly or applied without knowledge of mammal behavior, risks to nontarget wildlife would be higher under this alternative. If frustration from the lack of available assistance causes those persons experiencing mammal damage to use methods that were not legally available for use, direct, indirect, and cumulative effects on nontargets would be higher under this alternative. People have resorted to the use of illegal methods to resolve wildlife damage that have resulted in the lethal removal of nontarget wildlife (e.g., White et al. 1989, USFWS 2001, FDA 2003). Therefore, adverse direct, indirect, or cumulative impacts to nontargets, including T&E species, could occur under this alternative; however WS does not anticipate any significant cumulative impacts.

T&E Species Effects

WS will not have any direct impact on T&E species. Risks to T&E species from increased private efforts to address damage management problems will vary depending upon the training and level of experience of the individual conducting the MDM. As stated above, frustrated individuals may resort to use of unsafe or illegal methods like poisons which may increase risks to T&E species. Risks to T&E species may be higher with this alternative than with the other alternatives because WS would not have any opportunity to provide advice or assistance with the safe and effective use of MDM techniques or have the opportunity to advise individuals regarding the presence of T&E species.

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

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

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

WS would use the WS Decision Model to determine the appropriate method or methods that would effectively resolve requests for assistance. The methods chosen would be continually evaluated for effectiveness and, if necessary, additional methods could be employed. Risks to human safety from technical assistance conducted by WS would be similar to those risks addressed under the other alternatives and minimal to non-existent. The use of nonlethal methods as part of an integrated approach to managing damage that would be employed as part of direct operational assistance by WS would be similar to those risks addressed by the other alternatives and also minimal.

WS' employees who conduct MDM activities would be knowledgeable in the use of methods, wildlife species responsible for causing damage or threats, and WS' Directives. That knowledge would be incorporated into the decision-making process inherent with the WS' Decision Model that would be applied when addressing threats and damage caused by mammals. Prior to and during the utilization of lethal methods, WS' employees would consider risks to human safety based on location and method. Risks to human safety from the use of methods would likely be greater in urban areas when compared to rural areas that are less densely populated. Consideration would also be given to the location where damage management activities would be conducted based on property ownership. Activities would generally be conducted when human activity is minimal (e.g., early mornings, at night) and/or in areas where human activities are minimal (e.g., in areas closed to the public).

Lethal methods available under the proposed action would include the use of firearms, kill traps (e.g., body-grip traps, snap traps, glue traps), live-capture followed by euthanasia, registered fumigants and toxicants, and the recommendation that mammals be harvested during the regulated hunting or trapping season established for those species by the VFWD.

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

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would include immobilizing drugs, euthanasia drugs, reproductive inhibitors, fumigants, toxicants, and repellents (Appendix B). The use of immobilizing drugs under the identified alternatives would only be administered to mammals that have been live-captured using other methods or administered through injection using a projectile (e.g., dart gun). Immobilizing drugs used to sedate wildlife are used to temporary handle and transport animals to lessen the distress of the animal from the experience. Drug delivery to immobilize mammals is likely to occur on site with close monitoring of the animal to ensure proper care of the animal. Immobilizing drugs are fully reversible with a full recovery of sedated animals occurring.

Euthanizing drugs would be administered under similar circumstances to immobilizing drugs under the relevant proposed alternatives. Euthanized animals would be disposed of in accordance with WS Directives and in accordance with label directions; therefore, would not be available for harvest and consumption. If mammals were immobilized for sampling or translocation and released, risks could

occur to human safety if harvest and consumption occurred. SOPs employed by WS to reduce risks are discussed in Chapter 2.

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

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

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

All WS' personnel who handle and administer chemical methods would be properly trained in the use of those methods. Training and adherence to agency directives would ensure the safety of employees applying chemical methods. Mammals euthanized by WS or lethally removed using chemical methods would be disposed of in accordance with WS Directive 2.515. All euthanasia would occur in accordance with AVMA guidelines and in the absence of the public to further minimize risks, whenever possible. All WS' personnel who apply fumigants and toxicants registered with the EPA pursuant to the FIFRA are licensed as pesticide applicators by the Vermont Agency of Agriculture, Food, and Markets. WS personnel are trained in the safe and effective use of fumigants and toxicants. Training and adherence to agency directives and label requirements would ensure the safety of both employees applying fumigants and toxicants and members of the public. To the extent possible, toxicants, treated baits, and/or mammals lethally removed with fumigants or toxicants by WS will be collected and/or disposed of in accordance with label requirements to reduce risk of secondary toxicity to people who may be exposed to them or attempt to consume them. WS would utilize locking bait stations to restrict access of children to rodenticides such as anticoagulants. As appropriate, WS would use signage and other means of notification to ensure the public is aware of fumigant or toxicant applications or applications sites, to ensure people, including children, are not exposed.

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

Drugs used in capturing, sedating, handling, and euthanizing wildlife for wildlife management purposes include ketamine hydrochloride, a mixture of tiletamine and zolazepam (Telazol), xylazine (Rompun), sodium pentobarbital, potassium chloride, Yohimbine, antibiotics, and others. WS would adhere to all applicable requirements of the Animal Medicinal Drug Use Clarification Act (AMDUCA) to prevent any significant adverse impacts on human health with regard to this issue. Standard operating procedures for the use of drugs would include:

- All drugs used in capturing and handling wildlife would be under the direction and authority of state veterinary authorities, either directly or through procedures agreed upon between those authorities and WS. As determined on a state-level basis by these veterinary authorities (as allowed by AMDUCA), wildlife hazard management programs may choose to avoid capture and handling activities that utilize immobilizing drugs within a specified number of days prior to the hunting or trapping season for the target species to avoid release of animals that may be consumed by hunters prior to the end of established withdrawal periods for the particular drugs used. Animals that have been drugged and released would be ear tagged or otherwise marked to alert hunters and trappers that they should contact state officials before consuming the animal.

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

- Activities involving the handling and administering drugs, drugs selected for use, animal marking systems, and the fate of any animals that must receive drugs at times during or close to scheduled hunting seasons would be coordinated with the VDH and VFWD.

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

There are no known occurrences of adverse direct or indirect effects to human safety from WS' use of methods to alleviate mammal damage from FY 2003 through FY 2016. The risks to human safety from the use of nonlethal and lethal methods, when used appropriately and by trained personnel, are considered low. No adverse direct effects to human health and safety are expected through the use of live-capture traps and devices or other nonlethal methods. Since WS personnel are required to complete and maintain firearms safety training, no adverse direct effects to human health and safety are expected as a result of the misuse of firearms by WS personnel. Additionally, WS personnel are properly trained on the safe storage, transportation, and use of all chemicals handled and administered in the field, ensuring their safety as well as the safety of the public. Therefore, adverse direct effects to human health and safety from chemicals used by WS are anticipated to be very low. The amount of chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. No adverse indirect effects are anticipated from the application of any of the chemicals available for WS. WS does not anticipate any additional adverse cumulative impacts to human safety from the use of firearms when recommending that mammals be harvested during regulated hunting seasons to help alleviate damage.

Alternative 2 - Nonlethal Mammal Damage Management Only by WS

Under this alternative, WS would not use lethal MDM methods. Concerns about human health risks from WS' use of lethal mammal damage management methods would be alleviated because no such use would occur. However, most lethal methods would still be available to licensed pest control operators. Benefits to the public from WS' MDM activities will depend on the ability of WS to resolve problems using nonlethal methods and the effectiveness of non-WS MDM efforts. In situations where risks to human health and safety from mammals cannot be resolved using nonlethal methods, benefits to the public will depend on the efficacy of non-WS use of lethal MDM methods. If lethal MDM programs are implemented by individuals with less experience than WS, they may not be able to safely and effectively resolve the problem or it may take longer to resolve the problem than with a WS program.

Direct, Indirect, and Cumulative Effects:

Since most methods available to resolve or prevent mammal damage or threats are available to anyone, the direct, indirect, and cumulative effects to human safety from the use of those methods are similar between the alternatives. Private efforts to reduce or prevent damage would be expected to increase, and would likely result in less experienced persons implementing chemical or other damage management methods which may have variable adverse direct, indirect, and/or cumulative effects to human and pet 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 direct, indirect, and/or cumulative impacts to humans and pets.

Alternative 3 - No Mammal Damage Management Conducted by WS

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

Direct, Indirect, and Cumulative Effects:

Similar to Alternative 2, reproductive inhibitors, immobilizing drugs, and euthanasia chemicals would not be available under this alternative to those persons experiencing damage or threats from mammals unless proper training and certifications were obtained. However, fumigants, toxicants, and repellents would continue to be available to those persons with the appropriate pesticide applicators license. Since most methods available to resolve or prevent mammal damage or threats are available to anyone, the threats to human safety from the use of those methods are similar between the alternatives. Habitat modification and harassment methods are also generally regarded as posing minimal adverse direct and indirect effects to human safety. Although some risks to safety are likely to occur with the use of pyrotechnics, propane cannons, and exclusion devices, those risks are minimal when those methods are used appropriately and in consideration of human safety. However, methods employed by those not experienced in the use of methods or are not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

Issue 4 - Humaneness and Animal Welfare Concerns of Methods

The issues of method humaneness relating to the alternatives are discussed below.

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

Under the proposed action, WS would integrate methods using WS' Decision Model as part of technical assistance and direct operational assistance. Methods available under the proposed action could include nonlethal and lethal methods integrated into direct operational assistance. Under this alternative, nonlethal methods would be used by WS which are generally regarded as humane. Nonlethal methods would include resource management methods (e.g., crop selection, habitat modification, modification of human behavior), exclusion devices, frightening devices, reproductive inhibitors, nets, repellents and live capture traps for trap and translocation.

WS may use EPA registered and approved chemicals to manage damage caused by some mammals. Some individuals consider the use of such chemicals to be inhumane. WS personnel are experienced, professional, and humane in their use of management methods and always follow label directions. Under this alternative, mammals would be removed by experienced WS personnel using the best and most appropriate method(s) available.

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 terms such as killing, collecting, or harvesting, recognizing that a distress-free death may not be possible" (Beaver et al. 2001).

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 his or her 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 (e.g., 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."

Some are concerned about beaver that drown while restrained by foothold traps, and these people consider drowning inhumane. There is considerable debate and disagreement among animal interest groups, veterinarians, wildlife professionals, fur trappers, and nuisance wildlife control specialists on this issue. The debate centers on an uncertainty as to whether the drowning animals are rendered unconscious by high levels of carbon dioxide (CO2) and are thus insensitive to distress and pain (Ludders et al. 1999). The AVMA identifies drowning as an unacceptable method of euthanasia (Beaver et al. 2001), but provides no literature citations to support this position. Ludders et al. (1999) concluded drowning is not euthanasia based on the animals not dying from CO2 narcosis and reported CO2 narcosis does not occur until 95 millimeters of mercury in arterial blood is exceeded. Ludders et al. (1999) showed death during drowning is from hypoxia and anoxia, and thus animals experience hypoxemia; concluding that animals that drown are distressed because of stress related hormones, epinephrine and norepinephrine, and therefore drowning is not euthanasia.

Direct, Indirect, and Cumulative Effects:

The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. MDM methods viewed by some persons as inhumane would be employed by WS under this alternative. These methods would include shooting, trapping, toxicants/chemicals, and cable restraints. Despite SOPs and state trapping regulations designed to maximize humaneness, the perceived stress and trauma associated with being held in a trap or cable

restraint until the WS employee arrives at the capture site to dispatch or release the animal, is unacceptable to some persons. Other MDM methods used to remove target animals including shooting and use of body-gripping traps (i.e., conibear) result in a relatively humane death because the animals die instantly or within seconds to a few minutes. These methods however, are also considered inhumane by some individuals.

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 MDM methods are used in situations where nonlethal damage management methods are not practical or effective. No indirect or cumulative adverse impacts were identified for this issue.

Alternative 2 - Nonlethal Mammal Damage Management Only by WS

The issues of humaneness of methods under this alternative are likely to be perceived to be similar to humaneness issues discussed under the proposed action. This perceived similarity is derived from WS' recommendation of methods that some 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.

Direct, Indirect, and Cumulative Effects:

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

Alternative 3 - No Mammal Damage Management Conducted by WS

Under this alternative, WS would have no involvement in any aspect of MDM. Those persons experiencing damage or threats associated with mammals could continue to use those methods legally available. Those methods would likely be considered inhumane by those persons who would consider methods proposed under any alternative as inhumane. The issue of humaneness would likely be directly linked to the methods legally available to the general public since methods are often labeled as inhumane by segments of society no matter the entity employing those methods.

Direct, Indirect, and Cumulative Effects:

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

involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the general public to use to resolve damage and threats caused by mammals.

3.2 ISSUES NOT CONSIDERED FOR COMPARATIVE ANALYSIS

The following resource values 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 or labeled as such by USFWS and/or VFWD), visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. Therefore, these resources were not analyzed.

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

Appropriateness of Preparing an EA (Instead of an EIS) for Vermont

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 FONSI. This EA addresses impacts for managing damage and threats to human safety associated with mammals in Vermont to analyze individual and cumulative impacts, provide a thorough analysis of other issues relevant to MDM, and provides the public an opportunity to review and comment on the analysis and alternatives.

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 VFWD, 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 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.

WS' Impact on Biodiversity

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

A Loss Threshold Should Be Established Before Allowing Lethal Methods

One issue identified through WS' implementation of NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss can be tolerated by cooperators until it reaches a threshold where damage becomes an economic burden. That tolerance or threshold level before lethal methods are implemented would differ among cooperators and damage situations. In human health and safety situations establishing a threshold would be difficult or inappropriate because human lives and health could be at stake and attributing a cost to human life or health is unethical.

Mammal Damage Management Should Not Occur at Taxpayer Expense

Some individuals may believe that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based. Funding for MDM activities is derived from federal appropriations and through cooperative funding. Activities conducted for the management of damage and threats to human safety from mammals would be funded through CSAs with individual property owners or associations. A minimal federal appropriation is allotted for the maintenance of the WS program in Vermont. The remainder of the WS program is fee-based. Technical assistance is provided to requesters as part of the federally-funded activities, but the majority of direct assistance in which WS' employees perform damage management activities is funded through CSAs between the requester and WS.

Cost Effectiveness of Management Methods

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

Mammal Damage Should Be Managed By Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce mammal damage for property owners or property managers when deemed appropriate by the resource owner. Some property owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to enter into an agreement with a government agency. In particular, large industrial businesses, airports, and cities and towns may prefer to use WS because of security and safety issues. The relationship between WS and private industry is addressed in WS Directive 3.101.

Effects from the Use of Lead Ammunition in Firearms

Questions have arisen about the deposition of lead into the environment from ammunition used in firearms to lethally remove mammals. As described in Appendix B, the lethal removal of mammals with

firearms by WS to alleviate damage or threats would occur using a rifle, air rifle or shotgun. In an ecological risk assessment of lead shot exposure in non-waterfowl birds, ingestion of lead shot was identified as the concern rather than just contact with lead shot or lead leaching from shot in the environment (Kendall et al. 1996).

The lethal removal of mammals by WS using firearms occurs primarily from the use of rifles. However, the use of shotguns could be employed to lethally remove some species. Mammals that are removed using rifles would occur within areas where retrieval of all mammal carcasses for proper disposal is highly likely (*e.g.,* at an airport). With risks of lead exposure occurring primarily from ingestion of bullet fragments, the retrieval and proper disposal (WS Directive 2.515) of mammal carcasses will greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a mammal, if misses occur, or if the mammal carcass is not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns exist that lead from bullets deposited in soil from shooting activities could lead to contamination of water, 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%) (USEPA 2005). Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "*fall zones*" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot where it was believed the lead contamination was due to runoff from the parking lot, and not from the shooting range areas. The study also indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water further downstream (Stansley et al. 1992). Ingestion of lead shot, bullets or associated fragments is not considered a significant risk to fish and amphibians (The Wildlife Society 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 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 is only one of many sources of lead in the environment, including use of firearms for hunting and target shooting, lost fishing sinkers (an approximated 3,977 metric tons of lead fishing sinkers are sold in the United States annually; The Wildlife Society 2008), and airborne emissions from metals industries (such as lead smelters and iron and steel production), manufacturing industries, and waste incineration that can settle into soil and water (USEPA 2013). Since the lethal removal of mammals can occur during regulated hunting seasons or through the issuance of permits by the VFWD. WS' assistance with removing mammals would not be additive to the environmental status quo since those mammals removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement. The amount of lead deposited into the environment may be lowered by WS' involvement in MDM activities. The proficiency training received by WS' employees in firearm use and accuracy increases the likelihood that mammals are lethally removed humanely in situations that ensure accuracy and that misses occur infrequently which further reduces the potential for lead to be deposited in the soil from misses or from projectiles passing

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

Effects of Mammal Damage Management Activities on the Regulated Harvest of Mammals

Another issue commonly identified is a concern that mammal damage management activities conducted by WS would affect the opportunity for persons to harvest those species during the regulated hunting and trapping seasons either by reducing local populations through the lethal removal of mammals or by reducing the number of mammals present in an area through dispersal techniques. Those species that are addressed in this EA that also can be hunted or trapped during regulated seasons in Vermont include: beaver, black bear, bobcat, Eastern cottontail, coyote, fisher, red fox, gray fox, gray squirrel, red squirrel, weasels, mink, moose, muskrat, porcupines, raccoons, river otter, snowshoe hare, striped skunk, Virginia opossums and white-tailed deer.

Potential impacts could arise from the use of nonlethal or lethal damage management methods. Nonlethal methods used to reduce or alleviate damage, reduce mammal densities by dispersing animals from areas where damage or the threat of damage is occurring. Similarly, lethal methods used to reduce damage could locally lower target species densities in areas where damage is occurring, resulting in a reduction in the availability of those species during the regulated harvest season. WS' MDM activities would primarily be conducted in areas where hunting access is restricted (*e.g.,* airports, urban areas) or hunting has been ineffective. The use of nonlethal or lethal methods often disperses mammals from areas where damage is occurring to areas outside the damage area which could serve to move those mammal species from those less accessible areas to places more accessible to hunters and trappers. In addition, in appropriate situations, WS commonly recommends recreational hunting and trapping as a damage management alternative for many of the species listed in this EA.

Effects of Beaver Dam Removal on the Status of Wetlands

Beaver dam removal during activities to manage damage caused by beaver sometimes occurs in areas inundated by water resulting from flooding. Beaver build dams primarily in smaller riverine systems (intermittent and perennial streams and creeks). Dam material usually consists of mud, sticks, and other vegetative material. Their dams obstruct the normal flow of water and can change the preexisting hydrology from flowing or circulating waters to slower, deeper, more expansive waters that accumulate bottom sediment. The depth of the bottom sediment depends on the length of time an area is covered by water and the amount of suspended sediment in the water.

Beaver dams, over time, can result in the establishment of new wetlands. The regulatory definition of a wetland stated by the USACE and the EPA (40 CFR 232.2) is "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

If a beaver dam is not removed and water is allowed to stand, hydric soils and hydrophytic vegetation eventually form. This process can take anywhere from several months to many 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 are met, then a wetland has developed that would have different wildlife habitat values than an area that has been more recently impounded by beaver dam activity.

The intent of most dam removal operations is not to drain old established wetlands. With few exceptions, requests received by WS to remove beaver dams have involved the removal of the dam to return an area to the condition that existed before the dam had been built, or before it had been affecting the area for more than a few years. WS' beaver damage management activities are primarily conducted to address damage to agricultural crops, timber resources, public property such as roads and bridges, and water management structures. Beaver dam removal activities would primarily be conducted on small watershed streams, tributary drainages, and ditches. Those activities could be described as small, exclusive projects conducted to restore water flow through previously existing channels.

In the majority of instances, beaver dam removal would be accomplished by manual methods (*i.e.,* hand tools). WS' personnel do not utilize heavy equipment, such as excavators or backhoes, for beaver dam removal. Only the portion of the dam blocking the stream or ditch channel would be breached. In some instances, WS' activities involve the installation of structures to manage water levels at the site of a breached beaver dam.

If the area does not have hydric soils, it usually takes many years for them to develop and a wetland to become established; this often takes greater than five years as indicated by the Swampbuster provision of the Food Security Act. Most beaver dam removal by WS would be allowed under exemptions stated in 33 CFR parts 323 and 330 of Section 404 of the Clean Water Act or parts 3821 and 3822 of the Food Security Act. However, the removal of some beaver dams could trigger certain portions of Section 404 that require landowners to obtain permits in compliance with Articles 15 and 24 from the USACE prior to removing a blockage. WS' personnel determine the proper course of action upon inspecting a beaver dam impoundment.

3.3 SUMMARY OF IMPACTS

No significant cumulative environmental impacts are expected from any of the three Alternatives. Under the Proposed Action, the lethal removal of mammals by WS would not have significant impacts on overall native mammal populations, but some short-term local reductions may occur. Some efforts to reduce damage caused by non-native species could result in elimination of the species from local areas or the state (*e.g.*, feral swine). No risk to public safety is expected when WS' programs are provided and accepted by requesting individuals in Alternative 1 since only trained and experienced wildlife biologists/specialists would conduct and recommend MDM activities. There is a slight increased risk to public safety when persons who reject WS assistance and recommendations in Alternatives 1 and 2 conduct their own MDM activities, and when no WS assistance is provided as in Alternative 3. In all three Alternatives, however, the increase in risk would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS's participation in MDM activities on public and private lands, the analysis in this EA indicates that WS Integrated MDM program will not result in significant cumulative adverse impacts on the quality of the human environment.

Summary of Potential Impacts

Issue	Alternative 1 Integrated Mammal Damage Management Program (Proposed Action/No Action)	Alternative 2 Nonlethal MDM Only by WS	Alternative 3 No Federal WS MDM Program
1. Target Mammal Species Effects	Low effect - reductions in local target mammal numbers; would not significantly affect local or state native populations.	No effect by WS. Low effect - reductions in local target mammal numbers by non-WS personnel variable but likely would not significantly affect local or state populations.	No effect by WS. Low effect - reductions in local target mammal numbers by non-WS personnel variable but likely would not significantly affect local or state populations.
2. Effects on Other Wildlife Species, Including T&E Species	Low effect - methods used by WS would be highly selective with very little risk to nontarget species. WS would provide operational assistance with T&E species protection.	Low effect - methods used by WS would be highly selective with very little risk to nontarget species. WS only able to provide limited operational assistance with T&E species protection.	No effect by WS. Impacts by non-WS personnel would be variable. WS would not provide operational assistance with T&E species protection.

