ENVIRONMENTAL ASSESSMENT

MAMMAL DAMAGE MANAGEMENT IN THE STATE OF NEW HAMPSHIRE

Prepared by:

United States Department of Agriculture
Animal and Plant Health Inspection Service
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In cooperation with:

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United States Department of the Interior, Fish and Wildlife Service

February 2019

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ACRONYMS

APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CSA	Cooperative Service Agreement
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FR	Federal Register
FY	Fiscal Year
IWDM	Integrated Wildlife Damage Management
MDM	Mammal Damage Management
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHDAMF	New Hampshire Department of Agriculture, Markets and Food
NHDHHS	New Hampshire Department of Health and Human Services
NHDPC	New Hampshire Division of Pesticide Control
NHFG	New Hampshire Fish and Game Department
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NWRC	National Wildlife Research Center
ROD	Record of Decision
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USGS	United States Geological Survey
USFWS	U.S. Fish and Wildlife Service
VS	Veterinary Services
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 (MDM) in New Hampshire. 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 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 MDM. Pursuant to the National Environmental Policy Act (NEPA) and the Council on 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].

[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.

The WS-New Hampshire 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) marten (*Martes Americana*), ermine (short-tailed weasel; *Mustela eminea*), long-tailed weasel (*Mustela frenata*), American beaver (*Castor canadensis*), muskrats (*Ondatra zibethicus*), North American porcupine (*Erethizon dorsatum),* Virginia opossum (*Didelphus marsupialis*), eastern gray squirrel (*Sciurus carolinensis*), red squirrels (*Tamiasciurus hudsonicus*), eastern chipmunk (*Tamias striatus*), northern flying squirrel (*Glaucomys sabrinus*), southern flying squirrel (*Glaucomys volans*), snowshoe hare (*Lepus americanus*), southern bog lemming (*Synaptomys cooperi*), northern bog lemming (*Synaptomys borealis*), eastern cottontail (*Sylvilagus floridanus*), New England cottontail (*Sylvilagus transitionalis*), feral/free-ranging rabbit (*Oryctolagus cuniculus domesticus*), feral/free-ranging swine (*Sus scrofa*), feral/free-ranging cat (*Felis domesticus*), and feral/free-ranging dog (*Canis familiaris*).

This EA will also address limited removal of miscellaneous small mammals, such as insectivores (shrews and moles), bats and rodents (mice, rats, and voles), such as the deer mouse (*Peromyscus maniculatus*), white-footed mouse (*Peromyscus leucopus*), house mouse (*Mus musculus*), meadow jumping mouse (*Zapus hudsonius*), woodland jumping mouse (*Napaeozapus insignis*), northern short-tailed shrew (*Blarina brevicauda*), masked shrew (*Sorex cinereus*), smoky shrew (*Sorex fumeus*), least shrew (*Crytotis parva*), long-tailed shrew (*Sorex dispar*), pygmy shrew (*Sorex hoyi*), American water shrew (*Sorex palustris*), hairy-tailed mole (*Parascalops breweri*), eastern mole (*Scalopus aquaticus*), star-nosed mole (*Condylura cristata*), rock vole (*Microtus chrotorrhinus*), southern red-backed vole (*Clethrionomys gapperi*), woodland vole (*Microtus pinetorum*), meadow vole (*Microtus pennsylvanicus*), Norway rat (*Rattus norvegicus*), and black rat (*Rattus rattus*). Bat species addresses include: eastern small-footed myotis (*Myotis leibii*), little brown bat/little brown myotis (*Myotis lucifugus*), northern long-eared bat/northern myotis (*Myotis septentrionalis*), eastern pipistrelle bat/tri-colored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*).

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

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 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

[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.

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 in New Hampshire from requests for assistance[2] 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[3] (FY) 2014 through FY 2018. 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 MDM 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.

Table 1.1 lists the number of requests for assistance by mammal species and resource type that WS received from FY 2014-2018. WS-New Hampshire received 13,030 requests during that five-year period with most requests associated damage or threats of damage to property and threats to human health and safety. For example, black bears and beaver represented 31% and 9% of the property damage requests, respectively. Additionally, black bears accounted for 27% of all human health and safety requests, whereas, raccoons and striped skunks represented 32%. As for assistance requests for agriculture, black bears, white-tailed deer and feral swine accounted for 40%, 16% and 21% of requests, respectively.

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.

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

[2] 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.

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

Table 1.1 – Mammal species addressed in the EA with WS requests for assistance received and the resource type damage by those species, from FY 2014 to FY 2018.

Species	Resource[1]					Species	Resource[1]				
	A	N	P	H	Total[2]		A	N	P	H	Total[2]
Bats (all)	1	0	12	106	**125**	Mole (all)	0	0	8	0	**8**
Beaver	56	28	401	90	**594**	Moose	12	2	3	5	**28**
Bear, Black	1245	1	1472	1084	**4316**	Muskrat	0	0	11	6	**17**
Bobcat	118	0	32	60	**220**	Opossum, Virginia	4	59	29	68	**177**
Cat, Feral/Free-ranging	0	72	3	4	**79**	Otter, River	5	1	1	2	**10**
Chipmunk, Eastern	1	0	25	10	**41**	Porcupine	52	2	194	71	**336**
Coyote	90	4	2	264	**520**	Eastern Cottontail	0	0	4	3	**14**
Deer, White-tailed	491	93	311	26	**925**	New England Cottontail	0	0	1	0	**1**
Deer, White-tailed (Captive)	0	0	1	0	**1**	Rabbit, Feral	1	0	3	1	**5**
Dog, Feral/Free-ranging	0	0	0	1	**2**	Raccoon	48	3	58	770	**911**
Domestic Animal	1	0	0	2	**4**	Rats, Norway	2	0	6	11	**19**
Fisher	43	0	77	78	**204**	Skunk, Striped	19	49	200	492	**791**
Fox, Gray	25	0	36	84	**154**	Sheep, Feral	0	0	1	1	**3**
Fox, Red	174	67	188	437	**912**	Shrew, (All)	0	0	5	1	**7**
Hare, Snowshoe	0	0	0	1	**1**	Squirrel, Eastern Gray	4	0	51	40	**118**
Lion, Mountain	2	0	0	2	**7**	Squirrel, Flying (all)	0	0	37	17	**59**
Mammal, Unidentified	2	0	5	6	**15**	Squirrel, Red	1	0	20	10	**35**
Martens, Pine	0	0	1	0	**1**	Swine, Feral	665	11	477	9	**1218**
Mice (all)	0	0	16	13	**32**	Vole (all)	1	0	11	2	**14**
Mink	12	1	4	11	**28**	Weasel (all)	32	0	3	15	**51**
						Woodchuck (Marmot)	11	0	860	141	**1025**
Overall Mammal Totals							**3,117**	**393**	**4,681**	**3,944**	**13,030**

[1]A=Agriculture, N =Natural Resources, P=Property, H=Human Health and Safety[2]; Totals includes requests where a resource was not identified.

Individuals or property owners that request assistance with mammals are often concerned about potential disease risks but are unaware of the specific 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 somewhat abnormally by roaming in human-inhabited areas during daylight, 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 may include:

- Potential exposure of residents to rabies due to high densities of raccoons in urban settings or from companion animals coming in contact with infected raccoons.
- Potential exposure of humans to tularemia, leptospirosis or Lyme disease posed by mammals living and foraging in a residential community or from companion animals coming in contact with infected mammals.
- Concern about the threat of histoplasmosis from the disturbance of a large deposit of guano in an attic where a large colony of bats routinely roosts or raises 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.
- Increasing risks of disease due to expanding feral swine populations that pose threats to humans, livestock, wildlife, and pets.

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

Diseases and parasites affecting feral cats and dogs can have particularly serious implications to human health given the close association of those animals with people and companion animals. The topic of feral animals and their impacts on native wildlife and human health elicits a strong response in numerous professional and societal groups with an interest in the topic. Feral cats 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 pathogens that are brought back into the home upon return where direct contact with people increases the likelihood of disease transmission, and interactions between companion animals and feral animals of the same species can increase the risk of exposure. Feral animals that are considered companion animals are also have the potential to impact multiple people

if infected since those animals are likely to come in direct contact with several members of families and friends before diagnosis of a disease occurs.

Table 1.2 -Wildlife diseases of mammals that pose a human health and safety risk in the United Sates (Davidson and Nettles 1997, Beran 1994, Davidson 2006).

Disease	Causative Agent	Hosts
Anthrax	bacterium (*Bacillus antracis*)	livestock, deer, dogs, cats
Demodectic mange	mange mite (*Demodex odocoilei*)	deer
Sarcoptic mange	mite (*Sarcoptes scabiei*)	red fox, coyote, dogs
Swine brucellosis	bacterium (*Brucella suis)*	swine
Trichinosis	nematode *(Trichinella spiralis)*	swine, bears, raccoon, fox, rats
Rabies	virus (Rhabidovirus)	mammals
Visceral larval migrans	nematode (*Baylisascaris procyonis)*	raccoon, skunks
Leptospirosis	bacteria (*Leptospira interrogans*)	mammals
Echinococcus	tapeworm (*Echinococcus multilocularis*)	fox, coyote
Bovine Brucellosis	bacterium (*Brucella abortus*)	cattle
Toxoplasmosis	protozoan parasite (*Toxoplasma gondii)*	cats, other mammals, birds
Spirometra	tapeworm (Spirometra mansonoides)	bobcat, raccoon, fox, dogs, cats
Murine typhus	bacteria (*Rickettsia mooseri = R. typhi*)	rats, mice
Giardiasis	protozoan parasite (*Giardia lamblia*)	beaver, coyote, dogs, cats
Hantavirus Pulmonary Syndrome	Hantavirus	rodents
Histoplasmosis	fungus *Histoplasma capsulatum*	bats
Lyme Disease	*Borelia burgdorferi* (spirocheate)	rodents
Plague	bacterium (*Yersinia pestis*)	rodents
Tularemia	bacterium (*Francisella tularensis*)	rodents, rabbits, and hares
Tuberculosis	bacterium (*Mycobacterium bovis*)	cervids
Tetanus	bacterium (*Clostridium tetani*)	mammals
Dermatophilosis	bacterium (*Dermatophilus congolensis*)	mammals
Pasteurellaceae	bacterium (*Haemophilus influenzae*)	mammals
Salmonellosis	bacterium (*Salmonella* spp.)	mammals
Chlamydioses	bacterium (*Chlamydophilia felis*)	cats
Typhus	bacterium (*Rickettsia prowazekii*)	opossum
Human ehrlichiosis	*Ehrlichia sp.*	deer, canids
Rocky Mountain Spotted Fever	bacterium *(Rickettsii rickettsia)*	dogs and rodents

†Table 1.2 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.

Several known diseases that are infectious to humans, including rabies, have been found in feral cats. Another common pathogen that can affect humans found in cats is ringworm. Ringworm (*Tinea* spp.) is a contagious fungal disease contracted through direct interactions with an infected person, animal, or soil. Other common zoonoses transmitted by cats are pasteurella, salmonellosis, cat scratch disease (fever), and numerous parasitic diseases, including roundworms, tapeworms, and *Toxoplasma gondii*.

Most of the zoonoses that are transmitted to humans by cats are not life threatening if diagnosed and treated early. However, certain societal segments are at higher risks if exposed to zoonoses. Women who are pregnant, people receiving chemotherapy for immunologic diseases and organ transplants, and those with weakened immune systems are at increased risk of clinical disease if exposed to *Toxoplasma gondii* (AVMA 2004). In 1994, five Florida children were hospitalized with encephalitis that was associated with cat scratch fever (AVMA 2004). The daycare center at the University of Hawaii in Manoa was closed for two weeks in 2002 because of concerns about potential transmission of murine typhus (*Rickettsia typhi*) and cat flea (*Ctenocephalides felis*) infestations afflicting 84 children and faculty. The fleas were from a feral cat colony that had grown from 100 cats to over 1,000, despite a trap, neuter, and release effort (AVMA 2004).

Tularemia, also known as "rabbit fever", is a disease caused by the bacterium *Francisella tularensis* and 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 (CDC 2017a). The causative agent of tularemia is one of the most infectious pathogenic bacteria known, requiring as few as 10 organisms to cause disease. The Working Group on Civilian Biodefense considers tularemia to be a dangerous potential biological weapon because of its extreme infectivity, ease of dissemination, and substantial capacity to cause illness and death (Dennis et al. 2001). Many wild animal species can be infected, (hares, rabbits, squirrels, muskrats, beavers, deer), and occasionally certain domestic animals can also be infected (sheep and cats). Rabbit species are most often involved in tularemia outbreaks. The bacteria can also be found in ticks and deerflies. Tularemia in humans is relatively rare in New Hampshire, with three cases identified from 2005-2015 (CDC 2017a).

In the past five years tickborne diseases in New Hampshire have been on the rise, specifically Lyme, anaplasmosis and babesiosis. The first reported case of the rare Powassan virus was detected in 2013 (DHHS 2016). From 2011-2015, a total of 7255, 410 and 148 cases of Lyme disease, anaplasmosis and babesiosis were confirmed, respectively (DHHS 2016). The tickborne diseases present in New Hampshire are also found throughout the northeast in significant numbers relative to the rest of the country with the white-footed mouse and deer the main, but not only reservoirs for these pathogens (DHHS 2016).

Beaver, which can be carriers of the intestinal parasite *Giardia lamblia*, can contaminate human water supplies and cause outbreaks of the disease Giardiasis in people (Woodward 1983, Beach and McCulloch 1985, Wade and Ramsey 1986, Miller and Yarrow 1994). Giardiasis is an illness caused by a microscopic parasite that the CDC reports as one of the most common causes of waterborne illness in people across the United States (CDC 2017b). People can contract giardiasis by swallowing contaminated water or putting anything in their mouth that has touched the fecal matter of an infected animal or person. Symptoms of giardiasis include diarrhea, cramps, and nausea (CDC 2017b). Beaver can also be carriers of tularemia (Wade and Ramsey 1986). In cattle ranching sections of Wyoming, Skinner et al. (1984) found that the fecal bacteria count was much higher in beaver ponds than in other ponds, which can be a concern to ranchers and recreationists.

There were a total of 237 reported giardiasis cases in New Hampshire from 2011-2012 (Painter et al. 2015). Children have been among the cases most reported in waterborne outbreaks as observed in Berlin, New Hampshire during an outbreak which resulted in infections in 38% and 60% of children under 10 years of age and children 10-19 years, respectively (Lopez et al. 1980). A statewide risk study of point sources for infection in New Hampshire was conducted and identified endemic giardiasis contributors such as untreated surface water, shallow dug wells, natural bodies of water used for swimming, and exposure to someone infected with the organism (Dennis et al. 1993). The rural and heavily forested landscape of New Hampshire provides and acceptable environment for the relatively high incidence of giardiasis (O'Connell 2003).

Beaver activity in certain situations can also become a threat to public health and safety (*e.g.*, burrowing into or flooding of roadways and railroad beds can result in serious accidents) (Miller 1983, Woodward 1983). Increased water levels in urban areas resulting from beaver activity can lead to unsanitary conditions and potential health problems by flooding septic systems and sewage treatment facilities (DeAlmeida 1987, Loeb 1994). Beaver damming activity can also create conditions favorable to 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 encephalitis (Green 1982) and West Nile Virus (CDC 2000).

Although reports of rabies in beaver and muskrats are not common, both species have tested positive for rabies in the United States. Between 2008 and 2012, 2 muskrats and 10 beaver across the United States tested positive for rabies virus (Blanton et al. 2009, Blanton et al. 2010, Blanton et al. 2011, Blanton et al. 2012, Dyer et al. 2013). Beaver infected with the rabies virus have aggressively attacked pets and people (Brakhage and Sampson 1952, CDC 2002, Caudell 2012). In 2001, a beaver that was exhibiting aggressive behavior by charging canoes and kayaks on a river in Florida tested positive for rabies (CDC 2002). In 2012, a beaver, that tested positive for rabies, attacked a person wading in a New York river. The person suffered six puncture wounds over their body and underwent treatment for rabies (Caudell 2012).

The expansion of feral swine populations is of significant concern to farmers, livestock producers, natural resource managers, animal health officials, and the general public. Feral swine have arguably become the most invasive and destructive large mammal species in North America and now currently inhabit many northeastern states including New Hampshire. Feral swine are potential reservoirs for at least 30 viral and bacterial diseases (Davidson and Nettles 1997, Samuel et al. 2001, Williams and Barker 2001) and 37 parasites (Forrester 1991) that are transmissible to 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 2009), through contamination of food crops (Jay et al. 2007), or through secondary infection of a third host (West et al. 2009). 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 influenza viruses 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). Although incidence of disease transmission from feral swine to humans is rarely documented, some diseases like brucellosis, tuberculosis and tularemia can be fatal. Feral swine could also play a role in the spread and amplification of several foreign animal diseases, which could severely limit opportunities for hunting, fishing, and other outdoor recreation; reduce agency income; require substantial public funds for eradication and thereby severely reduce resources available for traditional wildlife management (Hutton et al. 2006). International trade and travel and the popularity of exotic pets have also resulted in an ongoing risk of foreign animal disease introduction. In the event of a foreign animal disease outbreak in

New Hampshire, WS could be requested to provide assistance and/or aid USDA Veterinary Services (VS) or state animal and human health authorities in the management of animals involved in the outbreak.