3. Human Health and Safety Effects	The proposed action has the greatest potential of successfully reducing this risk. Low risk from methods used by WS.	Low risk of injuries from methods used by WS. WS less likely to resolve risks associated with animals than with Alt 2. Efforts by non-WS personnel to use lethal MDM techniques could result in less experienced persons implementing control methods, a greater risk of injuries and greater potential of not reducing mammal damage than under the proposed action.	Efforts by non-WS personnel to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater risk of injuries and greater potential of not reducing mammal damage than under the proposed action.
4. Humaneness and Animal Welfare Concerns of Methods Used	Impact by WS low to moderate effect due to the use of BMPs and scientifically proven methods- methods viewed by some people as inhumane would be used by WS.	Impact by WS Lower effect than Alt. 2 since only nonlethal methods would be used by WS. Impacts by non-WS personnel would be variable.	No effect by WS. Impacts by non-WS personnel would be variable.

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APPENDIX A: LITERATURE CITED

ABC. 2011. Domestic cat predation on birds and other wildlife. http://www.abcbirds.org/abcprograms/policy/cats/materials/CatPredation2011.pdf. Accessed July 23, 2012.

Allen, S. H., and A. B. Sargeant. 1993. Dispersal patterns of red foxes relative to population density. J. Wildl. Manage. 57:526-533.

Apa, A. D., D. W. Uresk, and R. L. Linder. 1991. Impacts of Black-tailed Prairie Dog Rodenticides on Nontarget Passerines. In Great Basin Naturalist 51(4), 1991, pp. 301- 309.

Armitage, K. B. 2003. Marmots. Pages 188-210 in Wild mammals of North America: biology,management, and conservation. Edited by G. A. Feldhammer, B. C. Thompson, and J. A. Chapman. 2nd edition. The John Hopkins University Press, Baltimore, MD. 1216pp.

AVMA (American Veterinary Medical Association). 1987. Journal of the American Veterinary Medical Association. Panel Report on the Colloquium on Recognition and Alleviation of Animal Pain and Distress. 191:1186-1189.

AVMA. 2013. AVMA guidelines on euthanasia. American Veterinary Medical Association. <https://www.avma.org/KB/Policies/Documents/euthanasia.pdf>. Accessed on 27 February 2017.

Balser, D. S., D. H. Dill, and H. K. Nelson. 1968. Effect of predator reduction on waterfowl nesting success. J. Wildl. Manage. 32:669-682.

Barrows, P. L. 2004. Professional, ethical, and legal dilemmas of trap-neuter-release. Journal of the American Veterinary Medical Association 225:1365–1369.

Beach, R. 1993. Depredation problems involving feral pigs. Pages 67-75 in C.W. Hanselka and J. F. Cadenhead (eds.) Feral Swine: A Compendium for Resource Managers. Texas Agricultural Extension Service, San Angelo.

Beasley, J. C. and O. E. Rhodes Jr. 2008. Relationship between raccoon abundance and crop damage. Human-Wildlife Conflicts 2(2):248-259.

Beran, G. W. 1994. Handbook of zoonoses. Boca Raton, FL, CRC Press 1,168.

Beringer, J., L. P. Hansen, J. A. Demand, J. Sartwell, M. Wallendorf, and R. Mange. 2002. Efficacy of translocation to control urban deer in Missouri: costs, efficiency, and outcome. Wildlife Society Bulletin 30:767-774.

Berryman, J. H. 1991. Animal damage management: responsibilities of various agencies and the need for coordination and support. Proceedings of the Eastern Wildlife Damage Control Conference 5:12-14.

Bevan, D. J., K. P. Chandroo, and R. D. Moccia. 2002. Predator control in commercial aquaculture in Canada. http://www.aps.uoguelph.ca/aquacentre/files/miscfactsheets/Predator%20Control%20in%20Commercial%20Aquaculture%20in%20Canada.pdf. Accessed March 29, 2012.

Boggess, E. K. 1994. Raccoons. Pp C101-107 in S. E. Hygnstrom, R. M. Timm and G. E. Larson, Eds., Prevention and Control of Wildlife Damage. Univ. Nebr. Coop. Ext., USDA-APHIS-ADC, and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Burt, W. H., and R. P. Grossenheider. 1980. Peterson Field Guides: the Mammals, North America north of Mexico. Third Edition. Houghton Mifflin Company, New York.

California Department of Fish and Game. 1991. California Department of Fish and Game. Final environmental document - bear hunting. Sections 265, 365, 366, 367, 367.5. Title 14 Calif. Code of Regs. Calif. Dept. of Fish and Game, State of California, April 25, 1991. 13p.

California Food Emergency Response Team. 2007. Investigation of an Escherichia coli O157:H7 outbreak associated with Dole pre-packaged spinach. California Department of Health Services, Food and Drug Branch, Sacramento, CA.

Camenzind, F.J. 1978. Behavioral ecology of coyotes on the National Elk Refuge, Jackson Wyoming. Pp 267-294 *in* M. Bekoff, ed. Coyotes: biology, behavior and management. Academic Press, New York, New York.

Campbell, T. A. and D. B. Long. 2009. Feral swine damage and damage management in forested ecosystems. Forest Ecology and Management 257:2319-2326.

Castillo, D., AND A. L. Clarke. 2003. Trap/neuter/release methods ineffective in controlling domestic cat "colonies" on public lands. Natural Areas Journal 23:247–253.

CDC. 2011. Parasites – Baylisascaris infection. <http://www.cdc.gov/parasites/baylisascaris/>. Accessed 24 February 2017.

CDC. 2015. Tularemia. Information obtained at website: http://www.cdc.gov/tularemia/

CDC. 2015. Lyme Disease. Information obtained at website: https://www.cdc.gov/lyme/

CDC. 2016. Tularemia, Map of reported Cases. <http://www.cdc.gov/tularemia/statistics/index.html>. Accessed 14 February 2017.

CDFG (California Department of Fish and Game). 1991. California Department of Fish and Game. Final Environmental Document - bear hunting. Sections 265, 365, 367, 367.5. Title 14 Calif. Code of Regs. Calif. Dept. of Fish and Game, State of California, April 25, 1991. 13pp.

Census of Agriculture 2012, State Data Table 8. https://agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_2_US_State_Level/st99_2_008_008.pdf

Clark, F.W. 1972. Influence of jackrabbit density on coyote population change. Journal of Wildlife Management 36:343-356.

Cleary, E. C., S. E. Wright, and R. A. Dolbeer. 2000. Wildlife strikes to civil aircraft in the United States 1990-1999 U.S. Department of Transportation, Federal Aviation Admin. Ser. Rep. No.4. Washington, D.C. 61p.

Cleary, E. C. and R. A. Dolbeer. 2005. Wildlife Hazard Management at Airports: a Manual for Airport Personnel. 2nd edition. Federal Aviation Administration, Office of Airport Safety and Standards, Washington, D.C. (in press)

Coleman, J. S., S. A. Temple, and S. R. Craven. 1997. Facts on cats and wildlife: A conservation dilemma. University of Wisconsin, Cooperative Extension Publications, Madison, Wisconsin. http://m.extension.illinois.edu/wildlife/files/cats_and_wildlife.pdf. Accessed July 23, 2012.

Connolly, G.E. 1992. Coyote damage to livestock and other resources. Pp 161-169 *in* A.H. Boer, ed. Ecology and management of the eastern coyote. Wildlife Research Unit. University of New Brunswick, Fredericton, New Brunswick, Canada.

Connolly, G.E., and W.M. Longhurst. 1975. The effects of control on coyote populations. Univ. Calif., Div. Agric. Sci. Bull. 1872. 37 pp.

Conover, M.R. 1982. Comparison of two behavioral techniques to reduce bird damage to blueberries: Methiocarb and hawk-kite predator model. *Wildl. Soc. Bull*., 10,211-216.

Conover, M. R. 2002. Resolving human-wildlife conflicts: The science of wildlife damage management. Lewis Publishers, Washington, DC. 418 pp.

Conover, M. R., W. C. Pitt, K. K. Kessler, T. J. Dubow, and W. A. Sanborn. 1995. Review of human injuries, illnesses and economic-based losses caused by wildlife in the United States. Wildlife Society Bulletin 23:407-414

Corn, J. L., P. K. Swiderek, B. O. Blackburn, G. A. Erickson, A. B. Thiermann, and V. F. Nettles. 1986. Survey of selected diseases in wild swine in Texas. Journal of the American Veterinary Medical Association 189: 1029-1032.

Craig, J. R., J. D. Rimsstidt, C. A. Bonnaffon, T. K. Collins, and P. F. Scanlon. 1999. Surface water transport of lead at a shooting range. Bull. Environ. Contam. Toxicol. 63:312-319.

Craven, S. R. 1994. Cottontail rabbits. Pages D75-D80 in S. E. Hygnstrom, R.M. Timm, and G.E. Larson eds. Prevention and control of wildlife damage. Univer. of Nebraska Press, Lincoln, Nebraska, USA

Craven, S. R. and S. E. Hygnstrom. 1994. Deer. Pp D-25-40 in S. E. Hygnstrom, R. M. Timm and G. E. Larson, Eds., *Prevention and Control of Wildlife Damage*. Univ. Nebr. Coop. Ext., USDA-APHIS-ADC, and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Craven, S., T. Barnes, and G. Kania. 1998. Toward a professional position on the translocation of problem

wildlife. Wildlife Society Bulletin 26:171-177.

Crum, J.M. 2003. Non-seasonal mortality white-tailed deer. West Virginia Division of Natural Resources. http://www.wvdnr.gov/Hunting/DeerNSeasMortal.shtm. Accessed April 6, 2012.

Davidson, W. R. and V. F. Nettles. 2006. Field manual of wildlife diseases in the southeastern United States. 3rd ed. The Univ. of Georgia, Athens, Georgia. 448pp.

Decker, D. J. and G. R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder, Colorado, 424 p..

Decker, D. J., and K. G. Purdy. 1988. Toward a concept of wildlife acceptance capacity in wildlife management. Wildlife Society Bulletin 16:53-57.

Decker, D. J., and L. C. Chase. 1997. Human dimensions of living with wildlife – a management challenge for the 21st century. Wildlife Society Bulletin 25:788-795.

Deisch, M. S., D. W. Uresk, R. L. Linder. 1989. Effects of two prairie dog rodenticides on grounddwelling invertebrates in western South Dakota. Pages 166-170 in Ninth Great Plains wildlife damage control workshop proceedings. USDA Forest Service General Technical Report RM-171. 181 pp.

Deisch, M. S. 1986. The effects of three rodenticides on nontarget small mammals and invertebrates. Thesis, South Dakota State University, Brookings, South Dakota.

Deisch, M. S., D. W. Uresk, and R. L. Linder. 1990. Effects of prairie dog rodenticides on deer mice in western South Dakota. Great Basin Naturalist 50:347-353.

DeVault, T. L.,B. J. MacGowan, J. C. Beasley, L. A. Humberg, M. I. Retamosa, and O. E. Rhodes, Jr. 2007. Evaluation of corn and soybean damage by wildlife in northern Indiana. Pp. 563-570 In Proc. 12th Wildlife Damage Management Conference. Corpus Christi, TX.

Dolbeer, R.A. 1998. Population dynamics: the foundation of wildlife damage management for the 21st century. Proceedings from the 18th Vertebrate Pest Conference, Davis, CA, 2-11pp.

Dolbeer, R. A., S. E. Wright, J. Weller, and M. J. Beiger. 2012. Wildlife Strikes to Civil Aircraft in the United States, 1990–2010. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report No. 17, Washington, D.C..

Dolbeer, R. A., S. E. Wright, J. Weller, and M. J. Begier. 2013. Wildlife Strikes to civil aircraft in the United States 1990–2012, Serial report 19. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Washington, D.C., USA.

Dolbeer, R.A., S.E. Wright, J. R. Weller, A.L. Anderson and M.J. Beiger. 2015. Wildlife Strikes to Civil Aircraft in the United States, 1990–2014. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report No. 21, Washington, D.C., USA.

Dolbeer, R. A., J.R. Weller, A.L. Anderson and M. J. Begier. 2016. Wildlife Strikes to Civil Aircraft in the United States, 1990–2015. U.S. Department of Transportation, Federal Aviation Administration, Office of Airport Safety and Standards, Serial Report No. 22, Washington, DC, USA.

Dubey, J. P. 1973. Feline toxoplasmosis and coccidiosis: a survey of domiciled and stray cats. J. Amer. Vet. Med. Assoc. 162(10): 873-877.

Dubey, J. P. 1986. A review of toxoplasmosis in pigs. Vet Parsitol 19:181-223.

Evans, J. 1970. About nutria and their control. USDI, Bureau of Sport Fisheries and Wildlife, Resource Publication 86.

Federal Aviation Administration (FAA). 2016. FAA National Wildlife Strike Database. <http://wildlife.faa.gov/default.aspx>. Accessed 3 February 2017.

Federal Aviation Administration (FAA). 2018. Airport Data. Information obtained at website: https://www.faa.gov/airports/airport_safety/airportdata_5010/menu/#datadownloads.

Federal Emergency Management Agency. 2005. Dam Owner's Guide to Animal Impacts on Earthen Dams. FEMA L-264.

Feng, Y., K. A. Alderisio, W. Yang, L. A. Blancero, W. G. Kuhne, C. A. Nadareski, M. Reid, and L. Xiao. 2007. Crytosporidium Genotypes in Wildlife from a New York Watershed. Applied and Environmental Microbiology 73(20): 6475-6483.

Fernandez, S. 2008. Ticked off: Deer, Lyme Disease connected? Greenwich Post. September 4, 2008.

Fitzgerald, B. M., W. B. Johnson, C. M. King, and P. J. Moors. 1984. Research on Mustelids and cats in New Zealand. WRLG Res. Review No. 3. Wildl. Res. Liaison Group, Wellington. 22 pp.

Fowler, M. E. and R. E. Miller. 1999. Zoo and Wild Animal Medicine. W.B. Saunders Co., Philadelphia, PA.

Gardner, A. L. 1982. Virginia opossum. Pp 3-36 in J. A. Chapman and G. A. Feldhamer, Eds., *Wild mammals of North America: biology, management, and economics*. Johns Hopkins Univ. Press, Baltimore, Maryland. 1147 pp.

George, W. G. 1974. Domestic cats as predators and factors in winter shortages of raptor prey. Wilson Bulletin 86:384-396.

Gerhold, R. W. and D. A. Jessup. 2012. Zoonotic diseases associated with free roaming cats. Zoonosis and Public Health. 60 (3): 189-195.

Godin, A. 1977. Wild mammals of New England. The Johns Hopkins University Press, Baltimore, MD. 304 pp.

Greenhall, A. M. and S. C. Frantz. 1994. Bats. Pp D5-24 in S. E. Hygnstrom, R. M. Timm and G. E. Larson, Eds.,

Prevention and Control of Wildlife Damage. Univ. Nebr. Coop. Ext., USDA-APHIS-ADC, and Great Plains Agricutural Council Wildlife Resources Committee, Lincoln, Nebraska.

Greenwood, R. J. 1986. Influence of striped skunk removal on upland duck nest success in North Dakota. Wildl. Soc. Bull. 14:6-11.

Griffith, B., J. M. Scott, J. W. Carpenter, and C. Reed. 1989. Translocation as a species conservation tool: status and strategy. Science 245:477-480.

Grizzell, Jr., R. A. 1955. A study of the southern woodchuck, *Marmota monax monax*. American Midland Naturalist 53:257-93.

Hardin, G. 1986. Cultural carrying capacity: a biological approach to human problems. Bioscience. 36(9):599-606.

Hegdal, P. L. and T. A. Gatz. 1977. Hazards to pheasants and cottontail rabbits associated with zinc phosphide baiting for microtine rodents in orchards. Unpubl. report, Denver Wildlife Research Center.

Hegdal, P. L., T. A. Gatz, and E. C. Fite. 1980. Secondary effects of rodenticides on mammalian predators, p. 1781-1793. In Worldwide Furbearer Conf. Proceedings, Vol. Ill (J.A. Chapman and D. Pursley, eds.) [Frostburg, Md., Aug. 3-11, 1980] 2056 p.

Harris, S. 1977. Distribution, habitat utilization and age structure of a suburban fox (Vulpes vulpes) population. Mammal Rev. 7: 25-39.

Harris, S, and J. M. V. Rayner. 1986. Urban fox (Vulpes vulpes) population estimates and habitat requirements in several British cities. J. Anim. Ecol. 55:575–591.

Harrison, D. J., J. A. Bissonette, and J. A. Sherburne. 1989. Spatial Relationships between Coyotes and Red Foxes in Eastern Maine. The Journal of Wildlife Management. 53(1):181-185.

Henry, S., 2003. Biosecurity, control and eradication strategies of PRRS and Aujesky's disease. National Institute for American Agriculture Annual Meeting.

Hill, E. F. and J. W. Carpenter. 1982. Response of Siberian ferrets to secondary zinc phosphide poisoning. J. Wildl. Manage. 46(3).

Hoagland, J.W. 1993. Nuisance Beaver Damage Control Proposal. Okla. Dept. Wildl. Cons. Internal Document. 20 pp.

Hutton, T., DeLiberto, T., Owen, S., and Morrison, B. 2006. Disease Risks Associated with Increasing Feral Swine Numbers and Distribution in the United States. Midwest Association of Fish and Wildlife Agencies Wildlife and Fish Health Committee.

Jessup, D. A. 2004. The welfare of feral cats and wildlife. Journal of the American Veterinary Medical Association 225:1377-1383.

Johnson, G. D. and K. A. Fagerstone. 1994. Primary and secondary hazards of zinc phosphide to nontarget

wildlife - a review of the literature. USDA/APHIS/DWRC Research Report No. 11- 55-005.

Johnson, M.R., R.G. McLean, and D. Slate. 2001. Field Operations Manual for the Use of Immobilizing and Euthanizing Drugs. USDA, APHIS, WS Operational Support Staff, Riverdale, Maryland, USA.

Kaller, M. D., J. D. Hudson, III., E. C. Achberger, and W. E. Kelso. 2007. Feral hog research in western Louisiana: expanding populations and unforeseen consequences. Human-Wildlife Conflicts 1:168-177.

Kendall, C., S. R. Silva, C. C. Y. Chang, D. A. Burns, D. H. Campbell, and J. B. Shanley. 1996. Use of the d18O and d15N of nitrate to determine sources of nitrate in early spring runoff in forested catchments. IAEA, Symposium on Isotopes in Water Resources Management, Vienna, Austria, 20-24 March, 1995, 1:167-176.

Kennedy, M. L., J. P. Nelson, Jr., F. W. Weckerly, D. W. Sugg, and J. C. Stroh. 1991. An assessment of selected forest factors and lake level in raccoon management. Wildlife Society Bulletin 19:151-154.

Knowlton, F.F. 1972. Preliminary interpretations of coyote population mechanics with some management implications. Journal of Wildlife Management 36:369-383.

Kreeger, T. J., and J. M. Arnemo. 2012. Handbook of wildlife chemical immobilization: 4th edition. 448p.

Laidlaw, M. A. S., H. W. Mielke, G. M. Filippelli, D. L. Johnson, and C. R. Gonzales. 2005. Seasonality and children's blood lead levels: Developing a predictive model using climatic variables and blood lead data from Indianapolis, Indiana, Syracuse, New York, and New Orleans, Louisiana (USA) Environ Health Perspect 113793–800.800doi:10.1289/ehp.7759.

Latham, R. M. 1960. Bounties are bunk. Nat. Wildl. Federation, Wash., D.C. 10 pp.

Leopold, A. S. 1933. Game Management. Charles Scribner & Sons, New York, NY. 481p.

Levy, J.K. and P.C. Crawford. 2004. Humane strategies for controlling feral cat populations. Journal of American Veterinary Medical Association 225:1354-1360.

Lindsey, N. P., J. A. Lehman, J. E. Staples, and M. Fischer. 2014. West Nile Virus and other arboviral diseases – United States, 2013. Morbidity and Mortality Weekly Report 63:521-533.

Linnell, M. A., M. R. Conover, T. J. Ohashi. 1996. Analysis of bird strikes at a tropical airport. J. Wildl. Manage. 60:935-945.

Loss, S.R., T. Will, and P. P. Marra. 2015. Direct Mortality of Birds from Anthropogenic Causes. Annual Review of Ecology Evolution, and Systematics. 46:99-120.

MacArdle, J.J. 1996. Vermont. Pages 162-163 *in* Vermont Agency of Natural Resources, Dept. of Environmental Conservation, Water Quailty Division, Vermont 1996 305(b) Report. Waterbury, VT.

MacDonald, D. W., and M. T. Newdick. 1982. The distribution and ecology of fox, *Vulpes vulpes* (L.), in urban areas. Pages 123–135 in R. Bornkamm, J. A. Lee, and M. R. D. Seaward, Eds., *Urban ecology*. Blackwell Sci. Publ., Oxford, U.K.

Majumdar, S. K., J. E. Huffman, F. J. Brenner, and A. I. Panah. 2005. Wildlife Diseases: Landscape Epidemiology, Spatial Distribution and Utilization of Remote Sensing Technology. The Pennsylvania Academy of Sciences.

Mallis, A. 1982. Handbook of pest control, 6th edition. Franzak & Foster Co., Cleveland. 1101p.

Marchland, M. N., J. A. Litvaitis, T. J. Maier, and R. M DeGraff. 2002. Use of artificial nests to investigate predation on freshwater turtle nests. Wildlife Society Bulletin Vol. 30(4) 1092-1098.

Melvin, S. M, L. H. MacIvor, and C. R. Griffin. 1992. Predator exclosures: a technique to reduce predation at piping plover nests. Wildlife Society Bulletin, 20L 143+148.

Messmer, T. A., M. R. Conover, R. D. Dueser, P. W. Klimack, and C. E. Dixon. 1997. A landowner's guide to common North American predators of upland nesting birds. Berryman Institute Publication No.13, Utah State Univ. Logan.24 pp.

Merriam, H.G. 1971. Woodchuck burrow distribution and related movement patterns. Journal of Mammalogy 52:732-46.