This discussion on zoonoses is intended to briefly address the more commonly identified zoonoses found in those species specifically addressed in this EA, and is not intended to be an exhaustive discussion of all potential zoonoses. The transmission of diseases from wildlife to humans is not well documented or understood for most infectious zoonoses. Determining a vector for a human infected with a disease known to occur in wildlife populations is often complicated by the presence of the known agent across a broad range of naturally occurring sources. For example, a person with salmonellosis may have contracted the bacterium from direct contact with an infected pet or from eating undercooked meat or other sources.

Wildlife and feral animals are known carriers of pathogens infectious to humans which increases the risk of transmission directly through contact with infected wildlife or feral animals and through exposure from contact with livestock and pets that have been exposed to diseased wildlife or feral animals. Disease transmission to humans from wildlife is uncommon with few documented occurrences. However, this does not diminish the risk to humans. WS actively attempts to educate the public about the risks associated with disease transmission from wildlife to humans through technical assistance and by providing technical leaflets on the risks of exposure.

Disease Surveillance and Monitoring

Public awareness and health risks associated with zoonoses have increased in recent years. Several zoonotic diseases associated with mammals are addressed in this EA. Those zoonotic diseases remain a concern and continue to pose threats to human safety. 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 taken for other purposes). For example, WS may sample deer harvested during the annual hunting season or from cervids culled from captive herds when requested for Chronic Wasting Disease (CWD) or may collect blood samples from fox, coyotes, and muskrats that were lethally taken to alleviate damage occurring to property to test for tularemia or leptospirosis. WS has been increasingly requested to sample for diseases in other mammalian species and have conducted various disease surveillance and monitoring activities for plague, tularemia, leptospirosis, giardiasis, and raccoon roundworm, as well as for a number of feral swine diseases. Ticks have also been collected from mammals addressed during damage management activities and at big game check stations for tick-borne disease testing, such as Lyme disease, anaplasmosis and babesiosis.

Need for Mammal Damage Management at Airports

Airports provide ideal conditions for many wildlife species due to the large grassy areas adjacent to brushy, forested habitat used as noise barriers. Access to most airport properties is restricted so wildlife living within airport boundaries 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 health and safety from aircraft collisions with wildlife is increasing (Dolbeer 2000, MacKinnon et al. 2001, 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, 3,561 aircraft strikes were reported involving terrestrial mammals and 1,562 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. 2005). Civil and military aircraft have collided with a reported 65 mammal species (43 terrestrial and 22 bat) and nine mammal species groups (7 terrestrial and two bat) from 1990 through 2015 (Dolbeer et al. 2016).

Reported strikes involving terrestrial mammals in the United States caused an estimated $58,110,148 in damages from 1990 to 2013 (Dolbeer et al. 2014). In addition to damages caused by mammal strikes involving aircraft, those incidents can pose serious threats to human safety. For example, damage to the landing gear during the landing roll and/or takeoff run can cause a loss of control of the aircraft, causing additional damage to the aircraft and increasing the threat to human safety. Dolbeer et al. (2014) reported that 63% of mammal strikes from 1990 through 2012 occurred at night, with 57% occurring during the landing roll, 31% during the takeoff run, 7% on approach, and 2% during taxi.

In New Hampshire, there were 22 reported strikes with mammals from 1 January 1990 through 18 August 2016 (FAA 2018). Nine of the mammal strikes involved bats, whereas seven involved white-tailed deer. The other incidents included a striped skunk, eastern cottontail and a coyote. These strikes reported a total of $64,981 in damages (FAA 2018). Preventing damage and reducing threats to human safety is the goal of cooperators requesting assistance at airports given that a potential strike can lead to the loss of human life and considerable damage to property.

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

New Hampshire has approximately 29 registered airports, heliports and other landing facilities with two defined as certificated airports. Certificate airports are subject to FAA Federal Aviation Regulations Part 139. Airports that are certified 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 in order 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. 2014). Animals such as fox, skunk, opossum, and raccoon often venture onto airfields and become a direct threat to planes both landing and taking off. Although rare, 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 beaver, 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 act 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). New Hampshire WS has assisted five airports in the management of mammal threats to aviation. This includes, but is not limited to the removal of skunk, raccoon, opossum and rabbit 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, or removal of woodchucks that are digging around airfield equipment.

Other Mammal Hazards to Public Health and Safety

In addition to the threat of disease transmission by wildlife, requests are also received for assistance from a perceived threat of physical harm, especially from predatory wildlife (Conover 2002, Adams et al. 2006). WS may be requested to provide assistance to reduce the 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 the act in several species (deer, moose, and bear). The constant presence of human created refuse, readily available water supplies, and abundant rodent populations found in urban areas often increases the survival rates and carrying capacity of wildlife species that are adaptable to those habitats (Adams et al. 2006). Often, the only limiting factor of wildlife species in and around urban areas is the prevalence of diseases, which can be compounded by the overabundance of wildlife congregated into a small area.

As people are increasingly living with wildlife, especially around urban areas, this 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 of attack or aggressive behavior of wildlife towards pets is a topic that is common in many areas of New Hampshire, both urban and rural. In many cases the perception that there is a danger of attack simply because the public is unfamiliar with a particular species.

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 may 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. An example of this would be to immobilize a trapped bear, remove the bear from the trap, and treat any injuries and release.

Need for Mammal Damage Management to Protect Agricultural Resources

In a 2012 census, New Hampshire was determined to have 474,065 acres of land in farms and a total of 4,391 farms a 5% increase from the 2007 census. By determined land use for farms, 64.3% is woodland compared to 20.7% is crop land, 6.6% is pastureland and 8.4% is considered other uses (NASS 2012). In the 2014 State Agriculture Overview for New Hampshire, a total of 47,000 cattle and calves and 3,600

pigs were in livestock inventory (NASS 2014). New Hampshire's market value for agricultural products sold in 2012 totaled nearly $191 million with more $100 million in crops and $90 million in livestock and poultry, contributing greatly to the state's overall economy (NASS 2012). Nursery, greenhouse, floriculture, and sod products ($49.9 million), milk from dairy cows ($54.8 million), and poultry and eggs ($13.5 million) are the top value items by sales of agriculture in commodities for 2012 (NASS 2012).

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 bear, coyote, raccoon, weasel, and fox; 2) threat and occurrence of damage to crops, pasture and stored feed by feral swine, black bear, raccoon, and rodents; and 3) risk of disease transmission. WS could conduct and assist in management efforts with various mammals, coordinated by or with the New Hampshire Fish and Game Department (NHFG) and/or New Hampshire Department of Agriculture, Markets and Food (NHDAMF), 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 high-fenced hunting facilities that pose a threat to agricultural resources.

Damage to Crops

Farmers in New Hampshire produce a wide variety of cash crops including but not limited to corn, hay, blueberries, apples, vegetables (cucumbers, beans, peas, tomatoes, pumpkins, squash, and other greens), turf nursery crops, Christmas trees, and ornamental horticulture. Damage to crops by mammal species is a major concern to the agricultural community. Species such as raccoon, black bear, striped skunk, fox, woodchuck, and feral swine can cause significant damage to crops. Black bears 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.

Beaver may cause damage to a variety of agricultural crops. Beaver have been observed damaging field and sweet corn by local farmers and WS' personnel and reports of feeding and damage on other field crops as well as commercially grown standing timber and seedling trees. Populations of beaver are abundant throughout New Hampshire. Beaver activities cause flooding of prime bottomland crop fields, causing severe economic losses to agricultural producers. Similar flooding and subsequent killing of trees occurs in some commercial forest tracts, killing harvestable trees or seedlings.

Black bears cause agricultural damage to corn by feeding and trampling on stalks, damage orchard stock, berry crops and vineyards by breaking branches and vines to reach fruit, as well as damage bee hives and consume other agricultural crops. In New Hampshire from FY 2009-2016, WS reported agricultural losses to black bear totaling $77,156 with $43,685 in field crops, fruit and nut crops, hay and stored feed, and beehive losses alone. In 2016, the State paid out $28,378 in damage claims related to bear with $22,500 associated with corn and beehives (Robert Calvert, NHFG, personal communication).

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 because fields adjacent to wooded and riparian areas often sustain higher numbers of 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 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).

Browsing, feeding, and gnawing by deer, rabbits, squirrels, chipmunks, and voles can cause damage or destroy floral and ornamental nursery plants, sap collection equipment, maple trees and Christmas trees. 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, and potentially, foot-and-mouth disease, affect domestic animals and wildlife. Monitoring for and containment or eradication of these diseases to protect agricultural and natural resource interests could include wildlife damage management activities conducted by WS in cooperation with the VS program, NHFG, NHDAMF or other government agencies. As with WS' activities to protect human health and safety, WS could play an important role in the surveillance for diseases transmissible between livestock and wildlife including foreign animal diseases. Samples provided 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.