Merritt, J. F. 1987. Guide to the mammals of Pennsylvania. University of Pittsburgh Press. Pittsburgh, PA. 408pp.

Miller, R. S., et al. (2013). "Diseases at the livestock–wildlife interface: status, challenges, and opportunities in the United States." Preventive Veterinary Medicine 110(2): 119-132.

Miller, J. E. and G. K. Yarrow. 1994. S.E. Hygnstrom, R.M. Timm and G.E. Larson, eds., Prevention and Control of Wildlife Damage. Univ. Nebr. Coop. Ext., USDA-APHIS-ADC, and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Moore, G. C. and G. R. Parker. 1992. Colonizaton by the eastern coyote (Canis latrans) Pages 23-37 in A. H. Boer, ed., Ecology and management of the eastern coyote.

Mosillo, M., E. J. Heske, and J. D. Thompson. 1999. Survival and Movements of Translocated Raccoons in Northcentral Illinois. The Journal of Wildlife Management 63(1):278-286.

Mott, M. 2004. U.S. faces growing feral cat problem. *National Geographic News.* online [URL]: http://news.nationalgeographic.com/news/2004/09/0907_040907_feralcats.html

Musante, R, A., K. Pedersen and P. Hall. First Report of Pseudorabies and Winter Ticks Associated with an Emerging Feral Swine Population in New Hampshire.

NASS. 2007. http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=VERMONT

(NASS) National Agricultural Statistics Service. 2011. Cattle death loss 2010. Released May 12, 2011. USDA, National Agricultural Statistics Service, Washington, DC. <http://usda.mannlib.cornell.edu/usda/current/CattDeath/CattDeath-05-12-2011.pdf >. Accessed 25 September 2013.

NASS (National Agricultural Statistics Service). 2012 Vermont Agricultural Statistics Report. Information obtained at website: http://www.nass.usda.gov/Statistics_by_State/New_England_includes/Publications/Special_Reports/maple13.pdf

National Audubon Society. 2000. Field guide to North American mammals. J. O. Whitaker, Jr., ed. Indiana State Univ. Alfred A. Knopf, New York, N.Y. 937pp.

National Biological Survey. 1990. Symposium: Managing predation to increase production of wetland birds. 15-17 August 1990, Jamestown, North Dakota. Abstracts. Northern Prairie Wildlife Research Center, North Dakota Chapter of the Wildlife Society, North Dakota Game and Fish Department, U.S. Fish and Wildlife Service Region 3, U.S. Fish and Wildlife Service Region 6, Ducks Unlimited. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/birds/symabs/index.htm

Novak, M., J. A. Baker, M. E. Obbard, B. Mallock. 1987. Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150 pp.

NPPC. 2018 (National Pork Production Council). http://nppc.org/pork-facts/

Parker, G. 1995. Eastern coyote: The story of its success. Nimbus Publishing, Halifax, Canada.

Pearson, O. P. 1964. Carnivore-mouse predation: an example of its intensity and bioenergetics. Journal of Mammalogy 45:177–188.

Pedersen, K., 2013 Bevins, S., Baroch, A. J., Cumbee Jr. C. J., Chandler, C. S., Woodruff, S. B., Bigelow, T. T., and. DeLiberto, J. T. Pseudorabies in Feral Swine in the United States, 2009–2012. Journal of Wildlife Diseases 2013 49:3, 709-713

Phillips, R. L. 1970. Age ratio of Iowa foxes. J. Wildl. Manage. 34:52-56.

Phillips, R. L., and R. H. Schmidt. 1994. Fox. Pp C-83-88 in S.E. Hygnstrom, R.M. Timm and G.E. Larson, eds., Prevention and Control of Wildlife Damage. Univ. Nebr. Coop. Ext., USDA-APHIS-ADC, and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Pyrah, D. 1984. Social distribution and population estimates of coyotes in north-central Minnesota. Journal of Wildlife Management 48:679-690.

Ramey, C. A., J. B. Bourassa, and J. E. Brooks. 2000. Potential risks to ring-necked pheasants in California agricultural areas using zinc phosphide. Int. Biodeter. Biodegrad. 45:223-230.

Robinson, M. 1996. The Potential for Significant Financial Loss Resulting from Bird Strikes in or Around an Airport. Proceedings and Papers. International Bird Strike Committee (IBSC) meeting no. 23, May 1996. London, U.K.: IBSC, 1996. 353-367.

Rosatte, R. C. 1987. Skunks. Pp. 599-613 in M. Novak, J. A. Baker, M.E. Obbard, B. Mallock, eds., Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150 pp.

Roseberry, J. L., and A. Woolf. 1998. Habitat-population density relationships for white-tailed deer in Illinois. Wildlife Society Bulletin 26:252-258.

Saliki, J. T., S. J. Rodgers, and G. Eskew. 1998. Serosurvey of selected viral and bacterial diseases in wild swine from Oklahoma. Journal of Wildlife Diseases 34: 834-838.

Sanderson, G.C. 1987. Raccoons. Pages 486-499 in M. Novak, J. A. Baker, M.E. Obbard, B. Mallock, eds., Wild Furbearer Management and Conservation in North America. Ministry of Natural Resources, Ontario, Canada. 1150 pp.

Schmidt, R. 1989. Wildlife management and animal welfare. Trans. N.Amer. Wildl. And Nat. Res. Conf. 54:468-475.

Seidensticker, J., M. A. O'Connell, and A. J. T. Johnsingh. 1987. Virginia Opossum. Pages 247-261 in M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, eds. Wild Furbearer Management and Conservation in North America. Ontario Ministry of Natural Resour., Ontario Trappers Assoc., North Bay.

Slate, D.A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife management. Trans. N. A. Wildl. Nat. Res. Conf 57:51-62.

Slate, D. 1980. A study of New Jersey raccoon populations— determination of the densities, dynamics and incidence of disease in raccoon populations in New Jersey. N.J. Div. Fish, Game, and Wildl., Pittman-Robertson Proj. W-52-R-8, Final Rep. 67pp.

Slater, M.R. 2004. Understanding issues and solutions for unowned, free-roaming cat populations. Journal of the American Veterinary Medical Association 225:1350-1354.

Speake, D.W. 1980. Predation on wild turkeys in Alabama. In Proc. Fourth Natl. Wild Turkey Symp. 4:86-101.

Speake, L. H. Barwick, H. O. Hillestad, and W. Stickney. 1969. Some characteristics of an expanding turkey population. In Proc. Annu. Conf. SE Assoc. Fish and Wildl. Agencies 23:46-58.

Speake, L. H., R. Metzler, and J. McGlincy. 1985. Mortality of wild turkey poults in Northern Alabama. J. Wildl. Manage. 49:472-474.

Stansley, W., L. Widjeskog, and D. E. Roscoe. 1992. Lead contamination and mobility in surface water at trap and skeet ranges. Bulletin of Environmental Contamination and Toxicology 49:640-647.

Stevens, R. L. 1996. The feral hog in Oklahoma. Ardmore, Okla: Samuel Roberts Noble Foundation.

Stoskopf, M.K., and F. B. Nutter. 2004. Analyzing approaches to feral cat management-one size does not fit all. JAVMA 225:1361-1364.

Sweeney, J. R., J. M. Sweeney, and S. W. Sweeney. 2003. Feral hog. Pages 1164-1179 in Wild mammals of North America: biology, management, and conservation. Edited by G. A. Feldhammer, B.C. Thompson, and J. A. Chapman. 2nd edition. The John Hopkins University Press, Baltimore, MD. 1216pp.

Swihart, R. K. 1992. Home-range attributes and spatial structure of woodchuck populations. Journal of Mammalogy 73:604-18.

Teutsch, S. M., D. D. Juranek, A. Sulzer, J. P. Dubey, R. K. Sikes. 1979. Epidemic toxoplasmosis associated with infected cats. N. Engl. J. Med. 300(13): 695-699.

The Wildlife Society and American Fisheries Society. 2008. Sources and implications of lead ammunition and fishing tackle on natural resources. Technical Review 08-01. June 2008. 68p.

The Wildlife Society. 2010. Final Position Statement: Wildlife Damage Management. The Wildlife Society. Bethesda, MD. 2p.

The Wildlife Society. 2010. Final position statement: wildlife damage management. The Wildlife Society, Bethesda, Maryland, USA.

Thorpe, J. 1996. Fatalities and Destroyed Civil Aircraft due to Bird Strikes, 1912-1995. Proceedings of the Bird Strike Committee Europe 23:17-31.

Tietjen, H. P., and G. H. Matschke. 1982. Aerial prebaiting for management of prairie dogs with zinc phosphide. Journal of Wildlife Management 46:1108-1112.

Tietjen, H. P. 1976. Zinc phosphide – its development as a control agent for black-tailed prairie dogs. U.S. Fish and Wildlife Service, Special Report on Wildlife 195.

Tilghman, N.G. 1989. Impacts of white-tailed deer on forest regeneration in northwestern Pennsylvania. Journal of Wildlife Management 53:524-532.

Trautman, C. G., L. F. Fredrickson, and A. V. Carter. 1974. Relationship of red foxes and other predators to populations of ring-necked pheasants and other prey, South Dakota. In Trans. North Am. Wildl. Nat. Resour. Conf. 39:241-252.

Twichell, A. R. 1939. Notes on the southern woodchuck in Missouri. Journal of Mammalogy 20:71-74.

Twichell, A. R., and H. H. Dill. 1949. One hundred raccoons from one hundred and two acres. Journal of Mammalogy 30:130–133.

Uresk , D. W., R. M. King, A. D. Apa, M. S. Deisch, and R. L. Linder. 1988. Rodenticidal effects of zinc phosphide and strychnine on nontarget species. Eighth Great Plains wildlife damage control workshop proceedings, Rapid City, South Dakota, 28-30 April 1987. USDA Forest Service General Technical Report RM-154.

U.S. Census of Agriculture. 2012. State Agriculture Overview and Preliminary Report U.S. and State Data, February 2014 http://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=VERMONT

USDA. 2001. Environmental Assessment: Oral Vaccination to Control Specific Rabies Virus Variants in

Raccoons, Gray Fox, and Coyotes in the United States. USDA, APHIS, WS, 4700 River Road, Unit 87, Room 2D05, Riverdale, Maryland 20782.

USDA. 2005a. Environmental Assessment: Reducing Mammal Damage through an Integrated Wildlife Damage Management Program in the State of New Hampshire. USDA/APHIS/WS, 59 Chenell Drive, Suite 7, Concord, New Hampshire 03301

USDA. 2006*a*. Environmental Assessment: Mammal Damage Management in Vermont. USDA/APHIS/ Wildlife Services, Concord, New Hampshire.

USDA (U.S. Department of Agriculture). 2008. Wildlife Services Program Safety Review. USDA, Animal and Plant Health Inspection Service, Wildlife Services, Washington, D.C. http://www.aphis.usda.gov/wildlife_damage/nwrc/Safety_Review/content/WS_Safety_Review08.pdf

USDA. 2009*b*. Info sheet: PRRS seroprevalence on U.S. swine operations. United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Centers for Epidemiology and Animal Health, Fort Collins, Colorado. 2 pp.

USDA. 2009*c*. Summary Report: 2007 National Resources Inventory, National Resources Conservation Services, Washington, DC, and Center for statistics and Methodology, Iowa State University, Ames, Iowa. 123 pp.

USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Wildlife Services. 2010. Environmental Assessment (EA) and decision/finding of no significant impact (FONSI) - Oral vaccination to control specific rabies virus variants in raccoons, gray foxes, and coyotes in the United States. USDA, APHIS, Wildlife Services, 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

USDA (U.S. Department of Agriculture), Animal and Plant health Inspection Service (APHIS), Wildlife Services. 2012. Environmental Assessment (EA) and decision/finding of no significant impact (FONSI) – Field trial of an experimental rabies vaccine, human adenovirus type 5 vector in New Hampshire, New York, Ohio, Vermont, and West Virginia. USDA, APHIS, Wildlife Services. 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

USDA. 2012. Environmental Assessment Feral Swine Damage Management in New York. United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services. Retrieved from http://www.aphis.usda.gov/regulations/pdfs/nepa/NY_Feral_Swine_EA_website_DRAFT.pdf

USDA. 2013. Environmental Assessment: Feral Swine Damage Management in New York. USDA, APHIS, WS. 572 Third Ave. Extension Suite 2, Rensselaer, NY 12144.

USDA (U.S. Department of Agriculture), Animal and Plant health Inspection Service (APHIS), Wildlife Services. 2013. Supplement to the Environmental Assessment (EA) and decision/finding of no significant impact (FONSI) – Field trial of an experimental rabies vaccine, human adenovirus type 5 vector in New Hampshire, New York, Ohio, Vermont, and West Virginia. USDA, APHIS, Wildlife Services. 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

USDA. 2015*a*. Environmental Assessment: White-tailed Deer Damage Management in New York. USDA, APHIS, WS. 572 Third Ave. Extension Suite 2, Rensselaer, NY 12144.

USDA. 2015*b*. Final Environmental Impact Statement: Feral Swine Damage Management: A National Approach. USDS, APHIS, WS. 4700 River Road, Unit 87, Riverdale, MD 20737.

USDI. 1979. Mammalian predator damage management for livestock protection in the Western United States. Final Environmental Impact Statement. Washington, D.C. 789 pp.

USDI (U.S. Department of the Interior), and U.S. Department of Commerce and U.S. Census Bureau. 2011. 2011 National survey of fishing, hunting and wildlife-associated recreation. http://www.census.gov/prod/2012pubs/fhw11-nat.pdf

United States Environmental Protection Agency (USEPA). 2005. Ecological soil screening levels for lead – Interim final. OSWER Directive 9285.7-70. USEPA Office of Solid Waste and Emergency Response. 242p. <https://www.epa.gov/sites/production/files/documents/epa_bmp.pdf>.

USEPA. 2013. Integrated Science Assessment for lead, EPA/600/R-10/075F, Office of Research and Development, National Center for Environmental Assessment, Research Triangle Park, NC, June 2013.

United States Fish and Wildlife Service (USFWS). 2001. Inside Region 3: Ohio man to pay more than $11,000 for poisoning migratory birds. Volume 4(2):5.

USFWS. 2007. National Bald Eagle Management Guidelines.

USFWS. 2009. Final Environmental Assessment: Proposal to Permit Take as Provided Under the Bald and Golden eagle Protection Act.

U.S. Food and Drug Administration (FDA). 2003. Bird poisoning of federally protected birds. Office of Criminal Investigations. Enforcement Story 2003.

VanDruff , L. W. 1971. The ecology of the raccoon and opossum, with emphasis on their role as waterfowl nest predators. Ph.D. Thesis. Cornell University, Ithaca, New York. 140 pp.

VDH, 2017. Vermont Department of Health, Immunizations & Infectious Disease. http://www.healthvermont.gov/disease-control/mosquito-borne-diseases/west-nile-virus

Verts, B. J. 1963. Movements and populations of opossums in a cultivated area. Journal of Wildlife Management 27:127129.

VFWD. 2013. Vermont Furbearer Management Newsletter. Volume 12, Issue 1. http://www.vtfishandwildlife.com/common/pages/DisplayFile.aspx?itemId=111106 Springfield, VT.

VFWD. 2017 Vermont White-tailed Deer FAQs. http://www.vtfishandwildlife.com/cms/One.aspx?portalId=73163&pageId=165614#Vermont's Deer Herd Health

VTDEC (Vermont Dept. of Environmental Conservation). 1999. Wetlands Fact Sheet 1. Vermont Dept. of Environmental Conservation, Waterbury, VT. 4pp.

Wade, D. E. and C. W. Ramsey. 1986. Identifying and managing mammals in Texas: beaver, nutria and muskrat. Texas Agriculture Extension Service and Texas A&M University in cooperation with United States Department of the Interior-USFWS. Pub. B-1556. 46p.

Wagner, K. K., R. H. Schmidt, and M. R. Conover. 1997. Compensation Programs for Wildlife Damage in North America. USDA National Wildlife Research Center - Staff Publications. Paper 829.

West, B. C., A. L. Cooper, and J. B. Armstrong. 2009. Managing wild pigs: A technical guide. Human-Wildlife Interactions Monograph 1:1-55.

Whitaker, Jr., J.O., and W.L.J. Hamilton, Jr. 1998. Mammals of the Eastern United States. Cornell University Press, Ithaca, New York. 583 pp.

White, D. H., L. E. Hayes, and P. B. Bush. 1989. Case histories of wild birds killed intentionally with famphur in Georgia and West Virginia. Journal of Wildlife Diseases 25:144-188.

White-tailed deer harvest report, 2016. Vermont Fish and Wildlife Department, http://www.vtfishandwildlife.com/library/Reports_and_Documents/Hunting_and_Trapping/Harvest_Reports/2016_White-tailed_Deer_Harvest_Report.pdf

Winter, L. 2004. Trap-neuter-release programs: the reality and the impacts. Journal of the American Veterinary Medical Association 225:1369-1376.

Wiseman G. L., and G. O. Hendrickson. 1950. Notes on the life history of the opossum in southeast Iowa. Journal of Mammalogy 31:331-337.

Witmer, G. W., R. B. sanders, and A. C. Taft. 2003. Feral swine-Are they a disease threat to livestock in the United States? Pages 316-325 *in* K. A. Fagerstone, and G. W. Witmer editors. Proceedings of the 10th Wildlife Damage Management Conference. (April 6-9, 2003, Hot Springs, Arkansas). The Wildlife Damage Management Working Group of The Wildlife Society, Fort Collins, Colorado.

Witmer, G. W., R. B. Sanders, AND A. C. Taft. 2003. Feral swine--are they a disease threat to livestock in the United States? Pages 316-325 in K. A. Fagerstone, and G. W. Witmer editors. Proceedings of the 10th Wildlife Damage Management Conference. (April 6-9, 2003, Hot Springs, Arkansas). The Wildlife Damage Management Working Group of The Wildlife Society, Fort Collins, Colorado, USA. 146K

Woodward, D. K., 1983. Beaver management in the southeastern United States: a review and update. In Proceedings for the Eastern Wildlife Damage Control Conference 1:163-165.

Workman, D. (2019, March 1). Pork Exports by Country. Retrieved from http://www.worldstopexports.com/pork-exports-by-country/

WS Directive, 2.101, 2.105, 2.501 and 2.61, http://www.aphis.usda.gov/wildlife_damage/ws_directives.shtml .

Yeates, J. 2010. Death is a welfare issue. J Agric Environ Ethics 2010; 23:229-241.

Yeates, J. 2010. Ethical aspects of euthanasia of owned animals. In Practice 32(2):70-73.

APPENDIX B: METHODS AVAILABLE for RESOLVING or PREVENTING MAMMAL DAMAGE in the STATE of VERMONT

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

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

A variety of methods are potentially available to the WS program relative to the management or reduction of damage from mammals. Various federal, state, and local statutes and regulations and WS Directives govern WS' use of damage management tools and substances. WS develops and recommends or implements IWDM strategies based on resource management, physical exclusion, and wildlife management approaches. Within each approach there may be available a number of specific methods or tactics. The following methods and materials may be recommended or used in technical assistance and direct damage management efforts of the WS program.

Non-Chemical Mammal Damage Management Methods

Non-chemical management methods consist primarily of tools or devices used to repel, capture or kill a particular animal or local population of wildlife to alleviate damage and conflicts. Methods may be nonlethal (*e.g.*, fencing, frightening devices, etc.) or lethal (*e.g.*, firearms, body gripping traps, cable restraints, etc.). If WS personnel apply these methods on private lands, a Work Initiation Document or similar document must be signed by the landowner or administrator authorizing the use of each damage management method. Non-chemical methods used or recommended by WS include:

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

Cultural methods and habitat management includes the application of practices which seek to minimize exposure of the protected resource to damaging animals through processes other than exclusion. They may include animal husbandry practices such as employing guard dogs, herders, shed lambing, carcass removal, or pasture selection. Strategies may also include minimizing cover where damaging mammals might hide, manipulating the surrounding environment through barriers to deter animals from entering a protected area, or planting lure crops on fringes of protected crops. Lure crops/alternate foods are crops planted or other food resources provided to mitigate the potential loss of higher value crops. Removal of trees from around buildings can sometimes reduce damage associated with raccoons.

Some mammals which cause damage in urban environments are attracted to homes by the presence of garbage, pet food or birdseed that is outside and unprotected. Removal or sealing of garbage in tight trash receptacles and elimination of all pet foods from outside areas can reduce the presence of unwanted mammals.

Animal behavior modification refers to tactics that deter or repel damaging mammals and thus, reduce damage to the protected resource. These techniques are usually aimed at causing target animals to respond by fleeing from the site or remaining at a distance. They usually employ extreme noise or visual stimuli. Unfortunately, many of these techniques are only effective for a short time before wildlife habituate to them (Conover 1982). Devices used to modify behavior in mammals include:

- electronic guards (siren strobe-light devices)
- propane exploders
- pyrotechnics, shell crackers
- laser lights
- human effigies
- harassment/shooting into groups
- bean bag rounds, rubber bullets/shot

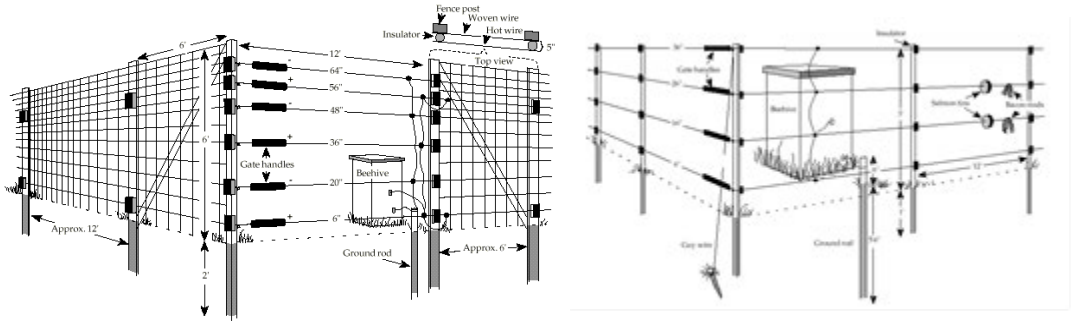
Electric Fencing and Maintenance

Electric fencing has proven effective in deterring a wide variety of mammal species. Bears have been dissuaded from landfills, trash dumpsters, apiaries, cabins, and other high-value properties. Electric fencing has also been effective in reducing crop damage from deer and also discouraging raccoons from depredating on T&E species. Fencing, however, can be an expensive abatement measure. When developing a damage prevention program, consideration is given to the extent, duration, and expense of damage in relation to the expense of using fencing. Numerous fence designs have been used with varying degrees of success. Electric fence chargers increase effectiveness.