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

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

Feral swine are potential reservoirs for 30 viral and bacterial diseases as well as 37 parasites many of which can be transmitted to livestock (Hutton et al. 2006). Of greatest concern is infection of swine production facilities with diseases such as swine brucellosis and pseudorabies. A study (Corn et al. 1986) conducted in Texas found that feral swine tested positive for pseudorabies, brucellosis, and leptospirosis. Other diseases that have been detected in by feral swine include tuberculosis, 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). Cholera, foot and mouth disease, and African swine fever are additional

diseases that can be transmitted between feral swine and livestock but do not currently exist in the U.S. Disease transmission is more likely to occur when domestic livestock and feral swine have a common interface, such as at water sources and livestock feeding areas. Since 2009, WS-New Hampshire has been conducting feral swine disease surveillance as part of the National Wildlife Disease Surveillance Program and 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. 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 more than 600,000 jobs. In 2004, domestic swine in all 50 states had attained Stage V pseudorabies free status.

A feral swine was identified as seropositive for PRV in Sullivan County in 2011, the first documented case 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, personal communication). This was not surprising because there had been no known contact between free-ranging feral swine and the domestic herds at the facilities where testing was conducted. Because of the 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 have negative effects on reproduction in swine. Witmer et al. (2003) 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 disease reintroduction and pose a constant threat to the progress of disease eradication programs in domestic livestock.

International trade and travel and the popularity of exotic pets have resulted in an ongoing risk of foreign animal disease introduction. Introduction of a foreign animal disease such as Classical Swine Fever, Foot and Mouth Disease, or African swine fever 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 in monitoring and disease response. 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.

Foot and Mouth Disease (FMD) is a severe, highly contagious vesicular viral disease of cloven-hoofed animals, including, but not limited to, cattle, swine, sheep, goats, and deer. The disease is rarely fatal in adult animals, although mortality in young animals may be high. FMD is endemic in Africa, Asia, South America, and parts of Europe, but the United States has been free of FMD since 1929. Although it is often not fatal, FMD causes severe losses in the production of meat and milk and therefore has grave

economic consequences. FMD does not infect humans or horses, however, both could potentially transmit the virus.

While FMD is primarily an economically devastating disease of livestock, experimental studies have clearly demonstrated that it also threatens wildlife. North American wildlife that are susceptible to FMD include white-tailed deer, feral swine, bison, moose, antelope, musk ox, caribou, sheep, and elk. Most free-living North American wildlife have not had previous viral exposure to FMD, and there is little information available about their vulnerability (USGS NWHC 2001). Feral swine are known to be susceptible to FMD, but could be an important carrier/reservoir of the disease in the event of an outbreak in the U.S. Each state in the U.S. is or has developed its own FMD emergency response plan. In the event of FMD outbreak in New Hampshire state officials along with the NHDAMF will contact the WS office to notify of a possible request for assistance from a field location if assessments warrant such a request.

Predation and Livestock

Wildlife can cause losses, injury or disease to livestock (*e.g.*, sheep, goats, cattle, pigs, horses, llamas, alpacas), poultry (*e.g.*, chickens, turkeys, geese, ducks), and aquaculture (trout, shellfish). 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 fox, raccoon, fisher, mink, skunk, coyote, bear and bobcat have all been identified as livestock predator threats through requests for assistance. Black bears may prey on livestock such as goats, sheep, and cattle and poultry. In New Hampshire from FY 2009-2016, WS and NHFG reported agricultural losses to black bear totaling $77,156 with $33,471 in livestock/poultry losses alone.

River otters and mink, and to a lesser extent bears, raccoons and muskrats may prey on fish and other cultured species at hatcheries and aquaculture facilities (Bevan et al. 2002). River otters may even prey on fish in marine aquaculture facilities (Goldburg et al. 2001). Direct damage results when the fish or other cultured organism is killed or seriously maimed by the predator and is therefore lost from production. Indirect damage is highly variable, and includes: non-lethal wounding of fish; chronic stress with a consequent reduction in feeding efficiency or health; transfer of harmful disease-causing organisms, including bacteria, viruses and parasites; and sometimes even physical damage to the animal enclosure system leading to escapement. Often, the indirect damage caused by a predator can result in a greater economic loss than that caused by direct damage. So, the total extent of damage to an aquaculture stock by predators can be highly varied and extremely costly depending on many factors (Bevan et al. 2002).

Need to Resolve Damage Occurring to Natural Resources, Including T&E Species

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

Mammals can cause damage to natural resources. Mammals causing damage are often locally overabundant at the damage site and threaten the welfare of a species' population identified as a natural resource. An example of this would be nest predation of a local ground-nesting bird population by mammalian carnivores, such as raccoons, opossum, feral cats, fisher, skunks, coyotes, or fox. WS-New

Hampshire has conducted predator control projects where native and feral mammal species were impacting the federally threatened and state endangered piping plovers. Predation can be especially harmful towards species with low productivity and declining populations. The presence of even a single predator at a nest site can result in the direct mortality of adult birds, chicks and eggs or cause birds to abandon active nests and the nesting site entirely (Erwin et al. 2011, Kress and Hall 2004). Virginia opossum, coyote, dog, fox, raccoon, mink, striped skunk, cat, rodents (i.e. rats) and other mammals are known or suspected to reduce breeding success of piping plovers (Patterson et al. 1991, Boettcher et al. 2007, Daisey 2009, Wilke 2011, Wilke 2012, USFWS 2014), and terns (Erwin et al. 2001, Kress and Hall 2004, Daisey 2009, Erwin et al. 2011, USFWS 2014).

Feral swine have a negative effect on "almost all aspects of ecosystem structure and function" (Jolley et al. 2010). The greatest damage often occurs in areas that are environmentally sensitive or which provide critically important habitat for species which are listed under the Endangered Species Act (ESA) or are otherwise imperiled (Campbell and Long 2009). Much of this damage occurs through feral swine rooting behavior (digging for food with their snout) which disturbs both the structure and properties of soil (Campbell and Long 2009). Rooting, in conjunction with trampling and compaction, leads to the leaching of important minerals, changes in decomposition rates and nutrient cycling as well as increased rates of erosion (Campbell and Long 2009). This disturbance, along with the consumption of seeds and young plants by feral swine, also changes the composition of vegetation on the landscape, the rate of plant regeneration and encourages growth of exotic invasive plants (Singer et al. 1984, Campbell and Long 2009). Howe et al. (1981) found that feral swine rooting activities in the forest of Tennessee and North Carolina had occurred to the extent that recovery would take three or more years while Bratton (1975) found that feral swine damage was so extensive that the forest understory was unlikely to ever recover. These changes in vegetation can be so extensive that local populations of native wildlife for which this vegetation provides critical habitat are no longer able to survive (Singer et al. 1984). This damage is most pronounced in areas that are more sensitive to disturbance such as aquatic environments (Seward et al. 2004, Kaller and Kelso 2006, Engeman et al. 2007, Kaller et al. 2007). Feral swine cause erosion, increased turbidity, increased sedimentation, fecal contamination, nutrient mobilization, and surface water enrichment. As a result, they can have direct and indirect effects on aquatic biota and communities (Zengel and Conner 2008).

Scientists estimate that cats kill hundreds of millions of birds nationwide and more than a billion small mammals, such as rabbits, squirrels, and chipmunks, each year. Cats kill common species such as cardinals, blue jays, and house wrens, as well as rare and endangered species such as piping plovers (American Bird Conservancy (ABC) 2005). Some feral and free-ranging cats kill more than 100 animals each year. One well-fed cat that roamed a wildlife experiment station was recorded to have killed more than 1,600 animals (mostly small mammals) over 18 months (ABC 2005). Researchers at the University of Wisconsin coupled their four-year cat predation study with the data from other studies, and estimated that rural feral and free-ranging cats kill at least 7.8 million and perhaps as many as 217 million birds a year in Wisconsin. In some parts of the state, feral and free ranging cat densities reached 114 cats per square mile, outnumbering all similar-sized native predators (Coleman et al. 1997). Churcher and Lawton (1989) observed 77 well fed free-ranging cats in a Britain village for one year. Based on information acquired in the study, Churcher and Lawton (1989) estimated that more than 20 million birds and more than 70 million animals overall are taken by cats annually in Britain. Most recently, Loss et al. (2013) estimated that free-ranging cats kill 1.4 to 3.7 billion birds and 6.9 to 20.7 billion mammals worldwide annually.