To energize the fences, a 110-volt outlet or 12-volt deep cell (marine) battery is connected to a high-output fence charger. The fence charger and battery should be protected against weather and theft. Warning signs should be used to protect human safety. Electric fences must deliver an effective shock to repel the mammal that is interested in a particular resource. Animals can be lured into licking or sniffing the wire by attaching attractants to the fence, such as peanut butter, which is effective in attracting such species as bear, deer, and raccoons.

Fence voltage should be checked each week at a distance from the fence charger; it should yield at least 3,000 volts. To protect against voltage loss, the battery and fence charger should be kept dry and their connections free of corrosion. Make certain all connections are secure and check for faulty insulators (arcing between wire and post). Also clip vegetation beneath the fence. Each month, check the fence tension and replace baits or lures as necessary. Always recharge the batteries during the day so that the fence is energized at night.

Below are two common examples of electric fences used for bears. Electric fences for other species would be very similar with their overall height and wire spacing varying depending on the species that is causing the conflict.



(Figure C-1)

Beaver dam removal may be recommended or executed by WS. Dam removal can only be conducted after receiving an Article 24 wetland permit from NYSDEC. Removing beaver dams not only restores natural hydrology, but it also often alleviates the damage associated with flooding, which may impact roads and private property. The specific tools to remove beaver dams may include hand tools, heavy machinery, or binary explosives.

Paintball guns are used as a non-lethal harassment method to disperse birds from areas using physical harassment. Paintballs are most often used to harass waterfowl. Paintballs can be used to produce physically and visually negative-reinforcing stimuli that can aid in the dispersement of birds from areas where damages or threats of damages are occurring.

Conducted Electrical Weapons (CEW), such as Tasers, are being used by some wildlife agencies throughout the country as a form of aversive conditioning to mitigate human-bear conflicts as well as other mammal related incidents. CEW's deliver electrical pulses with high voltage but low amperage electricity, much like an electric fence. It causes involuntary muscle contractions that inhibits neuromuscular control or temporarily incapacitates the target, but does not affect the central nervous system.

Live capture and relocation can be accomplished through the use of cage traps, species specific traps, live cable restraints, nets, foothold traps, and other methods to capture some species of mammals for the purpose of translocating them for release to wild sites. However, there are exceptions for the relocation of damaging mammals that might be a viable solution, such as when the mammals are considered to have high value such as T&E species. Under the right conditions, relocating wildlife can be a viable and effective wildlife management technique (Craven et al. 1998). WS-VT would only relocate wildlife at the direction of and only after consulting with the USFWS

and/or VFWD to coordinate capture, transportation, and selection of suitable relocation sites, as well as compliance with all proper guidelines.

Trapping can utilize a number of devices, including footholds, species specific traps, cage-type traps, body gripping (conibear) traps, snaps traps, and glue traps. These techniques are implemented by WS personnel because of the technical training required to use such devices.

Foothold traps can be effectively used to capture a variety of mammals. Foothold traps are either placed beside, or in some situations, in travel ways being actively used by the target species. Placement of traps is contingent upon the habits of the respective target species, habitat conditions, and presence of nontarget animals. Effective trap placement and adjustment and the use and placement of appropriate baits and lures by trained WS personnel also contribute to the foothold trap's selectivity. The animal is captured when downward pressure (activated by the animal's foot) triggers the spring loaded jaws to clamps shut. An additional advantage is that foothold traps can allow for the on-site release of nontarget animals. The use of foothold traps requires more skill than some methods, but they are indispensable in resolving many damage problems.

Species specific traps (*e.g.*, Dog-proof traps) can be effectively used specifically to capture raccoons and skunks. Species specific traps are either placed beside travel ways or foraging areas being actively used by the animal. These types of traps require bait to be placed inside the trap and the animal is required to reach in with its paw in an attempt to access the bait resulting in capture.

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

Body-grip traps (*e.g.*, Conibear-type) are designed to cause the quick death of the animal that activates the trap. Placement is at travel corridors or burrow entrances created or used by the target species. The animal is captured as it travels through the trap and activates the triggering mechanism. Safety hazards and risks to humans are usually related to setting, placing, checking, or removing the traps. There is also a small risk to nontarget/domestic species. To minimize nontarget trapping, precautionary signage is placed at trapping locations to make aware those that pass by and thoughtful trapping placement/techniques are practiced.

Hancock traps (*e.g.*, suitcase/basket-type) are designed to live-capture beaver. This type of trap is constructed of a metal frame covered in chain-link fence that is hinged with springs. Trap appearance is similar to a large suitcase when closed. When set, the trap is opened to allow an animal to enter, and when tripped the sides close around the animal.

Colony traps are multi-catch traps used to either live-capture or drown muskrats. There are various types of colony traps. One common type of colony trap consists of a cylindrical tube of wire mesh with a one-way door on each end (Novak 1987). Colony traps are set at entrances to muskrat burrows or placed in muskrat travel lanes.

Sherman box traps are small live traps used to capture small mammals such as rodents. These traps are often made of galvanized steel or aluminum and fold up for easy transport. Sherman

box traps also consist of a treadle towards the back of the trap that triggers the door to close behind the animal being trapped.

Cable restraints are traps made of light cable with a locking device, and are used to catch small and medium sized mammals. The cable is placed in the path of an animal in the form of a loop. When the target species walks into the snare the loop becomes smaller in size, holding the animal as if it were on a leash. When used as a live capture device, cable restraints are equipped with integrated stops that permit snaring, but do not choke the animal and allows nontargets such as white-tailed deer to release itself.

Bow nets are small circular net traps used to live capture raptors and small/medium sized mammals. 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 it triggered by an observer using a pull cord.

Hand nets are used to catch small mammals in confined areas such as homes and businesses. These nets resemble fishing dip nets with the exception that they are larger and have long handles

Catch poles are devices that allow animals to be restrained while keeping them a safe distance away. The device consists of a noose that is usually plastic coated cable at the end of a long pole. The operator of the pole can place the noose over the head and around the neck of an animal and tighten the noose to prevent the animal's escape.

Net guns are devices that project a net over a target animal using a specialized gun.

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. Rocket netting is normally used for birds and larger mammal species such as deer but can be used to capture other mammal species.

Snap traps are similar to body-grip traps in that they are designed to cause the quick death of the animal that activates the trap. Placement is along travel corridors or they may be baited. The animal is captured as crosses over the triggering mechanism or while it feeds on the bait. Snap traps are small, designed for mice and rats, and safety hazards and risks to humans are usually low and are related to setting, placing, checking, or removing the traps.

Glue traps also called glue boards or sticky traps are designed to capture mice and rats that cross over them in an extremely sticky glue. Placement is along travel corridors used by the target species. They do not cause a quick death of the animal trapped which generally die from dehydration and may be considered inhumane if they are not checked regularly. Therefore WS would continue to employ the SOPs of checking frequently when setting glue traps. Trapped animals should be humanely euthanized or released (the glue can be deactivated with vegetable oil) immediately after capture.

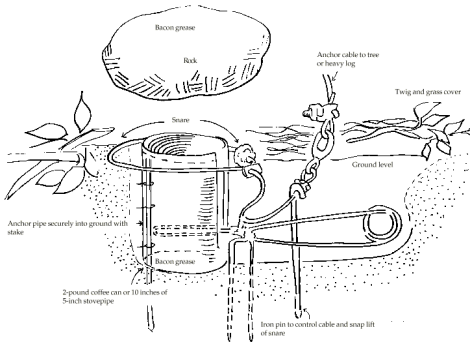
Shooting is selective for target species and may involve the use of spotlights and either a handgun, shotgun, rifle, or air rifle. Shooting is an effective method to remove a small number of mammals in damage situations, especially where trapping is not feasible. Removal of specific animals in the problem area can sometimes provide immediate relief from a problem. Shooting is sometimes utilized as one of the first lethal damage management options because it offers the potential of

resolving a problem more quickly and selectively than some other methods, but it is not always effective. Shooting may sometimes be one of the only damage management options available if other factors preclude setting of damage management equipment. WS personnel receive firearms safety training to use firearms that are necessary for performing their duties. Shooting may also require the use of artificial light, night vision and Forward Looking Infrared equipment when conducted at night.

Cervical dislocation is sometimes used to euthanize small rodents which are captured in live traps and when relocation is not a feasible option. The animal is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. When done properly, the AVMA approves this technique as humane method of euthanasia and states that cervical dislocation is a humane technique for euthanasia of small rodents (Beaver et al. 2001). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al. 2001).

Culvert traps have been used by wildlife managers to safely capture wild bears at least since the 1950's (Erickson 1957, Black 1958). The trap itself rarely injures the animal and trap mortality is rare (Erickson 1957). Occasionally, nontarget animals are caught in culvert traps, such as raccoons, fisher, and domestic dogs (*Canis familiaris*). Nontarget animals would be released unharmed.

Foot snares are spring activated (i.e., Aldrich-type) foot snares (Figure C-3) that would be used in situations that preclude the use of culvert traps. Foot snares are a safe and effective capture device when properly set and inspected (Miller et al 1973, Johnson and Pelton 1980). Bears captured in this manner can be tranquilized, released, relocated, or destroyed. WS uses bait as described previously to attract bears to foot snare sets.



(Figure C-2)

Hunting/Trapping is sometimes recommended by WS for resource owners to consider as an option for reducing mammal damage. Although legal hunting/trapping is impractical and/or prohibited in many urban-suburban areas, it can be used to reduce some populations of mammals.

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

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

Trail Cameras are used in wildlife surveillance and to monitor traps. They are remotely activated and equipped with a motion sensor or an infrared sensor, or may use a light beam as a trigger. Cameras types vary with models available to check activity either manually or through cellular/wireless technology.

Chemical Mammal Damage Management Methods

All chemicals used by WS are registered by the EPA (under FIFRA) and NYSDEC Division of Materials Management. WS personnel that use restricted-use chemical methods are certified as pesticide applicators by the Division of Materials Management and are required to adhere to all certification requirements set forth in FIFRA and VAAFM and regulations and have specific training by WS for MDM pesticide application. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner/manager. Pharmaceutical drugs, including those used in wildlife capture and handling, are administrated by FDA and/or DEA.

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

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

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions.

Telazol (tiletamine) is another anesthetic used in wildlife capture. It is two-and-a-half to five times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine

can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telezol produces extensive muscle tension in dogs, but produces a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for these wild species (Fowler and Miller 1999).

BAM is a combination of Butorphanol tartrate, Azaperone tartrate, and Medetomidine hydrochloride used for a broad range of species. BAM provides smooth induction times, as well as quick reversal times. BAM is potent in small volume quantities, which make it effective for immobilizing wildlife remotely by a dart. Animals that are administered BAM have superior muscle relaxation and a good anesthetic plane which facilitates handling and data collection.

Medetomidine (Medetomidine HCI) is an alpha-2 adrenergic agonist with sedative and analgesic properties. Medetomidine calms the animal and provides pain relief. Medetomidine is routinely used in combination with ketamine or tiletamine-zolazepam, and when the combinations are administered produce an animal that is very manageable and in a good state of analgesia. Medetomidine sedative effects can be reversed by yohimbine, tolazoline, or atipamezole.

Atipamezole (Atipamezole HCL) is an alpha-2 antagonist used to reverse the sedative effects of medetomidine and xylazine. Absorption of atipamezole is rapid which produces quick recovery times. Atipamezole typically reverses the sedative effect of medetomidine in 5-10 minutes. Atipamezole is highly selective which minimizes undesirable effects.

Naltrexone (Naltrexone HCL) is an antagonism of any opiate sedation in any species. High doses of naltrexone are an effective tool in reducing or preventing renarcotization. Naltrexone is a pure opioid antagonists, therefore it has a high therapeutic indices.

Tolazoline (Tolazoline HCL) is a combination alpha-1 and alpha-2 antagonist used to reverse the sedative effects of xylazine. Tolazoline works well on white-tailed deer, black-tailed deer, mule deer, moose, and blackbuck antelope. Reversal is quick typically within two minutes.

Yohimbine (Yohimbine HCL) is an alpha-2 antagonist used to reverse the sedative effects of xylazine. Yohimbine quickly reverses the sedative effects of xylazine, typically 2-10 minutes. Additionally, cardiac side effects such as arrhythmia and bradycardia are reverse with yohimbine. Yohimbine is effective on a variety of carnivores and hoofstock, but not cervids.

Sodium pentobarbital with local anesthetic additives combines pentobarbital with another substance to hasten cardiac arrest. Specific drugs in this category include Beuthanasia –D Special® and Euthasol®. Sodium pentobarbital is a barbituric acid derivative, which are generally the preferred method to euthanize animals and work on almost all species and size of animals (Kreeger and Arnemo 2012). Intravenous and intracardiac are the only acceptable routes of injection. As with pure sodium pentobarbital, IC injections are only acceptable for animals that are unconscious or deeply anesthetized. With other injection routes, there are concerns that the cardiotoxic properties may cause cardiac arrest before the animal is fully unconscious.

Potassium chloride, a common laboratory chemical, is injected by WS personnel as a euthanizing agent after an animal has been anesthetized.

Gas cartridges are incendiary devices composed of carbon and sodium nitrate. When ignited and placed in the target animal's burrow, the resultant carbon monoxide and other gases cause asphyxiation. The only risks to nontarget species are risks to rodents and other species found in burrows with the target species. WS will not use gas cartridges in areas where state and federally listed species may be in burrows with the target animal.

Anticoagulant Rodent Baits could be used in bait stations in and around airport structures. The use and proper placement of bait stations will minimize the likelihood that the bait will be consumed by nontarget species. There may also be secondary hazards from anticoagulant baits. These risks are reduced somewhat by the fact that the predator scavenger species will usually need exposure to multiple carcasses over a period of days. Areas where anticoagulants are used will be monitored and carcasses picked up and disposed of in accordance with label directions. Risks to scavengers are also minimized by continual efforts to reduce overall wildlife activity at the airport. As already stated, WS would consult with VFWD before applying rodenticides at airports in order to confirm that no state-listed threatened or endangered rodents would be harmed in the process.

Zinc Phosphide is a toxicant used to kill rodents, lagomorphs and nutria. In Vermont, this pesticide will not be used on species that are protected, including T&E species. It is two to 15 times more toxic to rodents than to carnivores (Hill and Carpenter 1982). Secondary risks appear to be minimal to predators and scavengers that scavenge carcasses of animals killed with zinc phosphide (Hill and Carpenter 1982, Tietjen 1976, Hegdal and Gatz 1977, Hegdal et al. 1980, and Johnson and Fagerstone 1994). This is because: 1) 90% of the zinc phosphide ingested by rodents is detoxified in the digestive tract (Matschke unpubl. as cited in Hegdal et al. 1980), 2) 99% of the zinc phosphide residues occur in the digestive tracts, with none occurring in the muscle, 3) the amount of zinc phosphide required to kill target rodents is not enough to kill most other predatory animals that consume prairie dog tissue (Johnson and Fagerstone 1994).

Use of zinc phosphide on various types of fruit, vegetable, or cereal baits (*e.g.,* apples, carrots, sweet potatoes, oats, and barley) has proven to be effective at suppressing nutria populations. All chemicals used by WS are registered under FIFRA and administered by EPA and the NYSDEC Division of Materials Management. Zinc phosphide is federally registered for use by APHIS/WS. Specific bait applications are designed to minimize nontarget hazards (Evans 1970). WS-NY personnel that use chemical methods are certified as pesticide applicators by the Division of Materials Management and are required to adhere to all certification requirements set forth in FIFRA and VAAFM and regulations. No chemicals are used on federal or private lands without authorization from the land management agency or property owner/manager.

In addition, zinc phosphide has a strong emetic action (*i.e.,* causes vomiting) and most nontarget animals in research tests regurgitated bait or tissues contaminated with zinc phosphide without succumbing to the toxicant (Hegdal and Gatz 1977, Hegdal et al. 1980, Johnson and Fagerstone 1994). Furthermore, predators tend to eviscerate zinc phosphide-poisoned rodents before eating them or otherwise avoid the digestive tract and generally do not eat the stomach and intestines (Hegdal et al. 1980, Johnson and Fagerstone 1994). Although zinc phosphide baits have a strong, pungent, phosphorous-like odor (garlic like), this characteristic seems to attract rodents, particularly rats, and apparently makes the bait unattractive to some other animals. Many birds appear capable of distinguishing treated from untreated baits and they prefer untreated grain when given a choice (Siefried 1968, Johnson and Fagerstone 1994). Birds appear particularly susceptible to the emetic effects of zinc phosphide, which would tend to offer an extra degree of protection against bird species dying from zinc phosphide grain bait consumption or, for scavenging bird species, from eating poisoned rodents. Use of rolled oats instead of whole grain also appears to reduce bird acceptance of bait. Uresk et al. (1988) reported on the effects of zinc phosphide on six nontarget rodent populations. They determined that no differences were observed from pretreatment until after treatment in populations of Eastern cottontail rabbits (*Sylvilagus floridanus*) and white-tailed jackrabbits (*Lepus townsendii*). However, primary consumption of bait by nontarget wildlife can occur and potentially cause mortality. Uresk et al. (1988) reported a 79% reduction in deer mouse (*Peromyscus maniculatus*) populations in areas treated with zinc phosphide, however the effect was not statistically significant because of high variability in densities and the reduction was not long-term (Deisch et al. 1990).

Ramey et al. (2000) reported that five weeks after treatment, no ring-necked pheasants (*Phasianus colchicus*) had been killed as a result of zinc phosphide baiting. In addition, Hegdal and Gatz (1977) determined that zinc phosphide did not affect nontarget populations and more radio-tracked animals were killed by predators than died from zinc phosphide intoxication (Hegdal and Gatz 1977, Ramey et al. 2000). Tietjen (1976) observed horned larks (*Eremophila alpestris*) and mourning doves (*Zenaida macroura*) on zinc phosphide-treated prairie dog colonies, but observations after treatment did not locate any sick or dead birds, a finding similar to Apa et al. (1991). Uresk et al. (1988) reported that ground feeding birds showed no difference in numbers between control and treated sites. Apa et al. (1991) further states that zinc phosphide was not consumed by horned larks because: 1) poison grain remaining for their consumption was low (*i.e.,* bait was accepted by prairie dogs before larks could consume it), 2) birds have an aversion to black-colored foods, and 3) birds have a negative sensory response to zinc phosphide. Reduced impacts on birds have also been reported by Tietjen and Matschke (1982). Deisch et al. (1989) reported on the effect zinc phosphide has on invertebrates. They determined that zinc phosphide bait reduced ant densities, however, spider mites, crickets, wolf spiders, ground beetles, darkling beetles and dung beetles were not affected. Wolf spiders and ground beetles showed increases after one year on zinc phosphide treated areas (Desich 1986). Generally, direct long-term impacts from rodenticide treatments were minimal for the insect populations sampled (Deisch et al. 1989).

Long-term effects were not directly related to rodenticides, but more to habitat changes (Deisch 1986) as vegetative cover and prey diversity increased without prairie dogs grazing and clipping the vegetation (Deisch et al. 1989).

Carbon Dioxide (CO_2) is sometimes used to euthanize mammals which are captured in live traps and when relocation is not a feasible option. Live mammals are placed in a sealed chamber. CO_2 gas is released into the chamber and the animal quickly dies after inhaling the gas. This method is approved as a euthanizing agent by the AVMA. CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

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

APPENDIX C: FEDERALLY LISTED THREATENED and ENDANGERED SPECIES

USFWS Listing of Threatened and Endangered Species in Vermont

Listed species -- 5 listings

Summary of Animals -- 3 listings

Summary of Plants -- 2 listings

Chapter 2 Animals -- 3 listings

Status	Species/Listing Name
E	Bat, Indiana Wherever found (*Myotis sodalis*)
T	Bat, Northern long-eared Wherever found (*Myotis septentrionalis*)
E	Wedgemussel, dwarf Wherever found (*Alasmidonta heterodon*)

Chapter 3 Plants -- 2 listings

Status	Species/Listing Name
E	Bulrush, Northeastern (*Scirpus ancistrochaetus*)
E	Milk-vetch, Jesup's (*Astragalus robbinsii var. jesupi*)

Notes:

- **As of 02/13/2015 the data in this report has been updated to use a different set of information. Results are based on where the species is believed to or known to occur. The FWS feels utilizing this data set is a better representation of species occurrence. Note: there may be other federally listed species that are not currently known or expected to occur in this state but are covered by the ESA wherever they are found; Thus if new surveys detected them in this state they are still covered by the ESA. The FWS is using the best information available on this date to generate this list.**
- This report shows listed species or populations believed to or known to occur in Vermont
- This list does not include experimental populations and similarity of appearance listings.
- This list includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.
- Click on the highlighted scientific names below to view a Species Profile for each listing.

Obtained from the USFWS website on 12/28/2017 at

https://ecos.fws.gov/ecp0/reports/species-listed-by-state-report?state=VT&status=listed

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
Maine Field Office
306 Hatchery Road
East Orland, Maine 04431
Telephone: 207/469-7300 Fax: 207/902-1588

April 27, 2018

Robin Dyer
State Director
USDA, APHIS, Wildlife Services
79 Leighton Road, Suite 12
Augusta, Maine 04330

Dear Ms. Dyer:

This document transmits the U.S. Fish and Wildlife Service's (Service) programmatic biological opinion (PBO) based on our review of the referenced project and its effects on the federally listed threatened Canada lynx *(Lynx canadensis)* and the federally listed endangered Atlantic salmon *(Salmo salar)* and their respective designated critical habitat in accordance with section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). Your request for formal consultation was received in August 22, 2018.

This Opinion is based on information provided in the biological assessment, telephone conversations, field investigations, and other sources of information. The consultation history is located after the Literature Cited. A complete administrative record of this consultation is on file in this office.

The Service determined the proposed action will have no effect on designated critical habitat for Canada lynx because proposed activities will not impact any primary constituent elements of critical habitat.