Need for Mammal Damage Management to Protect Property

Mammals cause damage to a variety of property or resource types each year. Table 1.1 lists the species WS has received technical assistance and damage reports in the past several years. The WS data only

reflects the reported property damage by species and general resource category. Additionally, the NHFG receives internal requests from the public concerning mammals and property damage; however, many of these requests do not get reported to WS.

From FY 2014 through FY 2018, WS received reports of damages or threats of damage caused by mammals to aircraft, airport runways and taxiways, roads and bridges, railroads and trestles, residential and non-residential buildings, swimming pools, landfills, machinery, equipment, trees, shrubs, flowers, and turf. The most frequently reported damage type is the threat of aircraft striking mammals. The direct threat of aircraft strikes with mammals can cause substantial damage requiring costly repairs and aircraft downtime. Indirect threats to aircraft may result from large populations of small mammals such as rabbits, insectivores, mice, and voles attracting mammal and avian predators to the airfield and increasing the risk of a wildlife strike.

Deer-vehicle collisions are a serious concern nationwide because of losses to property and the potential for human injury and death (Conover et al. 1995, Romin and Bissonette 1996, Conover 1997). The economic costs associated with deer-vehicle collisions include vehicle repairs, human injuries and fatalities, and picking up and disposing of deer with an estimated economic impact in New Hampshire at $2,400,000 in 2000 (Drake et al. 2005). Annually, there are estimated to be more than 1,000,000 deer-vehicle collisions nationwide, but the 2011 statistics show a 7% decrease in the total over the previous year and a 9% decrease over the previous three years (Williams et al. 2012). Williams et al. (2012) estimated that there were more than 200 human deaths attributable to deer-vehicle collisions annually. State Farm Insurance (2017) estimated that 1,250,000 auto-deer collisions occurred in the U.S. between July 1, 2014 and June 30, 2015 causing an average of $4,135 per collision. Often, deer-vehicle collisions in which a deer carcass was not recovered or little vehicle damage occurred go unreported. A Cornell University study estimated that the actual number of deer-vehicle collisions could be as high as six times the reported number (Decker et al. 1990).

Burrowing activities of woodchucks and muskrats can severely damage levees, dikes, earthen dams, landfills, and other structures (FEMA 2005). Such incidents can threaten the safety and lives of people living downstream from the dam. For that reason, managers of such sites are concerned with preventing excessive burrowing by those animals at dam sites. Much of the damage caused by muskrats is primarily through their burrowing activity (Perry 1982, Miller 1994, Linzey 1998) in dikes, dams, ditches, ponds, and shorelines. Muskrats can dig burrows into banks and levees, which can compromise the integrity of embankments (Perry 1982, Linzey 1998). Muskrats can dig burrows with underwater entrances along shorelines and burrowing may not be readily evident until serious damage has occurred. When water levels drop, muskrats often expand the holes and tunnels to keep pace with the retreating water level. Additionally, when water levels rise muskrats expand the burrows upward. Woodchuck burrows under roadbeds and embankments and could potentially weaken or cause the collapse of these structures. Woodchucks also cause damage by chewing underground utility cables, sometimes resulting in power outages. Additionally, woodchuck burrows may cause damage to property when tractors and other equipment drop into a burrow or roll over due to a burrow.

Bear, deer and moose can cause damage (e.g. consumption of or trampled crops, destruction of apiaries, destruction of fencing and maple tubing) and/or cause predation losses or injury or threat of injury to livestock (e.g. sheep, pigs and horses). Large game complaints are often associated with increased human development, recreational activity, and agricultural expansion, and included complaints about bears feeding on garbage (at residences, restaurants, and campgrounds), apiaries (beehives), crops, livestock and property damage, and general nuisance. WS works cooperatively with the NHFG to resolve bear and human conflicts. The State of New Hampshire provides monetary reimbursement to citizens for confirmed bear damage of property or agriculture. In 2016, the state of New Hampshire paid out $28,378 in damage claims related to bear (Robert Calvert, NHFG, personal communication March 23, 2017).

Need for Non-Damage Related Activities by WS Involving Mammals

Not all WS' activities related to mammals in New Hampshire 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 NHFG was 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 NHFG is responsible for managing wildlife in the state, including those mammal 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 NHFG 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-New Hampshire best respond to the need to reduce mammal damage?
- Do the alternatives have significant impacts meriting an Environmental Impact Statement?

1.5 AFFECTED ENVIRONMENT

Mammals can be found across New Hampshire 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 Memorandum of Understanding (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 New Hampshire 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 MDM 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 New Hampshire 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 New Hampshire 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

There are presently no federally-recognized tribes in New Hampshire. In the event that Native American tribes are federally-recognized in the state, the WS program would only conduct damage management activities when requested by a Native American Tribe and only after a MOU or CSA has been signed between WS and the Tribe requesting assistance. Because Tribal officials would be responsible for requesting assistance from WS and determining what methods would be available to alleviate damage, no conflict with traditional cultural properties or beliefs would be anticipated. Those methods available to alleviate damage associated with mammals on federal, state, county, municipal, and private properties under the alternatives analyzed in this EA would also be available for use to alleviate damage on Tribal properties when the use of those methods have been approved for use by the Tribe requesting WS' assistance. Therefore, the activities and methods addressed under the alternatives would include those activities that could be employed on Native American lands, when requested and agreed upon.

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 in New Hampshire. 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 3 for a description of the Decision Model and its application). Decisions made using the model would be in accordance with WS' directives and Standard Operating Procedures (SOPs) described in this EA as well as relevant laws and regulations.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within New Hampshire. 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 safety associated with wildlife. WS' directives define program objectives and guide WS' activities in managing wildlife damage.

United States Environmental Protection Agency (EPA)

The EPA is responsible for implementing and enforcing the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which regulates the registration and use of pesticides, 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), and the Migratory Bird Treaty Act (16 USC 703-711).

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).

New Hampshire Fish and Game Department (NHFG)

The NHFG currently has an MOU and CSA with WS which establishes a cooperative relationship between WS and the NHFG and outlines roles and responsibilities for resolving wildlife damage management situations in New Hampshire. The mission of the NHFG is to protect and manage the State's fish and wildlife to maximize their long-term biological, recreational, and economic values for all Granite State residents and visitors. The CSA between NHFG and WS includes a work and financial plan, combining state and federal expertise which handles wildlife damage management problems and programs involving resident game and furbearer species, as well as resident game birds. WS and the NHFG cooperatively assist airports with wildlife hazard management issues related to mammals, such as

white-tailed deer. The NHFG Nongame and Endangered Species Program (NHNESP) administers programs related to nongame species which may negatively impact T&E species recovery efforts, as well as conducts management and education programs for endangered, threatened, and nongame wildlife species.

New Hampshire Department of Agriculture, Markets and Food (NHDAMF)

The NHDAMF currently has a MOU with WS, which establishes a cooperative relationship between the two agencies. The MOU outlines roles and responsibilities for resolving wildlife damage management. The mission of the NHDAMF is to promote agriculture in the public interest and to serve farmers and consumers in the marketplace. The NHDAMF assures safety and healthy food supplies and provides animal disease programs designated to control and eliminate animal diseases and ensure general animal health. Per the MOU, the NHDAMF provides non-confidential agricultural information and statistics to WS, forwards citizen's requests for wildlife damage management assistance to WS, and communicates wildlife damage management information to agricultural community.

New Hampshire Department of Agriculture, Markets and Food, Division of Pesticide Control

The NH Division of Pesticide Control (NHDPC) 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 DPC implements regulations found in NH Agriculture, Horticulture and Animal Husbandry Title 40, Chapter 430, Subchapters 33-49. Pesticide products for bird damage control are registered through the DPC by WS and other entities (e.g., pesticide manufacturers).

New Hampshire Department of Health and Human Services (DHHS)

The mission of the DHHS is to join communities and families in providing opportunities for citizens to achieve health and independence. Of the DHHS major responsibilities, the DHHS recognizes its responsibility to improve access to health care, to ensure its quality and to control costs through improved purchasing, planning and organization of health care services. The Department will work to prevent disease and to protect and improve the health and safety of all citizens through regulatory and health promotion efforts.

The University of New Hampshire (UNH)

WS has established a cooperative relationship with the UNH and the UNH Cooperative Extension, outlining roles and responsibilities for resolving wildlife damage management situations in New Hampshire. UNH Cooperative Extension agents and specialists deliver wide-ranging educational programs in the areas of agriculture, fisheries, urban and community outreach, youth development, and related areas of economic and workforce development. The UNH and UNH Cooperative Extension provide educational, outreach, and extension information to citizens, and provides educational sessions and courses on wildlife issues.

1.7 RELATIONSHIP OF THIS EA TO OTHER ENVIRONMENTAL DOCUMENTS

Environmental Assessment – Mammal Damage Management in New Hampshire: WS- New Hampshire developed an EA that analyzed the environmental effects of WS' involvement in MDM in New Hampshire (USDA 2005) and a Supplement in 2013 (USDA 2013a). That EA identified the issues associated with managing mammal damage and analyzed alternative approaches to meet the specific need identified in the EA while addressing the identified issues. Since activities conducted under the previous

EA will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EA will be superseded by this analysis and the outcome of the Decision issued based on the analyses in this EA.

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 New Hampshire wildlife with ONRAB baits is included in the National EA (USDA 2012) and is not included in the New Hampshire MDM EA. However, potential impacts on mammal species anticipated in the rabies management EA have been included in the New Hampshire MDM EA to assess cumulative impacts of program actions.

Supplement to the 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 New Hampshire wildlife for ONRAB trials is included in the supplement to the National EA (USDA 2013b) and is not included in the New Hampshire MDM EA. However, potential impacts on mammal species anticipated in the rabies management EA have been included in the Vermont MDM EA to assess cumulative impacts of program actions.

Environmental Impact Statement – Feral Swine Damage Management: A National Approach: APHIS and cooperating agencies previously prepared an EIS that addressed feral swine damage management in the United States, American Samoa, Mariana Islands, United States Virgin Islands, Guam, and Puerto Rico (USDA 2015). 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.

Proposal to Permit Take as provided under the Bald and Golden Eagle Protection Act 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 22.27 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 MDM 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 Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document is being posted 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 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 NHFG, 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 some states, with the possible exception of restrictions on methods (*e.g.*, firearms restrictions, pesticide regulations), unprotected wildlife species and certain resident wildlife species are managed with little or no restrictions allowing them to be killed or taken by anyone at any time when they are committing damage. For MDM, the NHFG 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, or individuals) takes a MDM 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 NHFG (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 non-lethal technical assistance only; 3) or WS can take no action, at which point the non-federal entity could take action anyway, either without a permit, during the hunting or trapping season, or through the issuance of a permit by the NHFG. 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 MDM activities are addressed below:

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 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 22.23, 50 CFR 22.27). As necessary, WS would apply for the appropriate permits as required by the Bald and Golden Eagle Protection Act.

Endangered Species Act (ESA)

The ESA recognizes that our natural heritage is of *"aesthetic, 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.

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

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

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 NHDAMF, by the Drug Enforcement Agency (DEA), by MOUs with land managing agencies, and by WS' Directives. WS would properly dispose of any excess solid or hazardous waste. It is not anticipated that the proposed action 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 MDM 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. The Order states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species

and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education of invasive species.

The Native American Graves and Repatriation Act of 1990

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

Occupational Safety and Health Act of 1970

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

Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The EPA is responsible for implementing and enforcing the FIFRA. All chemical methods that would be available for use by WS or could be recommended by WS under any of the alternatives would be registered with and regulated by the EPA and the NHDAMF, and would be used or recommended by WS in compliance with labeling procedures and requirements. There are several products registered for the control of mammals (fumigants, toxicants, repellents) in New Hampshire listed in Appendix B.

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 USACE 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.

New Hampshire Wildlife Laws

Several state laws and regulations pertain to WS wildlife damage management actions (Appendix E). WS complies with these laws and regulations, and consults/cooperates with the NHFG and other agencies as much as possible.

New Hampshire Pesticide Laws

New Hampshire's pesticide regulations, N.H.R.S.A Title 40 Chapter 430, Subchapters 28-49, are implemented and enforced by the NHDAMF Division of Pesticide Control (DPC). These regulations include processes and requirements for pesticide product registration (Subchapter 36), certification of pesticide dealers (35), licensing of pesticide dealer businesses (35), licensing of commercial pesticide applicators (31), licensing of pesticide applicator businesses (31), certification of private pesticide applicators (31), pesticide exposure management (31), pesticide use, special use permits (31), and agricultural worker protection (31). In order for WS to apply a restricted use pesticide as part of bird damage management in NH, the product must be registered with the DPC, the applicator must be licensed, and WS must obtain a special permit from the DPC. Additionally, label instructions, and all other pesticide and wildlife laws and regulations must be adhered to (*e.g.*, possession of a depredation permit from the USFWS and/or the NHFG to take the protected bird species). Pesticide products are registered annually, and applicator licenses are obtained and maintained through completion of continuing education courses and examinations conducted through the DPC.

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

The analysis for magnitude of impact on populations from the use of lethal methods would be based on a measure of the number of animals killed in relation to their abundance. Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available. Generally, WS only conducts damage management on species whose population densities are high and usually only after they have caused damage. WS' removal is monitored by comparing numbers of animals killed with overall populations or trends in populations to assure the magnitude of removal 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 only if a cooperator requested assistance and NHFG provided authorization for the lethal removal, when required.

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 NHFG.

Therefore, any MDM activities conducted by WS under the alternatives addressed would be occurring along with other natural processes or 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 Management on Non-target Wildlife Species Populations, Including T&E Species

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

The ESA is a Federal legislation that makes it illegal for any person to '*take*' any listed endangered or threatened species or their critical habitat. The ESA defines take as, "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 USC 1531-1544). Critical habitat is a specific geographic area or areas that are essential for the conservation of a threatened or endangered species. The ESA states that all federal agencies *"...shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act"* [Sec. 7(a)(1)]. WS conducts Section 7 consultations with the USFWS to ensure compliance with the ESA and to ensure that *"any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species…Each agency shall use the best scientific and commercial data available"* [Sec. 7(a)(2)]. RSA 217-A, the New Hampshire Native Plant Protection Act, provides protection for native plants as well as endangered and threatened species documented in a list compiled by the NH Natural Heritage Bureau (see Appendix C).

At the State level, the New Hampshire Endangered Species Conservation Act (RSA 212-A) protects wildlife species listed as threatened or endangered. This list includes all species listed under the ESA that occur, as well as other species that were once more prevalent. The NHFG issues limited permits for harassment and incidental take of listed species for the purposes of research and protection of property and human safety.

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.

The USFWS New England Field Office has developed a website[4] that provides up-to-date species occurrence information and provides an outline for action agencies to assist in determining whether consultation for projects are needed under Section 7 of the ESA. More recently, the USFWS has developed the Information, Planning, and Conservation System (IPaC) and website[5] which provide the user an interactive planning and mapping tool for streamlining the environmental review process. WS

[4] The New England Field Office website for endangered species consultation could be found at www.fws.gov/newengland/endangeredspec-consultation.htm during the development of this EA.

[5] The USFWS IPaC website can be found at ecos.fws.gov/ipac

would review these websites and the online measures on a site-by-site basis to determine if any T&E species are located within the project area in order to conclude with a determination of effects.

WS has obtained and reviewed the list of T&E or species of special concern (see Appendix C) designated by the NHFG and the New Hampshire Division of Forest and Lands - New Hampshire Natural Heritage Bureau and has determined that the proposed WS' activities would not likely adversely affect any species listed as vulnerable or threatened and endangered, but consultations with the NHFG would be conducted on a case by case basis. If WS' activities are requested that may be beneficial to species listed by the State as vulnerable, threatened, or endangered by enhancing reproduction or survival of individuals through reduction of harassment, competition, or predation associated with mammals, WS would initiate consultation with the State prior to the start of any action.

Issue 3 - Effects of Management on Human Health and Safety

Risks to human safety associated with employing methods to manage damage caused by target species are often a concern. Both chemical and non-chemical methods have the potential to have adverse effects on human 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 at the highest risk since they administer damage management methods and are subject to workplace accidents. Selection of methods, as part of an integrated approach, includes consideration for public and employee safety.

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 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.

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. 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 identifies the methods that could be used on property owned or managed by the cooperator; and 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 1987), suffering is described as a *"…highly unpleasant emotional response usually associated with pain and distress."* However, suffering *"…can occur without pain…,"* and *"…pain can occur without suffering…"* Because suffering carries with it the implication of a time frame, a case could be made for *"…little or no suffering where death comes immediately…"* (California Department of Fish and Game 1991). Pain and physical restraint can cause stress in animals and the inability of animals to effectively deal with those stressors can lead to distress. Suffering occurs when action is not taken to alleviate conditions that cause pain or distress in animals.

Defining pain as a component in humaneness appears to be a greater challenge than that of suffering. Pain obviously occurs in animals, but assessing pain experienced by animals can be challenging (AVMA 2013, California Department of Fish and Game 1991). The American Veterinary Medical Association 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 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 which 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, livestock and some 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 non-target species, and the environment. IWDM may incorporate

cultural practices (e.g., animal husbandry), habitat modification (e.g., exclusion), animal behavior modification (e.g., scaring), removal of individual offending animals, local population reduction, elimination of invasive species (e.g., feral swine) or any combination of these, depending on the circumstances of the specific damage problem.