The Service also determined the proposed actions are not likely to adversely affect the federally listed endangered Atlantic salmon *(Salmo salar)* or its designated critical habitat. To date, the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) in Maine has not caused take to individual Atlantic salmon through application of any methods utilized for mammal damage management (MDM). The majority of MDM conducted by the WS does not occur in suitable Atlantic salmon habitat. The MDM activities associated with the beaver damage management program and activities to alleviate damage caused by other semiaquatic mammals such as mink, muskrats, and river otters would be the only MDM methods that could have the potential to affect Atlantic salmon. Avoidance of Atlantic salmon during the MDM activities will be achieved by determining if the area where the MDM activities will occur contained existing Atlantic salmon populations, or if the time of year precluded Atlantic salmon presence. In areas of known existing Atlantic salmon populations, the WS will incorporate all regulation and recommendations established by state wildlife agencies and the Service as well as

standard operating procedures (SOPs) established by the WS to avoid incidental take of Atlantic salmon. When the MDM includes trapping, the WS will also follow best management practices (BMPs) developed by the Association of Fish and Wildlife Agencies (AFWA) for trapping devices (AFWA 2006).

Proposed activities affecting key components of critical habitat, such as removal of beaver dams, will be temporary and result in only insignificant effects. Though the intensity and duration of the effects associated with turbidity and sedimentation result in measured changes of habitat preference by Atlantic salmon and sublethal effects to juvenile Atlantic salmon, but they do not have residual effects on the habitat function. Turbidity releases will be temporary and within the natural seasonal fluctuations in streams, and are not expected to affect Atlantic salmon redds and spawning areas, or reduce the quality of rearing habitat.

All trapping activities are considered to have discountable probability of causing adverse effects to Atlantic salmon and its designated critical habitat is predicated on the form and nature of the device in addition to the implementation of the following conservation measures as part of the proposed activities:

- Prior to the removal of a beaver dam; or the use of bodygrip traps, cable devices, suitcase traps, or water flow devices in the Atlantic salmon distinct population segment (DPS) area, the WS will consult with the Service and the appropriate state agencies to determine occupancy and presence of suitable spawning habitat or redds and to discuss how the WS should proceed.
- Water flow devices and beaver exclusion systems that would limit the ability of Atlantic salmon to migrate upstream or downstream past the device (e.g. perforated pipes with end caps) will not be installed in occupied salmon waters.
- The WS will avoid the use of suitcase traps in the Atlantic salmon DPS.
    - If suitcase traps are used, the WS personnel will use best judgment in trap placement to minimize the potential of incidentally capturing an Atlantic salmon.
    - The WS will not place suitcase traps perpendicular to stream flow or channel within a narrow (six feet or less) stream channel located within occupied Atlantic salmon habitat.
- The WS will make every attempt to avoid using bodygrip traps in the Atlantic salmon DPS. Bodygrip traps will be used when and where a need exists and only if other capture devices are deemed ineffective or impractical for situational use.
    - When setting bodygrip traps in water bodies occupied by Atlantic salmon, bodygrip triggers will be adjusted to minimize the chance of incidentally capturing an Atlantic salmon (AFWA 2016, Polechla and Walker 2008). Specific adjustments will include positioning the trigger mechanism within two inches of the side of the trap with one of the trigger wires bent perpendicular to the other wire (AFWA 2016, Polechla and Walker 2008).
    - If bodygrip traps are used, the WS personnel will use best judgment in trap placement to minimize the potential of incidentally capturing an Atlantic salmon.

- The WS will make every attempt to avoid using cable devices in the Atlantic salmon DPS. They will be used when and where a need exists and only if other capture devices are deemed ineffective or impractical for situational use.
    - In occupied Atlantic salmon habitat, loop sizes required to capture beaver will be set at least nine inches in diameter to allow Atlantic salmon to pass through without harm.
    - Cable devices will not be used for other semiaquatic species (river otter, mink, or muskrat) in occupied Atlantic salmon habitat.
    - If cable devices are used, the WS personnel will use best judgment in trap placement to minimize the potential of incidentally capturing an Atlantic salmon.
- The WS must conduct beaver dam removal between June 15 and September 30.
    - If beaver dam removal cannot be completed between June 15 and September 30, prior to removal, the WS must contact the Service to confirm the presence or absence of redds or suitable spawning habitat within 1,000 feet downstream of a proposed beaver dam removal site.
    - If redds or suitable spawning habitat is confirmed by the Service within 1,000 feet downstream of a proposed beaver dam removal site and removal cannot be completed between June 15 and September 30, the WS must install a turbidity curtain immediately downstream of the removal location prior to and during removal.
    - The WS will remove beaver dams by hand at the request of the cooperator, and when property damage is verified by the WS.
    - The WS will not use or recommend the use of heavy equipment such as backhoes and bulldozers for dam breaching or removal.
- The WS will immediately report any incidental take of Atlantic salmon to the Service in the event one were captured, injured, or killed through application of any method utilized by the WS for MDM.
- Activities associated with aquatic MDM will be included in the annual report.

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1.0 PROGRAMMATIC BIOLOGICAL OPINION

1.1 Programmatic Consultation Process

This programmatic consultation addresses the actions of the lead agency; the WS in the states of Maine, New Hampshire, and Vermont; and creates a streamlined and transparent process with efficiencies realized by the WS and the Service. The WS will utilize SOPs and BMPs that will incorporate a set of Avoidance and Minimization Measures (AMMs).

An annual summary of activities and potential adverse effects or take of Canada lynx will be provided to the Service. The effective period of this programmatic biological opinion (PBO) is five years and it will be renewed upon mutual agreement from the WS and the Service. This renewal will be facilitated through the issuance of a letter by the Service and will not require the creation of a new biological opinion, unless reinitiation is deemed necessary (standard consultation reinitiation conditions [50 CFR 402.16, e.g., new information on species or effects] apply).

1.2 Adaptive Management

The WS and the Service will apply adaptive management strategies throughout the effective lifetime of this consultation. Incorporating new information on the effects of the action and the function of the program will allow the WS and the Service to ensure that effects of the proposed actions are effectively minimized and that the programmatic is consistent with stated efficiency and conservation goals. Changes to this consultation will be considered on an annual basis, but they may also occur at any time that the WS and the Service agree it is appropriate. During annual reviews, the WS and the Service will discuss existing protocols, AMMs, and other commitments and assumptions made herein to ensure this programmatic consultation is being implemented successfully and appropriately.

The WS will generate an annual report for submittal to the Service, in addition to conducting an annual program review with the Service. This report will summarize program activities and any Take for the reporting year (for the sake of this PBO, "year" refers to the calendar year, January 1 to December 31), information that may inform potential effect assumptions, and implementation of conservation measures. The annual review may be facilitated by a meeting which will serve as the regular forum for all parties to discuss program changes and the need for reinitiation of consultation.

2.0 DESCRIPTION OF THE PROPOSED ACTION

As defined in the ESA Section 7 regulations (50 CFR 402.02), "action" means "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas." The "action area" is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The following is a summary of the proposed action and a detailed description can be found in the BA provided by the WS as part of this consultation.

2.1 Mammal Damage, Oral Rabies Vaccination, and National Rabies Management Programs

The Maine, New Hampshire, and Vermont WS programs include the MDM, the oral rabies vaccination (ORV) program, and the National Rabies Management Program (NRMP) activities. The current programs use an Integrated Mammal Damage Management (IMDM) approach to apply practical and effective MDM methods sequentially or in combination for the prevention and reduction of damage and conflicts caused by mammals, based on local problem analyses and the informed decisions of trained WS personnel.

The WS provides services (technical assistance or direct operational) to protect livestock, property, human health and safety, and natural resources from damage caused by a wide range of mammal species. Requests for assistance may be handled by: 1) taking no action, if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by mammals, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage. The exception to this is bats, which the WS does not work with. Requests for assistance with bats received by the WS are sent to the respective state wildlife agency.

Technical assistance is information, demonstrations, and advice on available and appropriate MDM methods. The implementation of damage management actions is the responsibility of the requester. In some cases, the WS can provide supplies or materials that are of limited availability for non-WS entities to use. Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Technical assistance may include providing advice, information, instructional sessions, demonstrations, recommendations, equipment loans, and information on the availability and use of non-lethal and lethal methods for others to use in resolving mammal damage problems. Non-lethal methods recommended by the WS could include, but would not be limited to, localized habitat modification, cultural practices, pyrotechnics, harassment, animal husbandry practices, installation of electric fences, referring mammal damage situations out to private nuisance wildlife control operators, live-trapping and translocation, and guard animals. Lethal methods recommended by the WS could include, but would not be limited to, shooting, trapping and euthanizing, and recreational hunting and trapping.

Direct operational damage management assistance includes damage management methods that are directly conducted or supervised by WS personnel. The WS direct operational mammal damage management efforts utilize site-specific non-lethal and lethal management measures and could include nonchemical methods such as shooting, aerial shooting, animal capture devices, hazing, beaver dam removal, exclusions, habitat modification, water flow devices, translocation, and cervical dislocation, and chemical methods, including repellents, immobilizing and reversal agents, medicinal drugs, euthanizing agents, and registered pesticides.

The IMDM approach would encompass the use of the most practical and effective methods to resolve a problem, and methods would be selected based on the efficiency to reduce damage or threats to human safety for each request. Preference would be given to non-lethal methods. However, non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of non-lethal and lethal

methods, or could include instances where application of lethal methods alone would be the most appropriate strategy. In many situations, the implementation of non-lethal methods would be the responsibility of the requester which means that, in those situations, the only function of the WS would be to implement lethal methods if determined to be necessary. The MDM by the WS would be conducted when requested on private property or public facilities where a need has been documented upon the completion of a cooperative service agreement. All management actions would comply with appropriate Federal, state, and local laws.

The WS MDM efforts are not intended to reduce overall native mammal populations in the state or region although in some instances, reduction of local population densities may be conducted to address site specific damage problems. However, projects to address problems with non-native species, such as feral swine and exotics, may be intended to reduce or eliminate the local, regional (within a state), or state populations.

The MDM activities may be conducted on additional species as requested, but MDM activities will only utilize the methods described in this document unless the method would have no effect on a threatened and endangered species. If new or additional methods are utilized that are not covered in this PBO and have the possibility of affecting a threatened and endangered species, a separate section 7 consultation will occur prior to that action. During the annual review, if the WS believes they will continue utilizing any methods not covered by this PBO that may have affects to any listed species; the WS and the Service may reinitiate to add this action to the PBO.

2.2 Canada Lynx Response Team

The WS may respond to emergency calls as part of a state Canada lynx response team, for example in the case of incidental Canada lynx captures; injured Canada lynx; or individuals that are trapped in enclosures, buildings, or structures. Prior to assisting any state's Canada lynx response team, the WS will undergo training in Canada lynx chemical immobilization and handling and care in order to release, translocate, seek veterinarian care, or attach tags/transmitters to them safely. When responding as part of a Canada lynx response team, WS staff would follow state specific Canada lynx response protocols.

To date, the Maine WS has not been asked to participate in the Canada lynx response team but would be available to assist if a situation occurs. The WS in Maine foresees assistance with the Maine Department of Inland Fish and Wildlife (MDIFW) Response Team to continue over the next three to five years. The WS has been asked to participate on Canada lynx response teams in Vermont and New Hampshire. To date, the WS has not responded to a trapped Canada lynx in either Vermont or New Hampshire. The WS anticipates this will not occur often, but the WS would be available to assist if a situation occurs. WS in Vermont and New Hampshire foresees assistance with the Vermont Fish and Wildlife Department and New Hampshire Fish and Game Response Team to continue over the next three to five years.

2.3 Canada Lynx Translocation

It is possible under certain circumstances for the WS to be called upon to assist with the translocation of Canada lynx by a state wildlife agency or a private entity as part of a Canada lynx response team, if a Canada lynx is discovered in sensitive areas (e.g., military, business, or

airport facilities), trapped in buildings or structures, or if a Canada lynx is causing damage or a threat of damage to human health and safety, agricultural resources, property, or natural resources. Translocation of wildlife is discouraged by the WS policy (WS Directive 2.501) because of stress to the translocated animal, poor survival rates, difficulties in adapting to new locations or habitats, and potential to spread disease and damage concerns at the new location. However, there are exceptions for the translocation of damaging mammals that might be a viable solution, such as when the mammals are considered to have high value such as threatened and endangered species. If the WS needed to translocate a Canada lynx, it would only be done at the direction of, and only after consulting with the Service and/or the appropriate state agency.

2.4 Activity Summary

Descriptions of specific MDM program activities conducted by the Maine WS program, the Vermont WS program, the New Hampshire WS program, and the NRMP are summarized in Table 1. A detailed description of each activity can be found in the BA provided by the WS as part of this consultation.

Table 1. Summary of program activities conducted by WS in Maine, Vermont, and New Hampshire and as part of the NRMP.

Activity	State	Primary Target Species	Main Methods Utilized[1]	Frequency Activity Conducted[2]	3 to 5 Year Projection
Technical Assistance	ME	All mammals	Provide TA	D	No change
	VT				Increase
	NH				No change
MDM at Airports	ME	All mammals	DB, CR, CT, BL, CP, CU, FH, CFR, HN, CID, Tran, BG, SH, WB/ST, ZP, GC, WS	D	No change
	VT	Coyotes, white-tailed deer, foxes (red and gray), bats, beaver, rabbits, skunks, woodchuck, bobcat, raccoon, feral cats and dogs, & opossums	DB, BG, CT, CR, SH, GC, WB/ST, CL, CP, CU, FD, HN, RFH	D	No change
	NH			D	Increase
Human Health and Safety	ME	All mammals	FD, DB, CR, CT, CL, BL, CP, CU, FH, RFH, CFR, HN, CID, Tran, SH, WB/ST, CD, ZP, GC WS	D	No change
	VT	Woodchuck, raccoon, striped skunk, feral swine, opossum, porcupine, moose,	SH, GC, BG, CT, CU, WB/ST, FH, ZP, CL, CO, DB, HN, RFH	D	Increase

Table 1. Summary of program activities conducted by WS in Maine, Vermont, and New Hampshire and as part of the NRMP.

Activity	State	Primary Target Species	Main Methods Utilized[1]	Frequency Activity Conducted[2]	3 to 5 Year Projection
	NH	coyote, muskrat, beaver, black bear, feral cat, fox (red and gray), white-tailed deer		D	Increase
Disease Surveillance	ME	Exotic cervids	SH, CID, CT, BG	M	No change
	VT	Raccoon, striped skunk, fisher, fox (red & gray), white-tailed deer, coyote, cottontail rabbits, opossum, snowshoe hare, E gray squirrel, red squirrel, bobcat, E chipmunk, mice-all, bats-all, black bear, feral goat, swine, & sheep	CP, RFH, HN, CID, BG, SH, WB/ST, CT, GC, CR, CFR, FH, CL, CO, CU	M	Increase in NH & VT
	NH			M	
Rabies Management (NRMP)	ME	Raccoons, skunks, beaver, woodchucks, bats, feral cats & dogs, fox (red & gray), coyote	CT, CID	D	No change
	VT		CT, FH, CP, RFH, CID,SH, WS, CR, BG, HN	D/S	No change
	NH			D/S	No change
Bear Management	ME	Black bears	CT, CP, CU, CFR, CID, Tran, SH, WS	Q	No change
	NH		CU, CT, HN, CID, Tran, CFR, SH	D/S	No change
	VT				Increase
Cervid Management	ME	White-tailed deer, moose, exotic cervids	SH, CID, CL, WS	Q	No change
	VT		CID,SH, Tran, CL	A	No change
	NH				
Feral Swine Management	ME	Feral swine	SH, CO, CID, CR	Q	No change
	VT		SH, CO, CID,CR	D/S	Decrease
	NH			D/S	No change
Aquatic Rodent Management	ME	Beavers, muskrats	SH, BG, FH, ST, FD, DB, BL	D/S	No change
	VT	Beavers, muskrats	FD, DB, CR, BL, FH, BG, SH	D/S	Increase
	NH			Q	Increase

Table 1. Summary of program activities conducted by WS in Maine, Vermont, and New Hampshire and as part of the NRMP.

Activity	State	Primary Target Species	Main Methods Utilized[1]	Frequency Activity Conducted[2]	3 to 5 Year Projection
Terrestrial Rodent Management	ME	Woodchuck, mink, chipmunk, porcupine, gray squirrel, red squirrel, vole, mole, rat, deer mouse, house mouse, shrew	ST, CT, ZP, GC, WS	S	No change
	VT	Woodchuck	SH, GC, BG, FH, CP, CT, CR,	D/S	No change
	NH			D/S	Increase statewide
MDM at Landfills	ME	All mammals	WS	M	No change
	VT	Raccoons, skunks, woodchucks, fox (red & gray), black bear, opossum, rats, moose, black bear, coyote	DB, BG, CT, CR, SH, GC, WB/ST, CL, CP, CU, FD, HN, RFH	D	No change
	NH			D	No change
Livestock Protection	ME	None	None	None	No change
	NH	Coyotes, gray fox, red fox, black bear, feral swine	FH, CU, SH, CR, CO, GC	S	Increase statewide
	VT			D/S	
Natural Resource Protection	ME	All mammals	FD, DB, CR, CT, CL, BL, CP, FH, CFR, HN, CID, Tran, BG, SH, WB/ST, ZP, GC, WS	D	No change
	VT	Raccoon, striped skunk, feral cat, woodchuck, red fox, opossum	SH, CT, CR, BG, FH, RFH, CO, DB, FD, GC	D/S	No change
	NH				

Table 1. Summary of program activities conducted by WS in Maine, Vermont, and New Hampshire and as part of the NRMP.

Activity	State	Primary Target Species	Main Methods Utilized[1]	Frequency Activity Conducted[2]	3 to 5 Year Projection
Threatened and Endangered Species Protection	ME	Red fox, gray fox, coyote, raccoon, striped skunk, opossum, short-tailed weasel, long-tailed weasel, mink, feral cats, feral/free ranging dogs, eastern chipmunks	CR, CT, CP, FH, BG, SH, WB/ST, GC,	S	No change
	VT	Raccoon, striped skunk, feral cat, woodchuck, red fox, opossum	SH, CT, CR, BG, FH, RFH, CO, DB, FD, GC	S	Increase
	NH			S	Increase
Canada Lynx Response Team and Translocations	ME	Canada lynx	CT, CP, FH, CID, Tran, WS	A	No change
	VT		CID, Tran	A	NH joining LRT
	NH				

[1] Method abbreviations are as follows: FD=water flow devices, DB=beaver dam breaching/removal, CR=cable restraints, CT=cage traps, CL=clover traps, BL=beaver live traps, CP=catch pole, CU=culvert traps, FH=foothold traps, RFH=specialized raccoon foothold traps, CFR=cable foot restraints, HN=hand nets, CID=chemical immobilization and accessory drugs (ketamine, xylazine, Tiletamine, yohimbine, tolazoline, atropine, doxapram, and/or antibiotics), Tran=translocation, BG=bodygrip traps, SH=shooting, AS=aerial shooting, WB/ST=weasel boxes/snap traps, CD=cable devices, ZP=zinc phosphide, GC=gas cartridges, and WS=wildlife surveys. This list contains the most common methods employed for each activity. In certain circumstances, additional methods may be employed.

[2] Frequency abbreviations and definitions are as follows: D=daily (multiple times/week), M=monthly (several months/year), Q=quarterly (once/quarter), A=annually (once/year), S=seasonally (less than two seasons/year), and D/S=daily/seasonally (daily for greater than six months/year).

2.5 Methods

The WS uses a wide variety of methods to conduct MDM and the NRMP activities listed in Section 2.1 that have potential to affect Canada lynx. A detailed description of each method can be found in the BA provided by the WS as part of this consultation. All methods will be used in accordance with the WS program policies and use of methods by will comply with all applicable Federal, state, and local laws and regulations. The WS directives describe specific training requirements for employees before they may utilize particular methods. Table 2 is a summary of the extent that WS has employed each method.

Table 2. Summary of methods employed to carry out program activities conducted by WS in Maine, Vermont, and New Hampshire.

Method	State	Average Annual Trap Nights or Use[1]	Utilization Notes
Non-lethal			
Translocation	ME, VT, NH	--	Has not been utilized

Table 2. Summary of methods employed to carry out program activities conducted by WS in Maine, Vermont, and New Hampshire.

Method	State	Average Annual Trap Nights or Use[1]	Utilization Notes
Cable restraints	ME	--	Not currently legal
	VT	127	
	NH	--	Not currently utilized
Cage traps	ME	1,731	The most frequently utilized trap type, checked daily
	VT	15,861	
	NH	1,477	
Clover/corral traps	ME	--	Neither clover or corral traps are currently utilized
	VT	--	
	NH	255	Annual average only reflects corral traps, clover traps are currently utilized
Catch poles	ME, VT, NH	--	Catch poles are utilized in all three states to control non-target mammals incidentally caught in traps before release
Culvert traps	ME	--	Not currently utilized
	VT	--	
	NH	172	Typically utilized near campgrounds, resort areas, and suburban neighborhoods
Foothold traps (including specialized raccoon traps)	ME	306	All foothold trap use complies with BMP standards for the target species
	VT	169	
	NH	80	
Cable foot restraint	ME	8	Used by ME and VT WS in situations that preclude the use of culvert traps to capture black bears
	VT	42	
	NH	--	Not currently utilized
Suitcase traps	ME	1,861	Routine use of Hancock style suitcase traps
	VT	--	Not currently utilized
	NH	<1	There has been only one instance of the utilization of a suitcase trap over the last five years in NH

Table 2. Summary of methods employed to carry out program activities conducted by WS in Maine, Vermont, and New Hampshire.

Method	State	Average Annual Trap Nights or Use[1]	Utilization Notes
Hand nets	ME, VT, NH	--	Hand nets are used in urban situations to assist with capturing individual small to medium-size mammals trapped in a building, residence, or outdoors and used for handling captured animals caught within these areas
Lethal			
Bodygrip traps	ME	391	The wide variety of trap types utilized are summarized in the BA provided by the WS as part of this consultation
	VT	743	
	NH	332	
Shooting	ME	498	100 percent selective
	VT	128	
	NH	124	
Aerial shooting	ME, VT, NH	--	100 percent selective, though not currently utilized
Weasel boxes/snap traps	ME	1,316	Small box trap used on small mammals
	VT	82	
	NH	240	
Cable devices	ME	--	Not currently legal
	VT	257	
	NH	--	Not currently utilized
Lethal Chemicals			
Zinc phosphide	ME, VT, NH	--	Not currently utilized
Gas cartridges	ME	65	Highly targeted
	VT	52	
	NH	244	

Table 2. Summary of methods employed to carry out program activities conducted by WS in Maine, Vermont, and New Hampshire.