The IWDM Strategies Employed by WS

Direct 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 document provide for direct damage management by WS. The initial investigation defines the nature, history, and extent of the problem, species responsible for the damage, and methods available to resolve the problem. 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 conducted 13,658 requests for technical assistance projects that involved mammal damage to property, natural resources, and threats to human safety (see Table 1.1).

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 non-lethal 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 just a written documented process, but a mental problem-solving process common to most, if not all, professions.

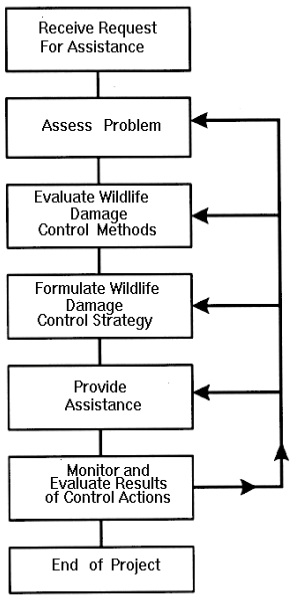

Figure 2.1 WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflicts.

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 non-lethal and lethal methods depending on the alternative selected. WS and other state, tribal and federal wildlife management agencies may facilitate discussions at local community meetings when resources are available.

Requests for assistance to manage damage caused by mammals often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives of the community, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on 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 New Hampshire Department of Agriculture, Markets and Food, 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 Management on Target Mammal Populations

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

- The removal of mammals under the alternatives would only occur when authorized by the NHFG, 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 New Hampshire or even across major portions of the state, would not be conducted with the exception of exotic and/or invasive species.

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

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

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

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

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

- WS has consulted with the USFWS and NHFG 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 NHFG will be implemented to avoid adverse effects on T&E species.

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

- Personnel would be present during the use of live-capture methods or live-traps would be checked frequently to ensure non-target and T&E species are released immediately or are prevented from being captured.

- WS will follow NHFG Administrative Rule: Fis 303.12 which defines trapping restrictions and the use of a lynx exclusion device on body gripping traps when required within the NHFG Canada Lynx Protection Zone to minimize possibly capturing a lynx. The protection zone stretches north of the lakes region from WMU F to WMU A, excluding WMU D2.

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

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

Issue 3 - Effects of Management on Human Health and Safety

- Damage management activities would be conducted away from areas of high human activity. If this is not possible, then activities would be conducted during periods when human activity is low

(*e.g.*, early morning), if possible. 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 would be fully trained 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 NHFG, 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.

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

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).

- WS' use of all traps, snares (cable devices), and other capture devices would comply with WS Directive 2.450.

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 be analyzed in detail in the 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:

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

The no action/proposed action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques, as deemed appropriate using the WS Decision Model, to reduce damage and threats caused by mammals. WS, in consultation with the NHFG, would continue to respond to requests for assistance with 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 mammal damage would integrate the use of the most practical and effective methods to resolve a problem as determined by site-specific evaluation. City/town managers, agricultural producers, property owners, and others requesting assistance would be provided information regarding the use of appropriate non-lethal and lethal techniques. 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 since mammals could be conditioned to an area and are familiar with a particular location. Subsequently, making that area unattractive 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 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 New Hampshire or designated a game species can only legally occur through regulated hunting and trapping seasons, issuance of a wildlife damage permit (NHRSA 541-A) by the NHFG; or through NHRSA 207:26, where an unprotected wild animal which the landowner finds in the act of doing actual and substantial damage to poultry, crops, domestic animals, or the person's property, may authorize a family member, employee, or other person requested lethally remove the animal under the provision of a depredation permit issued by the executive director pursuant to RSA 207:22-c, III. Activities conducted under this alternative would occur in compliance with the New Hampshire General Statutes and the MOU signed between the NHFG and WS.

Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical non-lethal 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 American Veterinary Medical Association (AVMA) for free-ranging wildlife, when administered appropriately (AVMA 2013). On occasion, euthanasia of live-captured mammals would 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 method of euthanasia (AVMA 2013).

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

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

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

Lethal methods would be employed to resolve damage 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. Lethal methods are often employed to reinforce non-lethal methods and to remove mammals that have been identified as causing damage or posing a threat to cause damage. The number of mammals removed from the population 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 damage, and the efficacy of methods employed.

WS may recommend mammals be harvested during the regulated hunting and/or trapping season 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 NHFG.

Alternative 2: Non-lethal Mammal Damage Management Only by WS

Under this alternative, WS would be restricted to only using or recommending non-lethal methods to resolve damage caused by mammals (Appendix B). Lethal methods could continue to be used under this alternative by those persons experiencing damage by mammals without involvement by WS. In situations where non-lethal methods were impractical or ineffective to alleviate damage, WS could refer requests for information regarding lethal methods to the NHFG, local animal control agencies, or private businesses or organizations. Property owners or managers might choose to implement WS' non-lethal 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 MDM. All requests for assistance received by WS to resolve damage caused by mammals would be referred to the NHFG 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 since the lethal removal of mammals to alleviate damage or threats can occur despite the lack of involvement by WS. The lethal removal of mammals could occur through the issuance of NHFG permits or through NHRSA 207:26 when required, and during the hunting or trapping seasons. All methods described in Appendix B would be available for use by those persons experiencing damage or threats except for the use of immobilizing drugs and euthanasia chemicals. Immobilizing drugs and euthanasia chemicals can only be used by WS or appropriately licensed veterinarians.

2.6 ALTERNATIVES AND STRATEGIES NOT CONSIDERED 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:

Non-lethal Methods Implemented Before Lethal Methods

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

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

Use of Lethal Methods Only by WS

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

Trap and Translocate Mammals Only

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

Translocation sites would be identified and have to be pre-approved by the NHFG and the property owner where the translocated mammals would be placed prior to live-capture and translocation. Translocation of all wildlife in New Hampshire requires written permission of landowner where wildlife is to be released as stated by the NHFG (Rule Fis 805.02 Permits To Release Wildlife). Live-capture and translocation could be conducted as part of the alternatives analyzed in detail. When requested by the NHFG, 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 NHFG, this alternative was not considered 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. 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 Northcentral Illinois, raccoons were trapped, relocated, and 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, depending on the mammal causing damage, hundreds of mammals might need to be captured and translocated to solve some 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 wildlife diseases by moving wildlife from one location to another.

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

Under this alternative, the only method available to resolve requests for assistance would be the recommendation and the use of reproductive inhibitors to reduce or prevent reproduction in mammals responsible for causing damage. Reproductive inhibitors are often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et al. 1997). Use and effectiveness of reproductive control as a wildlife population management tool is limited by population dynamic characteristics (*e.g.*, longevity, age at onset of reproduction, population size and biological/cultural carrying capacity), habitat and environmental factors (*e.g.*, isolation of target population, cover types, and access to target individuals), socioeconomic, and other factors.

Currently, no reproductive inhibitors are available for use to manage most mammal populations. Also, the use of reproductive inhibitors is prohibited in New Hampshire under NHFG RSA 207:8-c which states, "No person shall administer any drug, including but not limited to drugs used for fertility control, disease prevention or treatment, immobilization, or growth stimulation, to any mammal, bird, reptile, or amphibian under the jurisdiction of the fish and game department without the written authorization from the executive director." RSA 207:8-c also states that a drug shall not be administered by any person for fertility control or growth stimulation without the written authorization of the executive director. Given the lack of availability of chemical reproductive inhibitors for the management of most mammal populations, this alternative was not evaluated in detail.

Compensation for Mammal 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.

- 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 state agencies, such as the NHFG, 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. The circumstances surrounding the lethal removal of animals are typically arbitrary and completely unregulated because it is difficult or impossible to ensure animals claimed for bounty were not lethally removed from outside the area where the damage occurred. Also, MDM often targets problem individuals or groups of individuals and establishment of a bounty may not resolve conflicts created by those individuals. In addition, WS does not have the authority to establish a bounty program.

Trap-Neuter-Release Program for Feral and Free Ranging Cats

This topic has undergone considerable debate in animal welfare and scientific communities for a number of years. The debate focuses on whether controlling feral, free-ranging, or invasive animal populations through Trap-Neuter-Release (TNR) programs, 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 invasive species in the wild with this technique is not currently reasonable, especially with the animals being self-sufficient and not relying on humans to survive. Additionally, some individuals within a population can be trap-shy. Capturing or removing trap shy individuals often requires implementing other methods.

In addition, the National Association of State Public Health Veterinarians and the AVMA oppose TNR programs based on health concerns and threats (AVMA 2016). 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.

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, AVMA 2016). Animals subjected to TNR would continue to cause the same problems[7] 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.