Method	State	Average Annual Trap Nights or Use[1]	Utilization Notes
Non-lethal Chemicals			
Ketamine, Xylazine	ME	141	Highly targeted use to immobilize mammals
	VT	669	
	NH	31	
Tiletamine, Yohimbine, Tolazoline, Atropine, Doxapram, antibiotics	ME, VT, NH	--	Not currently utilized

[1] Traps list trap nights while chemicals list the number of times administered

2.6 Conservation Measures

The following conservation measures are proposed as part of the action and are measures that will help avoid, minimize, and mitigate effects of the proposed action on Canada lynx. These AMMs are numbered consecutively to make it easier to reference them later in this document.

2.6.1 Translocation

1. Translocation of Canada lynx would be considered a choice of last resort, and will only carried out if the WS sees no alternative.
2. The WS will consult with the Service and the appropriate state agency to get authorization and to determine the best method to carry out translocation.
3. The WS will follow state specific protocols for trapping, handling, and releasing of Canada lynx.
4. The WS employees will be trained in Canada lynx trapping, handling, and translocation; in order to trap, release, translocate, seek veterinarian care, or attach tags/transmitters to Canada lynx.

2.6.2 Cable Restraints

The Vermont and New Hampshire WS have developed the following SOPs to minimize this potential while operating within the Canada lynx protection zone, which will also be implemented if cable restraints are utilized within the Canada lynx review area (the geographic area where the Services requires consultation for actions that may affect Canada lynx) in Maine:

5. Cable restraints will not be set in the vicinity of Canada lynx tracks and the WS will remove cable restraints if Canada lynx tracks are observed in the vicinity of cable restraints during MDM activities.

6. Cable restraints will be checked daily. During extreme environmental conditions, traps could be checked more frequently or traps will not be set.
7. Cable loops for coyotes and foxes will measure at least eight inches wide since this detail would aid a Canada lynx to avoid or remove the cable restraint before it closes.
8. Cable restraints will not be set within 30 feet of bait. Bait is defined as: animal matter, including meat, skin, bones, feather, hair, or other solid substance that used to be part of an animal. This includes live and dead fish. For purposes of this paragraph, bait does not include animal dropping (scat), urine, or animals, dead or alive, held in a trap as the result of otherwise lawful trapping activities.

The WS will follow the current cable restraint regulations proposed by the MDIFW in the Incidental Take Plan for Maine's Trapping Program until these regulations are amended:

9. Cable restraints will include cable with a diameter of 1/8 or 3/32 inches, a relaxing mechanical lock of a reverse-bend washer with a minimum diameter of 1 1/4 inches, and at least one swivel on the cable restraint.
10. Cable restraints will include a breakaway device with a resistance set at 350 pounds.
11. Cable restraints will include two stops:
    a) One to restrict the loop size to no larger than a 12 inch loop.
    b) One to restrict the loop size to 2.5 inches when fully closed.
12. Cable restraints will be securely anchored to the ground and all surrounding vegetation (including woody vegetation 0.5 inches or larger in diameter) which the restrained animal can become entangled in will be removed.
13. The WS employees will be trained in the proper use and setting of cable restraints before setting cable restraints in the field.

2.6.3 Cage Traps

14. The WS will check cage traps at least once daily.
15. Good judgment in trap placement will be used to avoid added exposure to environmental conditions such as direct sunlight.
16. The WS will avoid the use of fresh meat of any species (especially rabbit or hare) or lure designed to attract Canada lynx when setting cage traps in identified Canada lynx areas.
17. If a need arises for the WS to perform cage-trapping activities in occupied Canada lynx range, the WS will consult with state wildlife officials to identify areas of Canada lynx use and to evaluate the options to avoid Canada lynx capture.

2.6.4 Clover Traps/Corral Traps

18. Traps set in Canada lynx protection zones or within the Canada review area will be equipped with an escape route.
19. The WS will check clover traps on a daily basis.

20. The WS will use best judgment in trap placement to avoid added exposure to environmental conditions such as direct sunlight. During extreme environmental conditions, traps will be checked more frequently or traps will not be set.
21. The WS will not set a clover trap in the vicinity of Canada lynx tracks, and if possible, will set clover traps in habitat that is generally avoided by Canada lynx (urban, suburban, and/or agricultural environments, and hardwood habitat that deer require). If fresh Canada lynx tracks were observed in the vicinity of a clover trap, the WS will remove the trap from the area.

2.6.5 Catch Poles

22. The WS will be trained and follow their individual state plans on the proper use of a catch pole.

2.6.6 Suitcase Traps

23. The WS will place all beaver live traps with the bottom portion in the water and with the opening of the trap facing away from land.
24. Whereas it is understood that Canada lynx are attracted to beaver castor, beaver live traps must be placed in a position that will allow Canada lynx to approach the back of the trap to reach the lure without passing through the open side of the trap. Open access to the rear portion of the traps will be maintained free of heavy vegetation or large obstacles.

2.6.7 Culvert Traps

25. When utilizing these traps in known Canada lynx habitat, the WS will not use any olfactory attractant containing cat lure, fish oil, or fresh meat (especially rabbit or hare). In most cases, sweet baits, (e.g., cakes, pastries) should be utilized to attract bear and not Canada lynx. In Maine, the WS will not set culvert traps within 50 yards of visual attractants, such as brightly colored objects.
26. Culvert traps will be checked at least on a daily basis.
27. Best judgment in trap placement will be used to avoid added exposure to environmental conditions such as direct sunlight. During extreme environmental conditions, traps will be checked more frequently or traps will not be set.
28. If possible, the WS will set culvert traps in habitat that is generally avoided by Canada lynx. If fresh Canada lynx tracks are observed in the vicinity of a culvert trap, the WS will remove the culvert trap from the area.

2.6.8 Foothold Traps (including Specialized Raccoon Foot Traps)

29. The WS will not set foothold traps in the vicinity of Canada lynx tracks or other sign, and if possible, will set foothold traps in habitat that is generally avoided by Canada lynx. The WS will also remove foothold traps if Canada lynx tracks or other sign are observed in the vicinity of the foothold traps during MDM activities.
30. Foothold traps will be checked daily.

31. The WS personnel will use best judgment in trap placement to minimize non-target species and to avoid added exposure to environmental conditions such as direct sunlight. During extreme environmental conditions, traps will be checked more frequently or traps will not be set.
32. Foothold traps will not be set within 50 yards of bait visible from above. Flagging will not be used in conjunction with trap sets in identified Canada lynx areas.
33. The WS will not use snowshoe hares, other fresh meat, or cat lure as bait.
34. The WS will follow the most up-to-date state specific trapping regulations and standards, within potentially occupied Canada lynx habitat, developed to minimize the potential of capturing a Canada lynx in a foothold trap.
35. All foothold traps used by the WS will comply with BMP standards for the target species listed in WS Directive 2.450. The WS will only set BMP foothold traps in Canada lynx areas with an inside jaw spread of less than five and three-eighths inches and that have padded, offset, cast, or laminated jaws.

2.6.9 Cable Foot Restraints

36. The WS will not set cable foot restraints in the vicinity of Canada lynx tracks, and if possible, will set cable foot restraints in habitat that is generally avoided by Canada lynx. The WS will also remove cable foot restraints if Canada lynx tracks are observed in the vicinity of the cable foot restraints during MDM activities.
37. Cable foot restraints will be checked daily.
38. The WS personnel will use best judgment in trap placement to minimize capture of non-targets and to avoid added exposure to environmental conditions such as direct sunlight. During extreme environmental conditions, traps will be checked more frequently or traps will not be set.

2.6.10 Weasel Boxes (Snap Traps)

39. The WS will not set a snap trap in the vicinity of Canada lynx tracks, and if possible, will set snap traps in habitat that is generally avoided by Canada lynx. If fresh Canada lynx tracks were observed in the vicinity of a snap trap, the WS will remove the trap from the area.
40. The WS will utilize so-called weasel boxes, insofar as practical, to restrict access of Canada lynx to snap traps. In situations where snap traps must be set outside of weasel boxes, snap traps could be anchored in such a way that will allow a Canada lynx to pull its foot out of the trap.

2.6.11 Bodygrip Traps

41. The WS will not set bodygrip traps in the vicinity of Canada lynx tracks, and if possible, will set bodygrip traps in habitat that is generally avoided by Canada lynx. The WS will also remove bodygrip traps if Canada lynx tracks are observed in the vicinity of the trap during MDM activities.

42. The WS will follow the most up-to-date state specific trapping regulations and standards, within potentially occupied Canada lynx habitat, developed to minimize the potential of capturing a Canada lynx in a bodygrip trap.

2.6.12 Cable Devices (Lethal)

The Vermont and new Hampshire WS have developed the following SOPs:

43. In Vermont, this includes Caledonia, Orleans, and Essex counties and in New Hampshire this includes the Lynx Protection Zone.
44. The WS will not set cable devices in the vicinity of Canada lynx tracks and the WS will remove cable devices if Canada lynx tracks were observed in the vicinity of a cable device during MDM activities.
45. Cable devices set for beavers will be placed so that the cable loops will be at least one-half submerged in water when set, placed, and tended and away from areas easily accessible by Canada lynx.
46. Within Caledonia, Orleans, and Essex counties in Vermont and the Lynx Protection Zone in New Hampshire, cable loops for coyotes and foxes will measure at least eight inches wide since this detail would aid a Canada lynx to avoid or remove the device before it closes (Golden and Krause 2003).
47. Cable devices will not be set within 30 feet of exposed carcasses, according to WS Directive 2.450. Flagging will not be used in conjunction with trap sets in identified Canada lynx habitat.

Since cable devices are only approved for use by the WS in Maine for beaver as underwater sets, the Maine WS has developed the following SOPs:

48. The WS will not set cable devices in the vicinity of Canada lynx tracks and the WS will remove cable devices if Canada lynx tracks were observed in the vicinity of a cable device during MDM activities.
49. Cable devices will be set for beavers so that the cable loops are completely submerged in water when set, placed, and tended.

2.6.13 Zinc Phosphide

50. The Maine WS will not use zinc phosphide in the Canada lynx review area in Maine.
51. The WS will not use zinc phosphide in the Canada lynx protection zone in New Hampshire or in Caledonia, Orleans, or Essex counties in Vermont.

2.6.14 Gas cartridges

52. The WS will check dens and burrows for sign and presence of Canada lynx before application. If there are any signs (i.e., tracks, fresh scat, etc.) that a Canada lynx has been in the area or if a Canada lynx is observed in the vicinity of the den or burrow, the WS will not use gas cartridges in the den or burrow.

53. The WS will use gas cartridges in accordance to label directions.
54. The WS will be trained in the proper use of gas cartridges before applying this method.

2.6.15 Non-Lethal Chemicals

55. The WS administering immobilizing drugs will be trained and certified. The WS will follow approved procedures outlined in the WS Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson et al. 2001) and Directive 2.430.
56. In the event an individual Canada lynx experiences an adverse reaction to the drug administered, a veterinarian, the Service, a trained state wildlife biologist, and/or a trained WS employee would be consulted on the appropriate actions to take.
57. Any use of non-lethal drugs on Canada lynx will only occur through a previously agreed upon protocol approved by the Service, appropriate state wildlife agencies and/or state wildlife response team.

2.6.16 Shooting

58. The WS will make every attempt to remove carcasses and spent ammunition from the environment while carrying out this action.

3.0 ACTION AREA

The action area for this programmatic biological opinion consists of the entire states of Maine, New Hampshire, and Vermont. MDM could be conducted on private, Federal, state, county, and municipal lands or any other areas in these states upon request.

4.0 STATUS OF THE SPECIES AND CRITICAL HABITAT

Per the ESA Section 7 regulations (50 CFR 402.14(g)(2)), it is the Service's responsibility to "evaluate the current status of the listed species or critical habitat."

4.1 Status of the Species

To assess the current status of the species, it is helpful to understand the species' conservation needs which are generally described in terms of reproduction, numbers, and distribution (RND). The Service frequently characterizes RND for a given species via the conservation principles of resiliency (ability of species/populations to withstand stochastic events–numbers, growth rates), redundancy (ability of a species to withstand catastrophic events–number of populations and their distribution), and representation (variation/ability of a species to adapt to changing conditions); collectively known as the three R's.

As described in the Species Status Assessment (Service 2017) Canada lynx conservation needs include:

- Large (hundreds to thousands of square kilometers) boreal forest landscapes with dense horizontal cover and robust populations of its primary prey, the snowshoe hare.

- Long (four plus months) winters with deep, persistent snow
- Connectivity with populations in Canada; however, whether, and if so to what extent, the demographic and/or genetic health of DPS populations relies on periodic immigration from Canadian populations remains uncertain.

Currently, as a whole, the range-wide status of the species varies depending between the different Units in the DPS. The population in Units 1, 2, 3, 4, and 6 are stable; while populations in Unit 5 are unlikely to persist (Service 2017). Resiliency, the ability to withstand stochastic disturbance events, and redundancy, the ability to withstand catastrophic events, are currently exhibited in the Canada lynx DPS by the persistence of individual Canada lynx populations and their broad distribution across the geographic scope of the DPS. Available information indicates that five out of six geographic units in the DPS (all but the Greater Yellowstone Area) currently contain resident breeding Canada lynx populations. Although we lack precise historical and current population-size estimates for all of the geographic units, Canada lynx experts familiar with each unit provided their estimates of the number of resident Canada lynx each unit could potentially support.

The apparent long-term (historical and current) persistence of resident Canada lynx populations in at least four of the six geographic units (Units 1 through 4) and the absence of reliable information indicating that the current distribution and relative abundance of resident Canada lynx are substantially reduced from historical conditions suggest the historical and recent resiliency of Canada lynx populations in the DPS. The current resident population in Unit 6 has also demonstrated resiliency thus far. The large sizes and broad geographic distributions of the areas occupied by resident Canada lynx populations likewise indicate historical and current redundancy in the DPS sufficient to preclude the possibility of extirpation from catastrophic events.

Representation, the ability of a species to adapt to changing environmental conditions over time, is characterized by the breadth of genetic and ecological diversity within and among populations (Lynx SSA Team 2016). Information provided by Canada lynx experts and geneticists indicates high rates of dispersal and gene flow and, therefore, generally low levels of genetic differentiation across most of the species' range, including the DPS (Lynx SSA Team 2016). Hybridization with bobcats has been documented but is not considered a substantial current threat to the DPS (Lynx SSA Team 2016). Despite differences in forest community types and topographic/elevation settings, Canada lynx across the range of the DPS occupy a similarly narrow and specialized ecological niche defined by specific vegetation structure, snow conditions, and the abundance of a single prey species. Thus, Canada lynx naturally have little ability to adapt to changing environmental conditions (i.e., shift to other forest habitats, snow conditions, or prey species). However, although some small populations may have become extirpated recently, resident Canada lynx in the DPS remain broadly distributed across the range of ecological settings that seems to have supported them historically in the contiguous United States. There are no indications of current threats to the genetic health or adaptive capacity of Canada lynx populations in the DPS, and the current level of representation does not appear to represent a decrease from historical conditions.

The primary factors influencing the status include regulations on Federal lands, climate change, state forestry regulations, and wildfires. The lack of regulations protecting Canada lynx habitat

from potential threats on Federal lands at the time of listing has been largely addressed by formal and binding amendments or revisions to most Federal land management plans within the DPS range. Although uncertainty remains about the efficacy of this improved regulatory framework, Federal lands are now being managed specifically to protect and restore Canada lynx habitats, with the goal of supporting continued Canada lynx presence on these lands. Most Federal lands, which constitute 64 percent of Canada lynx habitat, are found in the western United States.

Climate change is occurring at a global and, thus, a DPS-wide scale. Climate warming has reduced snow amount, duration, and quality (in terms of conditions thought to be favorable for Canada lynx); it has been linked to increased frequency, size, and severity of wildfires and forest insect outbreaks; and it likely has already resulted in some changes in forest vegetative communities. Climate warming has also been suggested as contributing to changes in the amplitude, periodicity, and synchronicity of northern hare population cycles, which could alter (and perhaps have already altered) the timing and magnitude of Canada lynx dispersal from Canada into the contiguous United States. If Canada lynx populations in the DPS depend on immigration from Canada which is no longer occurring or has been reduced substantially relative to historical conditions, population declines and an increased likelihood of extirpation among resident DPS populations would be expected. However, whether, and if so to what extent, these climate-mediated factors have influenced current Canada lynx numbers, other demographic parameters, and/or habitat quality and distribution is uncertain and has not been quantified across the range of the DPS or in individual geographic units. Despite uncertainty regarding its influence over current conditions for Canada lynx, climate modeling and expert opinion concur that continued climate warming will adversely impact Canada lynx in the DPS at some point in the future.

There are other current stressors that are not occurring across the entire DPS range but which affect Canada lynx in one or more geographic units. For example, in northern Maine, where most high-quality Canada lynx habitat occurs on private commercial timber lands and is the result of past timber harvests, changes in State forestry regulations (i.e., the Maine Forest Practices Act of 1989) that govern private forest management may currently be facilitating decreases in habitat quantity, quality, and distribution, and may result in reduced Canada lynx numbers. The lack of binding Canada lynx conservation commitments on most private lands may exacerbate this risk to current lynx habitats in Maine. However, the current amount and distribution of high-quality Canada lynx and hare habitats created in Maine by past timber harvest is thought to be several times higher than the likely natural historical condition. In North-central Washington, recent large-scale wildfires have resulted in the temporary loss of over a third of Canada lynx habitat, likely reducing this unit's current Canada lynx population and potentially compromising its current ability to support a resident population until habitats recover. Increased wildfire activity also has impacted Canada lynx habitats in the other western geographic units (Northwestern Montana/Northeastern Idaho, the Greater Yellowstone Area, and Western Colorado), but the extent to which it may have influenced the current condition of Canada lynx populations in those units is uncertain.

For a more detailed account of the species description, life history, population dynamics, threats, and conservation needs, refer to Species Status Assessment (Service 2017).

4.2 Status of Critical Habitat

Critical habitat for this species has been designated; however, this action will have no effect on designated critical habitat.

5.0 ENVIRONMENTAL BASELINE

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated and/or ongoing impacts of all proposed Federal projects in the action area that have undergone Section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

5.1 Status of the Species within the Action Area

This programmatic BO covers potential projects in the states of Maine, Vermont, and New Hampshire, effectively, the Northern Maine Unit (Unit 1). This unit has likely supported resident Canada lynx since at least the southward re-expansion of boreal spruce-fir forests into the northeastern United States during and following the Little Ice Age. Currently, northern Maine is thought to support many more resident Canada lynx than likely occurred historically, and many more than was known or suspected at the time the DPS was listed. This unit currently contains an unnaturally-high amount of high-quality hare habitat; the result of dense conifer regeneration following landscape-level clearcutting in the 1970s and 1980s in response to a large spruce budworm outbreak. These dense young regenerating conifer stands are much more extensive than they are thought to have been historically under natural disturbance regimes. However, habitat extent probably peaked in the late 1990s and early 2000s, and habitat quality is projected to decline in these stands over the next few decades as they age beyond 35 to 40 years post-harvest. This unit currently is thought to support the largest resident population in the DPS; perhaps 750 to1,000 individual Canada lynx (Lynx SSA Team 2016). This geographic unit may also be the source of dispersing Canada lynx that recently recolonized northern New Hampshire as well as several that temporarily established residency in northern Vermont. Some reproduction has been verified recently in both states, although neither was occupied when the DPS was listed, and resident Canada lynx were thought to have been extirpated from New Hampshire.

5.2 Status of Critical Habitat

Critical habitat for this species has been designated in the action area, specifically in Maine, not in Vermont or New Hampshire; however, this action will have no effect on designated critical habitat.

6.0 EFFECTS OF THE ACTION

Direct effects are the direct or immediate effects of the project on the species, its habitat, or designated/proposed critical habitat. Indirect effects are defined as those that are caused by the

proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. Direct and indirect effects of the proposed action along with the effects of interrelated/interdependent activities are all considered together as the "effects of the action."

The potential effects of the proposed action are described in Table 3. The following project components: suitcase traps, hand nets, zinc phosphide, and gas cartridges; are unlikely to result in any impacts to Canada lynx because they are targeted and/or aren't used where Canada lynx occur, and the WS will follow AMMs 22-23 (suitcase traps), 49 to50 (zinc phosphate), and 51 to 53 (gas cartridges). For those components of the proposed action that are determined to result in "no effect" to Canada lynx, there will be no further discussion in this Opinion.

There are several other components of the project that may affect Canada lynx. The effects of these actions are largely discountable and insignificant, especially with implementation of AMMs, though some are likely to adversely affect Canada lynx, despite the implementation of AMMs. In the cases of potential adverse effects, AMMs will largely attempt to avoid the effects altogether. The effects of these actions are summarized in Tables 3 and in Sections 6.1 to 6.6. For many components of the proposed action that may affect Canada lynx, conservation measures have been incorporated to ameliorate those effects and those are also noted in Table 3, and summarized in Section 2.6.

6.1 Translocation

Translocations of Canada lynx will be carried out only after all other methods have been eliminated as unfeasible or impossible. All translocations would only be carried out using protocols approved by the Service and will be done at the direction of and only after discussion with the Service. To accomplish the response under this activity, the WS may utilize many methods including, but not limited to, cage traps, catch poles, foothold traps, and chemical immobilization. Effects due to these particular methods could range from negligible in the cases where Canada lynx are cooperative and docile, to harm if a Canada lynx attempts to escape a capture device, to death as a result of overdose on drugs administered to ease capture and handling. Adverse effects may also occur as a result of the translocation to a new area. Canada lynx are highly mobile and the individual may attempt to return from considerable distances, decreasing time spend foraging or finding shelter. The new area may be less suitable (smaller prey base, less sheltering opportunities, etc.) leading to a stressed individual attempting to acclimate to the new area. Additionally, the new area may already be occupied, leading to translocated Canada lynx coming into conflict with resident individuals. Careful timing of translocation and selection of release site can markedly improve acclimation and survival rates. Translocating animals also runs the risk of spreading parasites and diseases to previously uninfected areas. Translocation of wildlife is discouraged by the WS's policy (WS Directive 2.501) because of stress to the translocated animal, poor survival rates, difficulties in adapting to new locations or habitats, and potential to spread disease and damage concerns at the new location. However, there are exceptions for the translocation of damaging mammals that might be a viable solution, such as when the mammals are considered to have high value such as

Canada lynx. The WS will follow AMMs detailed in the Section 2.6 to minimize potential effects. Therefore, translocation may affect and is likely to adversely affect Canada lynx.

Table 3. Potential effects of proposed action to Canada lynx.

Sub-activity	Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor) (a change in resource quantity or quality-clear descriptor of what can be avoided, minimized, or mitigated)		Resources exposed to Direct interaction or Indirect interaction (Stressor)			Species' Responses to Exposure to Direct interaction or Indirect interaction (Stressor)	Effect to individuals	Effect to population	Avoidance Minimization Mitigation Measures	Effects remaining	Determination (Not Likely to Adversely Affect [NLAA], Likely to Adversely Affect [LAA])
	DIRECT interaction	Indirect interaction (STRESSOR to resource)	Resource or Individuals (if direct)	Life stage (of the species)	Conservation Functions of the Resource (Breeding, Feeding, Sheltering, Migration/Dispersal)						
Translocation	Immobilization		Individuals	Adults		Individual Canada lynx–Range of responses from negligible (may remain docile after capture) to harm (may become injured while struggling to escape) to death (may die while trying to escape or as a reaction to chemicals applies to ease translocation)	Ranges from negligible to reduced fitness to reduced survivorship	Negligible to reduction in numbers	1-4	Varies	LAA
	Introduction to novel area		Individuals	Adults		Individual Canada lynx–Negligible (individual easily integrates into new environment) to harm or death (individual struggles to acclimate to new area, conflict with resident individuals)	Ranges from negligible to reduced fitness to reduced survivorship	Negligible to reduction in numbers		Varies	LAA
	Spread of disease or parasites		Individuals	Juveniles Adults		Individual Canada lynx–Negligible to death, depending on severity of newly introduced novel disease or parasites to resident Canada lynx in new area	Ranges from negligible to reduced fitness to reduced survivorship	Negligible to reduction in numbers		Varies	LAA

Table 3. Potential effects of proposed action to Canada lynx.

Sub-activity	Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor) (a change in resource quantity or quality-clear descriptor of what can be avoided, minimized, or mitigated)		Resources exposed to Direct interaction or Indirect interaction (Stressor)			Species' Responses to Exposure to Direct interaction or Indirect interaction (Stressor)	Effect to individuals	Effect to population	Avoidance Minimization Mitigation Measures	Effects remaining	Determination (Not Likely to Adversely Affect [NLAA], Likely to Adversely Affect [LAA])
	DIRECT interaction	Indirect interaction (STRESSOR to resource)	Resource or Individuals (if direct)	Life stage (of the species)	Conservation Functions of the Resource (Breeding, Feeding, Sheltering, Migration/Dispersal)						
	Remove individual from hazardous situation		Individuals	Juveniles Adults		Individual Canada lynx–Beneficial, Canada lynx is removed from situation that could be detrimental to the Canada lynx's survival	Beneficial, increased fitness, increased survivorship	Beneficial		Varies	NLAA
Cable restraints (non-lethal)	Immobilization, temporary immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Negligible (may become temporarily trapped [self-release] or may require release from trap by WS) to harm (may become injured while struggling to escape trap)	Reduced fitness	Negligible	VT & NH: 5-8 ME: 9-13	Varies	LAA
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA
Cage traps	Immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Negligible (may require release from trap by WS) to harm (may become injured while struggling to escape trap)	Reduced fitness	Negligible	14-17	Varies	LAA

Table 3. Potential effects of proposed action to Canada lynx.

Sub-activity	Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor) (a change in resource quantity or quality-clear descriptor of what can be avoided, minimized, or mitigated)		Resources exposed to Direct interaction or Indirect interaction (Stressor)			Species' Responses to Exposure to Direct interaction or Indirect interaction (Stressor)	Effect to individuals	Effect to population	Avoidance Minimization Mitigation Measures	Effects remaining	Determination (Not Likely to Adversely Affect [NLAA], Likely to Adversely Affect [LAA])
	DIRECT interaction	Indirect interaction (STRESSOR to resource)	Resource or Individuals (if direct)	Life stage (of the species)	Conservation Functions of the Resource (Breeding, Feeding, Sheltering, Migration/Dispersal)						
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA
Clover traps/corral traps	Immobilization, temporary immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Negligible (may become temporarily trapped [self-release] or may require release from trap by WS) to harm (may become injured while struggling with trap)	Ranges from negligible to reduced fitness	Negligible	18-21	Varies	LAA
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA
Catch polls	Restraint, immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Negligible (used very short term to immobilize Canada lynx while being released from some other trap, or to apply immobilizing agents to harm (may become injured while struggling with catch pole)	Reduced fitness	Negligible	22	Varies	LAA

Table 3. Potential effects of proposed action to Canada lynx.

Sub-activity	Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor) (a change in resource quantity or quality-clear descriptor of what can be avoided, minimized, or mitigated)		Resources exposed to Direct interaction or Indirect interaction (Stressor)			Species' Responses to Exposure to Direct interaction or Indirect interaction (Stressor)	Effect to individuals	Effect to population	Avoidance Minimization Mitigation Measures	Effects remaining	Determination (Not Likely to Adversely Affect [NLAA], Likely to Adversely Affect [LAA])
	DIRECT interaction	Indirect interaction (STRESSOR to resource)	Resource or Individuals (if direct)	Life stage (of the species)	Conservation Functions of the Resource (Breeding, Feeding, Sheltering, Migration/Dispersal)						
Culvert traps	Immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Negligible (may require release from trap by WS) to harm (may become injured while struggling to escape trap)	Ranges from negligible to reduced fitness	Negligible	25-28	Varies	LAA
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA
Foothold traps	Immobilization, temporary immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Negligible (may become temporarily trapped [self-release] or may require release from trap by WS) to harm (may become injured while struggling to escape trap)	Reduced fitness	Negligible	29-35	Varies	LAA
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA

Table 3. Potential effects of proposed action to Canada lynx.

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality-clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Avoidance Minimization Mitigation Measures***	***Effects remaining***	***Determination*** *(Not Likely to Adversely Affect [NLAA], Likely to Adversely Affect [LAA])*
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*						
Cable foot restraints	Immobilization, temporary immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Negligible (may become temporarily trapped [self-release] or may require release from trap by WS) to harm (may become injured while struggling to escape trap)	Reduced fitness	Negligible	36-38	Varies	LAA
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA
Weasel boxes/snap traps	Immobilization, temporary immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Negligible (may become temporarily trapped [self-release] or may require release from trap by WS) to harm (may become injured while struggling to escape trap)	Reduced fitness	Negligible	39-40	Varies	LAA
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA

Table 3. Potential effects of proposed action to Canada lynx.

Sub-activity	***Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor)*** *(a change in resource quantity or quality-clear descriptor of what can be avoided, minimized, or mitigated)*		***Resources exposed*** *to Direct interaction or Indirect interaction (Stressor)*			***Species' Responses to Exposure*** *to Direct interaction or Indirect interaction (Stressor)*	***Effect to individuals***	***Effect to population***	***Avoidance Minimization Mitigation Measures***	***Effects remaining***	***Determination*** *(Not Likely to Adversely Affect [NLAA], Likely to Adversely Affect [LAA])*
	DIRECT interaction	***Indirect interaction (STRESSOR to resource)***	***Resource or Individuals*** *(if direct)*	***Life stage*** *(of the species)*	***Conservation Functions of the Resource*** *(Breeding, Feeding, Sheltering, Migration/Dispersal)*						
Bodygrip traps	Immobilization, temporary immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Death (trap is designed as a lethal trap)	Reduced survivorship	Reduction in numbers	41-42	Varies	LAA
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA
Cable Devices (Lethal)	Immobilization, temporary immobilization		Individuals	Juveniles Adults		Individual Canada lynx–Death (trap is designed as a lethal trap)	Reduced survivorship	Reduction in numbers	VT & NH: 43-47 ME: 48-49	Varies	LAA
		Alteration of foraging behavior (avoidance of trap and surrounding area)	Individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, Reduced feeding success	Negligible	Negligible		Varies	NLAA
Sedation agents (Ketamine, Xylazine, Tiletamine)	Immobilization, alters bodily functions		Individuals	Juveniles Adults		Individual Canada lynx–Beneficial (reduces likelihood of injury to captured individual) to Negligible (administered in a controlled environment by trained individuals) to death (accidental overdose on administered drugs, unexpected reaction to drugs)	Beneficial to negligible to reduced fitness to reduced survivorship	Negligible to reduction in numbers	55-57	Varies	LAA

Table 3. Potential effects of proposed action to Canada lynx.

Sub-activity	Direct interaction (vehicle strike, crushing, trampling, etc.) OR Indirect interaction (Stressor) (a change in resource quantity or quality-clear descriptor of what can be avoided, minimized, or mitigated)		Resources exposed to Direct interaction or Indirect interaction (Stressor)			Species' Responses to Exposure to Direct interaction or Indirect interaction (Stressor)	Effect to individuals	Effect to population	Avoidance Minimization Mitigation Measures	Effects remaining	Determination (Not Likely to Adversely Affect [NLAA], Likely to Adversely Affect [LAA])
	DIRECT interaction	Indirect interaction (STRESSOR to resource)	Resource or Individuals (if direct)	Life stage (of the species)	Conservation Functions of the Resource (Breeding, Feeding, Sheltering, Migration/Dispersal)						
Sedation antagonists (Yohimbine, Tolazoline, Atropine, Doxapram)	Alters bodily functions		Individuals	Juveniles Adults		Individual Canada lynx–Beneficial (reduces likelihood of injury to captured individual) to Negligible (administered in a controlled environment by trained individuals) to death (accidental overdose on administered drugs, unexpected reaction to drugs)	Beneficial (reduces likelihood of injury to captured individual) to negligible to reduced fitness to reduced survivorship	Negligible to reduction in numbers	55-57	Varies	LAA
Antibiotics	Protects against infection		Individuals	Juveniles Adults		Individual Canada lynx–beneficial negligible, administered in a controlled environment by trained individuals to protect against infection when administering sedation agents or antagonists	Beneficial (reduces likelihood of infection in captured individual) to negligible	Negligible	55-57	Varies	NLAA
Shooting		Deposition of lead in environment	Prey, individuals	Juveniles Adults	Feeding	Individual Canada lynx–Negligible, may ingest prey that has an increased lead level or carcasses of mammals that have been shot	Ranges from negligible to reduced fitness	Negligible	58	Varies	NLAA

6.2 Non-lethal Traps

Non-lethal cable restraints, cage traps, clover traps/corral traps, culvert traps, foothold traps, cable foot restraints, and weasel boxes/snap traps are all methods used by the WS that could cause adverse effects to individual Canada lynx through incidental capture while trying to capture target mammals. Effects are largely associated with the individual Canada lynx being immobilized, exposed to the environment while immobilized, attempting to extricate itself from the device, or avoiding the location of the device. These effects can range from negligible in the cases where the Canada lynx are cooperative and docile and are released from the device easily, to injury while attempting to escape a device. None of these devices are expected to cause lethal harm. Additionally, the WS has never had a known instance where use of these devices resulted in harm to a Canada lynx. To further avoid and minimize potential effects the WS will follow AMMs detailed in the Section 2.6. Despite this, in the remote chance that use of these devices results in the incidental capture of a Canada lynx, they may affect and are likely to adversely affect Canada lynx.

6.3 Catch Poles

Catch poles could be used by the WS to allow a safe release of a Canada lynx that was unintentionally captured in a trap. Canada lynx could be adversely affected by the use of a catch pole while attempting to escape or avoid placement in the catch pole. The WS would immediately report to the Service, state wildlife agencies, and/or other trained WS employees, in the event a Canada lynx is incidentally captured and the use of a catch pole is necessary, ensuring a properly trained individual is performing the action. To date, no Canada lynx have been trapped incidentally during normal activities of the WS, and therefore use of a catch pole on a Canada lynx has never occurred. The proper implementation of the AMMs listed in Section 2.6 will further minimize this likelihood. Despite this, in the remote chance that there is an incidental capture of a Canada lynx, the use of a catch pole they may affect and is likely to adversely affect Canada lynx.

6.4 Lethal Traps

Bodygrip traps and lethal cable devices are all methods used by the WS that could cause adverse effects to individual Canada lynx through incidental capture while trying to capture target mammals. Although these devices are designed to be lethal and would kill a Canada lynx if caught, the WS has never had a known instance where a Canada lynx has been captured. To further avoid and minimize potential effects the WS will follow AMMs detailed in the Section 2.6. Despite this, in the remote chance that use of these devices results in the incidental capture of a Canada lynx, they may affect and are likely to adversely affect Canada lynx.

6.5 Non-lethal Chemicals

Several non-lethal chemicals such as sedation agents and sedation antagonists, or antibiotics; are approved and authorized to assist in the handling of live-captured wildlife by the WS. These chemicals could be used on a Canada lynx when translocation of the individual is deemed appropriate or to assist in the releasing of a Canada lynx captured in a live-capture device. If not administered properly, immobilizing agents have the potential to cause effects to a Canada lynx

from an overdose. Even when administered properly, there is the potential for an individual to experience an allergic or adverse reaction to the drug. However, the use of immobilizing drugs is not expected to have any long-lasting effects on Canada lynx. The WS will not leave an individual Canada lynx until it has returned to full and normal function, thereby reducing its chances of succumbing to potential predators or other dangers while still under the influence of a sedation agent. Most drugs used are metabolized and excreted within hours after the individual returns to full function. The use of immobilizing drugs has a degree of beneficial effects, by allowing for a safer release of a Canada lynx unintentionally captured, or by easing translocation from a potentially harmful situation. Additionally, the WS will adhere to AMMs to minimize the risk of adversely affecting a Canada lynx when administering a non-lethal drugs as detailed in the Section 2.6. Therefore, the use of non-lethal chemicals may affect and is likely to adversely affect Canada lynx.

6.6 Shooting

Though the act of shooting is a highly targeted action and in of itself will have no effect on Canada lynx, deposition of lead in the environment in the carcasses of targeted mammals or when an attempted shooting misses its target may result as a consequence of this action. Though the WS will make every attempt to remove carcasses and spent ammunition by following the AMMs listed in Section 2.6, not all lead will be retrieved. Some of this lead may be consumed by an individual Canada lynx scavenging on the carcass of a targeted mammal or if a Canada lynx prey item has ingested lead deposited in the environment. Though the effects of lead ingestion can be harmful and may decrease the fitness of an individual Canada lynx, these effects are both discountable (it is highly unlikely that a Canada lynx would be in the area and would also scavenge a targeted animal that could not be retrieved, or would eat prey with increased lead levels as a result of stray ammunition), and insignificant (the amount of lead deposited in the environment would be very low with adherence to the AMMs), and therefore this action may affect but is not likely to adversely affect Canada lynx.

7.0 CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, and private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 (a)(2) of the ESA. The programmatic action area encompasses the entire geographic range of the Canada lynx in Maine, New Hampshire, and Vermont; an extensive area of land. Hence, an array of future state, tribal, local, and private actions are likely to occur. Individual projects covered by this consultation will have much smaller action areas (a micro-fraction of the entire range of Canada lynx). The range of the Canada lynx contains relatively little Federal land. Reasonably foreseeable non-Federal activities will include (but are not limited to) agriculture, forestry, municipal infrastructure maintenance, residential and commercial/industrial development, energy projects, and recreational fishing. Within each of these broad categories, a variety of actions that could affect Canada lynx and their habitat include water withdrawal to irrigate crops, logging roads, non-point source pollution from residential and commercial development, and loss of forest and other natural habitats from development, recreation, and private hunting and trapping.

Forestry and agricultural concerns, an ongoing activity often with no Federal nexus, can result in altered or degraded habitat within the range of the Canada lynx. Habitat alterations and degradation may increase if crop acreages increase or forestry practices change. Reduction in suitability can affect Canada lynx. Many areas with suitable Canada lynx habitat are subject to recreational pressure, including all-terrain vehicles, snowmobiles, hiking, biking, and trapping and hunting. Where occupied Canada lynx habitat and recreation intersect, there is a possibility for adverse effects. Canada lynx behavior may be altered by recreating individuals and Canada lynx may be incidentally caught by trappers. Many activities that impact suitable Canada lynx habitat require Federal permits from the Corps under the Clean Water Act and Rivers and Harbors Act, or other Federal permits or funding. Therefore, these potential future actions (state, tribal, local, and private) that will affect Canada lynx and critical habitat will be subject to ESA section 7(a)(2) consultation.

Maine's total population, as of July 2015, was 1,329,328 compared to 1,125,043 in 1980 (18.2 percent growth over 35 years). Maine's population is expected to grow by 11.5 percent through 2030 (Census Bureau 2012). Subsequently, patterns and types of land use and development are not expected to dramatically change relative to trends seen over recent decades. Activities that have affected Canada lynx and their habitat in recent years are expected to continue relatively unchanged, although various efforts at conservation have and will continue to benefit Canada lynx (e.g., conservation easements). Projects as a part of this action are not expected to increase development for residential or commercial use.

8.0 ANALYTICAL FRAMEWORK FOR JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

8.1 Jeopardy Determination

Section 7(a)(2) of the ESA requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

8.2 Jeopardy Analysis Framework

"Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The following analysis relies on 4 components: (1) Status of the Species, (2) Environmental Baseline, (3) Effects of the Action, and (4) Cumulative Effects. The jeopardy analysis in this Opinion emphasizes the range-wide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

8.3 Destruction/Adverse Modification Analysis Framework

The final rule revising the regulatory definition of "destruction or adverse modification of critical habitat" became effective on March 14, 2016 (81 FR 7214). The revised definition states: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features." The proposed action will have no effect on designated critical habitat; therefore it will not be analyzed for destruction or adverse modification.

8.4 Analysis for Jeopardy

8.4.1 Impacts to Individuals

The proposed action includes several methods of trapping, shooting, and chemical control of mammals. As discussed in the Effects of the Action, Sections 6.0, potential effects of the action include effects to Canada lynx present within the action area. Effects would be the result of individual Canada lynx incidentally getting caught in traps or the WS participating in a Canada Lynx Response Team call, though, to date, no Canada lynx have been trapped as a result of WS activities and the WS hasn't responded to a Canada Lynx Response Team call. Despite this, as has been shown by data collected by the MDIFW trapping programs (MDIFW 2015, Service 2014), Canada lynx can get trapped incidentally to otherwise legal trapping. The MDIFW and the Service anticipate that rates of incidental Canada lynx capture in traps will remain low (13 per year [195 Canada lynx over 15 years]), and the rates of lethal trapping of Canada lynx even lower (0.2 per year [3 Canada lynx over 15 years]), and this is a conservative estimate, actual numbers are likely to be lower (MDIFW 2015, Service 2014). The SOPs, such as implementation of trap placement, trap size specifications, and bait use are proposed as part of the action in order to avoid and minimize adverse effects to Canada lynx. These SOPs were developed based on past consultation history, research and literature, and experience with Canada lynx impacts from similar activities. Since the WS must commit and adhere to all the SOPs, this further helps to ensure that the WS are avoiding and minimizing effects to Canada lynx to the extent possible. Though implementation of the SOPs will greatly reduce the already low likelihood of Canada lynx getting trapped, there will be impacts to individuals, ranging from harassment (an individual is caught and escapes or is released unharmed) to harm (an individual is caught and escapes or is released with minor injuries) to death (an individual is caught and can't be released due to injuries or dies in the trap).

8.4.2 Impacts to Populations

As we have concluded that individual Canada lynx are likely to be harmed, we will assess the aggregated consequences of the anticipated losses/reductions in fitness (i.e., reproductive success and long-term viability) of the exposed individuals on the population to which these individuals belong. Canada lynx are highly dispersed across the landscape within occupied habitat and individual actions proposed as part of this PBO will likely only affect a single individual at a time. Additionally, no part of the proposed actions covered by this PBO will affect habitat in any way. The effects are not expected to measurably decrease the fitness of these individuals for

several reasons. The SOPs will be implemented that are designed to decrease the likelihood of Canada lynx being attracted to, caught in, or permanently held by a trap. In the highly unlikely chance that a Canada lynx is caught and held, the SOPs that require that traps are checked frequently and placed in areas that will minimize environmental exposure of the individual, limit affects to the level of non-lethal harm or harassment, as opposed to lethal levels.

Although the magnitude of several of the effects of these actions cannot be precisely determined, we do not anticipate that they will occur at levels that would reduce Canada lynx populations at the action area scale or range-wide scale over the next five years. Based on data from the MDIFW's trapping program (MDIFW 2015, Service 2014), fewer than eight individuals are anticipated to be either harmed or harassed over five years through implementation of the activities carried out by the WS and described in this PBO. The total population estimated in the entire range of Canada lynx in Maine, Vermont, and New Hampshire, is approximately 750 to 1,000 individuals. The estimated eight individuals "taken" by the proposed action over five years equates to 0.8 to 1.1 percent of the entire estimated population of Canada lynx in the action area. Additionally, for reasons described above, the majority of this "take" does not result in death or loss of individuals from the populations, but can result in temporary impacts that meet one of the technical definitions of "take" but do not result in mortality. Therefore, we do not anticipate a long-term reduction in any fitness because of the extremely low number of individual Canada lynx trapped.

8.4.3 Impacts to Species

As we have concluded that population of Canada lynx are unlikely to experience reductions in their fitness, therefore there will be no harmful effects (i.e., there will be no reduction in RND) on the species as a whole.

8.5 Conclusion

We considered the current overall stable status of Canada lynx and the similar condition of the species within the action area (environmental baseline). We then assessed the effects of the proposed action and the potential for cumulative effects in the action area on individuals, populations, and the species as a whole. These types of effects of the proposed action are currently considered primary factors influencing the status of the species. While they may compound those factors, as stated above, we do not anticipate any reductions in the overall RND of Canada lynx. It is the Service's opinion that the programmatic action, as proposed, is not likely to jeopardize the continued existence of the Canada lynx.

9.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering (50 CFR § 17.3). Harass is defined by the Service as intentional or negligent actions that create the

likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering (50 CFR § 17.3). Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the WS so that they become binding conditions, as appropriate, for the exemption in Section 7(o)(2) to apply. The WS has a continuing duty to regulate the activity covered by this incidental take statement. If the WS: (1) fails to assume and implement the terms and conditions of the incidental take statement, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of incidental take, the WS must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

9.1 Amount or Extent of Take Anticipated

The Service analyzed the effects to the species above. Take estimates are calculated based on data collected by the WS (trap nights) and data collected by the MDIFW's trapping program (MDIFW 2015, Service 2014). Based on the rate of incidental trapping of Canada lynx in the MDIFW's data, the Service extrapolated the potential for take of the WS's program as a product of expected trap nights. This is summarized in Table 4.

Table 4. Canada Lynx Trapping Rates Based on the MDIFW (2015) and the Service (2014) 2005 to 2013 Data.

Trapping, non-lethal type	
Non-lethal type trap nights per year	110,000
Canada lynx trapped (2005-2013)	58
Average Canada lynx trapped per year	6.4
Canada lynx trapped per trap night	**0.00006**
Trapping, lethal type	
Lethal-type trap nights per year	150,000
Canada lynx trapped (2005-2013)	6
Average Canada lynx trapped per year	0.7
Canada lynx trapped per trap night	**0.000004**

Additionally, we anticipate that the WS will respond once per year to a call from the Canada Lynx Response Team. The anticipated take estimate for the next five years is eight Canada lynx (three from trapping and five from responding to calls from the Canada Lynx Response Team). This calculation is summarized in Table 5 below. The take for this proposed action can be broken into lethal and non-lethal. As part of the MDIFW's trapping program, they anticipated that 94 percent of the take as a result of their trapping program will result in Canada lynx released with no injuries or with minor injuries; while 4.4 percent will be released after treatment and 1.6 percent will die or need to remain in care (MDIFW 2015, Service 2014). For the WS's program, the majority of take will be non-lethal as it would occur either in a non-lethal type trap

or it would be during a response to a call from the Canada Lynx Response Team; a portion of the WS's program that ultimately benefits Canada lynx by removing them from a potentially lethal situation.

Table 5. Summary of program components used to calculate take to Canada lynx as a result of activities conducted by WS in Maine, Vermont, and New Hampshire.

Trapping, non-lethal type	
Cable restraints	127
Cage traps	6,357
Clover/corral traps	255
Culvert traps	172
Foothold traps	555
Cable foot restraint	50
Weasel boxes/snap traps	1,638
Total average annual trap nights	9,154
Extrapolated Canada lynx trapped per year	0.5
Total take over five years	2.68
Trapping, lethal type	
Bodygrip traps	1,469
Cable devices	257
Total average annual trap nights	1,726
Canada lynx trapped per year	0.008
Total take over five years	0.04
Total trapping take over five years, non-lethal plus lethal type traps[1]	3 (2.72)
Canada Lynx Response Team (CLRT)	
Annual Responses to CLRT calls (take per year)	1
Total take over five years	5
Total program take over 5 years[1]	**8** (7.72)

[1] Total take has been rounded up to the nearest whole number, pre-rounded number is in parentheses.

9.2 Reasonable and Prudent Measures

Due to the inclusion of the AMMs in the proposed action, the only required reasonable and prudent measure is that all AMMs and project descriptions as described in Section 2 of this PBO must be followed.

9.3 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the WS must comply with the following terms and conditions, which implement the reasonable and prudent measure described above and outline the required monitoring and reporting requirements. These terms and conditions are nondiscretionary.

- All applicable SOPs described in this PBO will be fully implemented.
- The WS will generate an annual report for submittal to the Service. This report will summarize program use and take for the reporting year, information that may inform potential effect assumptions, and implementation of conservation measures (for the sake of this PBO, "year" refers to the calendar year, January 1 to December 31) and will be submitted to the Service by March 1 of the year following the activities.
- If take of Canada lynx occurs while the WS is carrying out the proposed action, it will be reported within one week of the take occurring to the Service.

10.0 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service requests notification of the implementation of any conservation recommendations and to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

- We suggest that the WS continue to investigate and implement new measures that will decrease the likelihood of take of Canada lynx.

11.0 REINITATION NOTICE

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. If you have any questions regarding this Opinion, our response to your concurrence request, or our shared responsibilities under the ESA, please contact Anna Harris by telephone at 207/902-1567 or by email at *Anna_Harris@fws.gov*.

Sincerely,

ANNA HARRIS

Digitally signed by ANNA HARRIS
Date: 2018.04.27 13:23:21 -04'00'

Anna Harris,
Project Leader
Maine Field Office
Maine Fish and Wildlife Service Complex

12.0 CONSULTATION HISTORY

- April 6, 2016–Initial draft biological assessment submitted.
- June 17, 2016–The Service submits comments on draft biological assessment to the WS.
- August 22, 2017–Final BA submitted.
- April 27, 2018–PBO finalized and signed

13.0 LITERATURE CITED

AFWA. 2006. Best management practices for trapping in the United States. Washington, D. C.

AFWA. 2016. Trapper Education Manual. URL: *https://www.fishwildlife.org/afwa-inspires/furbearer-management*; accessed April 27, 2018

Census Bureau. 2012. Statistical Abstract of the United States: 2012.

Johnson, M.R., R.G. McLean, and D. Slate. 2001. Field operations manual for the use of immobilizing and euthanizing drugs. U.S. Department of Agriculture, WS Operational Support Staff. Riverdale, Maryland, USA.

Lynx SSA Team. 2016a. Canada Lynx Expert Elicitation Workshop-Final Report. April 18, 2016.

MDIFW. 2015. Incidental take plan for Maine's trapping program. Plan as accepted October 28, 2014. Minor amendments September 24, 2015. Augusta, Maine.

Polechla, P.J. and Walker, S. 2008. Range extension and a case for a persistent population of river otters *(Lontra Canadensis)* in New Mexico. International Union for Conservation of Nature Otter Specialist Group Bulletin 25(1): 13-22.

Service. 2014. Findings and recommendations on issuance of an Incidental Take Permit to the Maine Department of Inland Fisheries and Wildlife. Hadley, Massachusetts.

Service. 2017. Species Status Assessment for the Canada lynx *(Lynx canadensis)* Contiguous United States Distinct Population Segment. Version 1.0, October, 2017. Lakewood, Colorado.

APPENDIX E: STATE LISTED THREATENED and ENDANGERED SPECIES in the STATE of VERMONT

Endangered and Threatened Animals of Vermont
Vermont Natural Heritage Inventory
Vermont Fish & Wildlife Department
28 March 2015

The species in the following list are protected by **Vermont's Endangered Species Law (10 V.S.A. Chap. 123)**. There are 36 state-endangered and 16 state-threatened animals in Vermont. Those with a federal status of Threatened or Endangered are also protected by the **Federal Endangered Species Act (P.L. 93-205)**.

For further information contact the Vermont Natural Heritage Inventory, Vermont Fish & Wildlife Department, 1 National Life Drive, Montpelier, VT 05620-3702. (802) 828-1000.

Common Name	Scientific Name	State Status	Federal Status
Fishes			
Northern Brook Lamprey	*Ichthyomyzon fossor*	E	
American Brook Lamprey	*Lethenteron appendix* Synonym: *Lampetra appendix*	T	
Lake Sturgeon	*Acipenser fulvescens*	E	
Stonecat	*Noturus flavus*	E	
Eastern Sand Darter	*Ammocrypta pellucida*	T	
Channel Darter	*Percina copelandi*	E	
Amphibians			
Fowler's Toad	*Anaxyrus fowleri*	E	
Boreal Chorus Frog	*Pseudacris maculata*	E	
Reptiles			
Spotted Turtle	*Clemmys guttata*	E	
Spiny Softshell (Turtle)	*Apalone spinifera*	T	
Common Five-lined Skink	*Plestiodon fasciatus* Synonym: *Eumeces fasciatus*	E	
North American Racer	*Coluber constrictor*	T	
Eastern Ratsnake	*Pantherophis alleghaniensis* Synonym: *Elaphe obsoleta*	T	
Timber Rattlesnake	*Crotalus horridus*	E	
Mammals			
Eastern Small-footed Bat	*Myotis leibii*	T	
Little Brown Bat	*Myotis lucifugus*	E	
Northern Long-eared Bat	*Myotis septentrionalis*	E	LT
Indiana Bat	*Myotis sodalis*	E	LE

Tri-colored Bat	*Perimyotis subflavus* Synonym: *Pipistrellus subflavus*	E	
Canadian Lynx	*Lynx canadensis*	E	LT
Eastern Mountain Lion	*Puma concolor couguar* Synonym: *Felis concolor couguar*	E	LE, PDL
American Marten	*Martes americana*	E	
Birds			
Spruce Grouse	*Falcipennis canadensis*	E	
Bald Eagle	*Haliaeetus leucocephalus*	E	
Upland Sandpiper	*Bartramia longicauda*	E	
Red Knot	*Calidris canutus*	T*	LT
Black Tern	*Chlidonias niger*	E	
Common Tern	*Sterna hirundo*	E	
Eastern Whip-poor-will	*Antrostomus vociferus* Synonym: *Caprimulgus vociferus*	T	
Common Nighthawk	*Chordeiles minor*	E	
Loggerhead Shrike	*Lanius ludovicianus*	E	
Sedge Wren	*Cistothorus platensis*	E	
Rusty Blackbird	*Euphagus carolinus*	E	
Henslow's Sparrow	*Ammodramus henslowii*	E	
Grasshopper Sparrow	*Ammodramus savannarum*	T	
Amphipods			
Taconic Cave Amphipod	*Stygobromus borealis*	E	
Freshwater Mussels			
Eastern Pearlshell	*Margaritifera margaritifera*	T	
Dwarf Wedgemussel	*Alasmidonta heterodon*	E	LE
Brook Floater	*Alasmidonta varicosa*	T	
Cylindrical Papershell	*Anodontoides ferussacianus*	E	
Pocketbook	*Lampsilis ovata*	E	
Fluted-shell	*Lasmigona costata*	E	
Fragile Papershell	*Leptodea fragilis*	E	
Black Sandshell	*Ligumia recta*	E	
Pink Heelsplitter	*Potamilus alatus*	E	
Giant Floater	*Pyganodon grandis*	T	

Beetles

Hairy-necked Tiger Beetle	*Cicindela hirticollis*	T	
Cobblestone Tiger Beetle	*Cicindela marginipennis*	T	
Puritan Tiger Beetle	*Cicindela puritana*	T	LT

Bees

Rusty-patched Bumble Bee	*Bombus affinis*	E	LE
Ashton Cuckoo Bumble Bee	*Bombus ashtoni* (*Bombus bohemicus*)	E	
Yellow-banded Bumble Bee	*Bombus terricola*	T	

Vascular Plants

Adiantum viridimontanum	Green Mountain Maidenhair-fern	T	
Agastache nepetoides	Yellow Giant Hyssop	T	
Agastache scrophulariifolia	Purple Giant Hyssop	T	
Allium canadense var. canadense	Wild Garlic	T	
Ammophila breviligulata ssp. champlainensis	Champlain Beach Grass	E	
Anemone multifida var. multifida	Early Thimbleweed	E	
Anthoxanthum monticola ssp. monticola	Alpine Sweet-grass	T	
Anticlea glauca	White Camas	E	
Aplectrum hyemale	Putty-root	T	
Arabidopsis lyrata	Lyre-leaved Rock-cress	T	
Arethusa bulbosa	Arethusa	T	
Arisaema dracontium	Green Dragon	T	
Asclepias amplexicaulis	Blunt-leaved Milkweed	T	
Asclepias tuberosa	Butterfly-weed	T	
Asclepias verticillata	Whorled Milkweed	E	
Asplenium montanum	Mountain Spleenwort	T	
Asplenium viride	Green Spleenwort	T	
Astragalus canadensis var. canadensis	Canada Milk-vetch	T	
Astragalus robbinsii var. jesupii	Jesup's Milk-vetch	E	LE
Betula minor	Dwarf Birch	E	
Blephilia hirsuta var. glabrata	Smooth Wood-mint	T	
Blephilia hirsuta var. hirsuta	Hairy Wood-mint	T	
Boechera stricta	Drummond's Rock-cress	E	
Botrychium minganense	Mingan Moonwort	E	
Braya humilis	Northern Rock-cress	T	
Calamagrostis pickeringii	Pickering's Reed-grass	E	
Calamagrostis stricta ssp. inexpansa	Bentgrass	E	

Calypso bulbosa var. americana	Fairy Slipper	T
Calystegia spithamaea ssp. spithamaea	Low Bindweed	T
Carex arcta	Contracted Sedge	E
Carex atratiformis	Blackish Sedge	T
Carex buxbaumii	Buxbaum's Sedge	E
Carex capillaris ssp. capillaris	Capillary Sedge	T
Carex chordorrhiza	Creeping Sedge	E
Carex foenea Willd. Synonym: *Carex aenea* Fern.	Bronze Sedge	E
Carex garberi	Garber's Sedge	T
Carex livida	Pale Sedge	T
Carex muehlenbergii var. enervis	Nerveless Muehlenberg Sedge	T
Carex muehlenbergii var. muehlenbergii	Muehlenberg's Sedge	T
Carex oligocarpa	Few-fruited Sedge	E
Carex richardsonii	Richardson's Sedge	E
Carex siccata	Hay Sedge	E
Carex vaginata	Sheathed Sedge	E
Castilleja septentrionalis	Northern Painted-cup	T
Ceanothus herbaceus	Prairie Redroot	E
Corallorhiza odontorhiza var. odontorhiza	Autumn Coral-root	T
Cornus florida	Flowering Dogwood	T
Corydalis aurea	Golden Corydalis	T
Crocanthemum bicknellii	Plains Frostweed	T
Crotalaria sagittalis	Rattlebox	T
Cynoglossum virginianum var. boreale	Northern Wild Comfrey	T
Cyperus diandrus	Low Cyperus	E
Cyperus houghtonii	Houghton's Cyperus	T
Cypripedium arietinum	Ram's Head Lady's-slipper	T
Desmodium cuspidatum	Large-bracted Tick-trefoil	E
Desmodium rotundifolium	Prostrate Tick-trefoil	T
Diapensia lapponica ssp. lapponica	Diapensia	E
Draba cana Synonym: *Draba breweri var. cana*	Hoary Draba	T
Draba glabella	Smooth Draba	T
Dracocephalum parviflorum	American Dragonhead	T
Dryopteris filix-mas	Male Fern	T
Eleocharis quinqueflora	Few-flowered Spikerush	T
Equisetum palustre	Marsh Horsetail	T
Eupatorium sessilifolium	Sessile-leaved Boneset	E
Fimbristylis autumnalis	Autumn Fimbristylis	E
Galium labradoricum	Bog Bedstraw	T
Gentiana andrewsii	Fringe-top Closed Gentian	T
Gentianella amarella	Felwort	T

Gentianella quinquefolia	Stiff Gentian	T	
Glyceria acutiflora	Sharp Manna-grass	E	
Hackelia deflexa ssp. americana	Nodding Stickseed	T	
Helianthus strumosus	Harsh Sunflower	T	
Hippuris vulgaris	Mare's-tail	E	
Hudsonia tomentosa	Beach Heather	E	
Hydrastis canadensis	Golden-seal	E	
Hydrophyllum canadense	Broad-leaved Waterleaf	T	
Hypericum ascyron	Great St. John's-wort	T	
Isoetes engelmannii	Engelmann's Quillwort	T	
Isoetes viridimontana	Green Mountain Quillwort	E	
Isotria medeoloides	Small Whorled Pogonia	E	LT
Isotria verticillata	Large Whorled Pogonia	T	
Juncus greenei	Greene's Rush	E	
Juncus militaris	Soldier Rush	E	
Juncus secundus	Secund Rush	E	
Juniperus horizontalis	Creeping Juniper	T	
Lactuca hirsuta	Hairy Lettuce	T	
Lathyrus japonicus var. maritimus	Beach Pea	T	
Lathyrus palustris	Marsh Vetchling	T	
Lechea mucronata	Hairy Pinweed	E	
Lespedeza frutescens [1] Synonym: *Lespedeza violacea*	Violet Bush-clover	T	
Lespedeza hirta ssp. hirta	Hairy Bush-clover	T	
Liparis liliifolia	Lily-leaved Twayblade	T	
Liriodendron tulipifera	Tulip Tree	E	
Ludwigia polycarpa	Many-fruited False-loosestrife	E	
Lupinus perennis	Wild Lupine	E	
Lygodium palmatum	Climbing Fern	E	
Malaxis monophyllos var. brachypoda	White Adder's-mouth	T	
Minuartia marcescens	Marcescent Sandwort	T	
Minuartia rubella	Marble Sandwort	T	
Morus rubra	Red Mulberry	T	
Nabalus boottii	Boott's Rattlesnake-root	E	
Neottia auriculata Synonym: *Listera auriculata*	Auricled Twayblade	E	
Neottia bifolia Synonym: *Listera australis*	Southern Twayblade	E	
Nymphaea leibergii	Pygmy Water-lily	E	
Omalotheca sylvatica	Woodland Cudweed	E	
Panicum flexile	Stiff Witch-grass	E	
Petasites frigidus var. palmatus	Sweet Coltsfoot	T	
Physostegia virginiana	Obedient Plant	T	

Pinus banksiana	Jack Pine	T	
Piptatheropsis pungens Synonym: *Piptatherum pungens*	Slender Mountain-rice	T	
Platanthera flava var. herbiola	Tubercled Orchis	T	
Platanthera hookeri	Hooker's Orchis	T	
Polemonium vanbruntiae	Eastern Jacob's Ladder	T	
Polygonum douglasii	Douglas' Knotweed	E	
Polymnia canadensis	White-flowered Leafcup	E	
Potentilla litoralis	Northern Cinquefoil	E	
Primula mistassinica	Bird's-eye Primrose	T	
Prunus americana	Wild Plum	T	
Prunus susquehanae	Susquehanna Sand Cherry	E	
Pterospora andromedea	Pinedrops	E	
Pycnanthemum incanum	Hoary Mountain-mint	E	
Pyrola asarifolia ssp. asarifolia	Bog Wintergreen	T	
Pyrola minor	Lesser Pyrola	E	
Quercus ilicifolia	Scrub Oak	E	
Quercus prinoides	Dwarf Chinquapin Oak	E	
Ranunculus allegheniensis	Allegheny Crowfoot	T	
Rhexia virginica	Virginia Meadow-beauty	T	
Rhodiola rosea	Roseroot	T	
Rhododendron maximum	Great Laurel	T	
Rhynchospora capillacea	Capillary Beak-rush	T	
Rorippa aquatica	Lake-cress	T	
Rosa acicularis ssp. sayi	Needle-spine Rose	E	
Salix planifolia	Tea-leaved Willow	T	
Salix uva-ursi	Bearberry Willow	E	
Sanicula canadensis var. canadensis	Short-styled Snakeroot	T	
Sanicula canadensis var. grandis	Greater Short-styled Snakeroot	T	
Scheuchzeria palustris	Pod-grass	T	
Scirpus ancistrochaetus	Barbed-bristle Bulrush	E	LE
Senna hebecarpa	Wild Senna	T	
Solidago odora ssp. odora	Sweet Goldenrod	T	
Solidago ulmifolia	Elm-leaved Goldenrod	E	
Sparganium natans	Lesser Bur-reed	T	
Sphenopholis nitida	Shiny Wedgegrass	E	
Sphenopholis obtusata	Blunt Sphenopholis	E	
Sporobolus compositus	Rough Dropseed	E	
Taenidia integerrima	Yellow Pimpernel	T	
Triantha glutinosa	Sticky False-asphodel	T	
Trichophorum planifolium	Bashful Bulrush	E	
Triglochin maritima	Arrow-grass	E	
Triphora trianthophora	Three-bird Orchid	T	

Ulmus thomasii	Rock Elm (Cork Elm)	T
Utricularia resupinata	Northeastern Bladderwort	T
Vaccinium stamineum	Deerberry	E
Valeriana uliginosa	Marsh Valerian	E
Veronicastrum virginicum	Culver's-root	E
Viburnum edule	Squashberry	T
Viola lanceolata ssp. lanceolata	Lance-leaved Violet	T
Vulpia octoflora	Eight-flowered Fescue	E
Woodsia alpina	Alpine Woodsia	E
Woodwardia virginica	Virginia Chain-fern	T
Xyris montana	Yellow-eyed Grass	T

ryophytes

Plagiobryum zieri	A Moss	E
Sphagnum subfulvum	A Peatmoss	E

State Status - Legal protection under Vermont Endangered Species Law (10 V.S.A. Chap. 123)
E = Endangered: in immediate danger of becoming extirpated in the state
T = Threatened: with high possibility of becoming endangered in the near future

Federal Status - Legal protection under the federal Endangered Species Act, U.S. Fish & Wildlife Service
LE = Listed Endangered
LT = Listed Threatened
SC = Species of Concern (does not denote legal protection)
C = Candidate for Listing (does not denote legal protection)

[1]List obtained from;

http://www.vtfishandwildlife.com/cms/one.aspx?pageId=268450

APPENDIX F: VFWD CONCURRENCE LETTER REGARDING STATE-LISTED THREATENED and ENDANGERED SPECIES

VERMONT

Fish & Wildlife Department
1 National Life Drive, Davis 2
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Agency Of Natural Resources

August 8, 2018

David Allaben
State Director – New Hampshire/Vermont
USDA/APHIS/Wildlife Services
59 Chenell Drive, Suite 7
Concord, NH 03301

Dear David,

We have reviewed the draft environmental assessment (EA) for addressing mammal damage management in the state of Vermont. We believe the EA adequately addresses the human and environmental impacts associated with mammalian species and the development of the alternatives will determine the level of involvement by your agency in assisting the state of Vermont in the management of mammal species' populations in Vermont. The USDA/APHIS/WS has been an important conservation partner on mammal damage effort and we look forward to continuing this partnership in the future. Therefore, we concur that Alternative 1 (Proposed Action) continuing the current Integrated Approach to Mammal Damage Management will provide the most effective and flexible strategy in the management of these species.

Thank you for allowing us to review the EA and we look forward to working with you and your staff.

Mark E. Scott
Wildlife Division Director
VT Fish and Wildlife Department

Cc: Scott Darling