[7] 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.

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.

Issue 1 - Effects of Management on Target Mammal Species Populations

Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No 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 operational assistance where an integrated approach to methods would be employed and/or recommended. Non-lethal methods can disperse or otherwise make an area unattractive to mammals causing damage; thereby, reducing the presence of mammals at the site and potentially the immediate area around the site where non-lethal methods are employed.

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

non-lethal methods would not have adverse impacts on mammal populations under any of the alternatives.

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. Lethal methods are often employed to reinforce non-lethal methods and to remove mammals that have been identified as causing damage or posing a threat to human safety. The use of lethal methods would result in local reductions of mammals in the area where damage or threats were occurring. The number of mammals removed from the population using lethal methods would be dependent on the number of requests for assistance received, the number of mammals involved with the associated damage or threat, 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 NHFG. 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 removal that could occur by WS under the alternatives or recommended by WS.

Generally, WS only conducts damage management on species whose population densities are high or concentrated 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, and estimated annual harvest by hunters and trappers within New Hampshire for 2012-2016. No indirect effects were identified for this issue.

Raccoons

Raccoons are distributed throughout New Hampshire. Absolute raccoon population densities are difficult or impossible to determine because of the difficulty in knowing the percentage of the population that has already been counted or estimated and the additional difficulty of knowing how large an area the raccoons are using (Sanderson 1987). Population estimates for raccoons are not available. A population estimate will be derived based on the best available information for raccoons to provide an indication of the magnitude of removal proposed by WS to alleviate damage and threats of damage. If raccoons were only found on 50% of the land area of the state and using densities of 10 to 80 raccoons per mi^2 (Riley et al. 1998), the population could range from 24,225 to 193,790 raccoons.

The statewide population has been estimated to range from 34,847 to 185,848 raccoons in New Hampshire (USDA 2009). The average raccoon density in Coos County, New Hampshire in 2001, 2002, and 2011 was 3.9 raccoons per square kilometer. Additionally, the furbearer management program with the NHFG relies on trapper data to monitor furbearer populations. Furbearer population trends are monitored by trapper catch rates. More specifically, trapper catch per unit effort data (catch per 100 trap nights) are used as species-specific population indices. Based on data from the NHFG, raccoon population values remained relatively stable and were well within historic norms ranging from 1.60 catch per 100 trap nights in 2016-2017 to 2.72 in 2015-2016 (NHFG 2018b).

Raccoon are managed by the NHFG as a furbearer game species and may be trapped from October 15 through December 31 or November 1 through January 15 depending on the State Wildlife Management

Unit. Additionally, raccoons may be hunted from September 1 through March 31. There is no daily or season harvest limit for either trapping or hunting raccoons (NHFG 2018a). Moreover, in damage situations, property owners, dwelling occupants, farmers, and their agents, may remove raccoons with no permit required, via lawful procedures to alleviate damage to property, agricultural resources (including livestock, crops, or poultry), and other resources.

Table 3.1 - Quantitative impacts of lethal removal for selected species in New Hampshire.

Species	Average Annual WS Removal 2014-2018 year Average[a]	Maximum Proposed WS Annual Removal[a]	NH Statewide Average Annual Estimated Season Harvest/Take 2013-2018[b]	Minimum NH Estimated Population	% WS Proposed Annual Removal Compared to Minimum NH Estimated Population	% WS Proposed Annual Removal Compared to Average Annual NH Harvest
Beaver	3.2	500	3,029	25,476	1.96%	16.51%
Black Bear	0	30 or less	815	5,800	0.52%	3.68%
Bobcat	0	10 or less	0	1,100	2.73%	n/a*
Coyote	1.6	100	492	2,238	4.46%	20.33%
Eastern Chipmunk	0.2	100	n/a*	n/a*	n/a*	n/a*
Eastern Cottontail	0	100	n/a*	88,481	0.11%	n/a*
Eastern Gray Squirrel	0	100	n/a*	n/a*	n/a*	n/a*
Moose	0	10 or less	59	2,900	0.34%	16.94%
Feral/Free Range Cat	0	50	n/a*	n/a*	n/a*	n/a*
Feral/Free Range Dog	0	5	n/a*	n/a*	n/a*	n/a*
Feral Swine	3.2	500	n/a*	n/a*	n/a*	n/a*
Fisher	0	30 or less	150	n/a*	n/a*	20%
Gray Fox	0	30 or less	120	n/a*	n/a*	25%
Long-tailed Weasel	0	30 or less	n/a*	n/a*	n/a*	n/a*
Mink	0	30 or less	194	n/a*	n/a*	15.46%
Muskrat	0.2	250	1,532	486,476	0.05%	16.32%
North American Porcupine	0	30 or less	n/a*	n/a*	n/a*	n/a*
Northern Flying Squirrel	0	100	n/a*	n/a*	n/a*	n/a*
Norway Rat	0	500	n/a*	n/a*	n/a*	n/a*
Pine Marten	0	10 or less	0	n/a*	n/a*	n/a*
Raccoon	1.4	250	686	34,847	0.72%	36.44%
Red Fox	2.8	50	205	6,034	0.83%	24.39%
Red Squirrel	0	100	n/a*	n/a*	n/a*	n/a*
River Otter	0	30 or less	259	n/a*	n/a*	n/a*
Short-tailed Weasel	0	30 or less	n/a*	n/a*	n/a*	n/a*

[a]Data only includes lethal removal

[b]Five-year average for furbearers includes nuisance wildlife control operator (NWCO) take and trapper harvest data from trapping season 2013-14, 2014-15, 2015-16, 2016-17, and 2017-18.

*Estimates currently unavailable.

Table 3.1 Continued - Quantitative impacts of lethal removal for selected species in New Hampshire.

Species	Average Annual WS Removal 2014-2018 year Average[a]	Maximum Proposed WS Annual Removal[a]	NH Statewide Average Annual Estimated Season Harvest/Take 2013-2018[b]	Minimum NH Estimated Population	% WS Proposed Annual Removal Compared to Minimum NH Estimated Population	% WS Proposed Annual Removal Compared to Average Annual NH Harvest
Snowshoe Hare	0	30 or less	n/a*	n/a*	n/a*	n/a*
Southern Flying Squirrel	0	100	n/a*	n/a*	n/a*	n/a*
Striped Skunk	4.8	250	780	26,000	0.96%	32.31%
Virginia Opossum	0.6	100	n/a*	4,060	2.46%	n/a*
White-Tailed Deer	0.2	200	11,866	85,000	0.24%	1.69%
Woodchuck	30.6	600	n/a*	474,065	0.13%	n/a*
Feral rabbit	0	30 or less	n/a*	n/a*	n/a*	n/a*
Bats	0	40 or less	n/a*	n/a*	n/a*	n/a*
Misc. mice, shrews, moles & voles	7.4	1,500 combined	n/a*	n/a*	n/a*	n/a*

[a]Data only includes lethal removal
[b]Five-year average for furbearers includes NWCO take and trapper harvest data from trapping season 2013-14, 2014-15, 2015-16, 2016-17, and 2017-18.
*Estimates currently unavailable.

Average annual harvest estimates for raccoon by New Hampshire recreational trappers from seasons 2013-14 through 2017-18 and take by Nuisance Wildlife Control Operators (NWCOs) outside the open trapping season for those years are shown in Table 3.1. Trappers had a five-year average annual harvest rate of 441 raccoons whereas, NWCOs averaged a take of 245 per year. Reported harvest of raccoons during the trapping seasons is based on estimates from trapping questionnaires. Often the number of individuals harvested annually for fur is often a function of the value of pelts with harvest increasing as fur prices increase and harvest declining as fur prices decline. Hunter harvest numbers in the state are not known for raccoons and therefore not included in the season harvest estimate.

In future programs, WS may be requested to address damage caused by raccoons anywhere in New Hampshire to protect resources or human health and safety. Activities might target single animals or local populations of the species at sites where their presence was causing unacceptable damage to agriculture, human health, natural resources, or property. Some local populations may be temporarily reduced if raccoons are lethally removed. Based upon an anticipated increase for requests for WS' assistance, up to 250 raccoons could be lethally removed by WS annually to alleviate damage, including raccoons that may be lethally taken during post-bait trapping activities associated with the ORV distribution program for rabies.

Direct, Indirect, and Cumulative Effects:

Using the lowest population estimate of 34,847 raccoons, the removal of 250 raccoons would represent 0.7% of the population. This level of removal is considered to be a low magnitude. Given that the actual

population is much higher than the low estimated population and estimated annual harvest, WS' removal is an even lower magnitude of the statewide population.

The unlimited harvest levels allowed by the NHFG during the length of the hunting and trapping seasons provides an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the raccoon population would occur resulting in an undesired population decline. The NHFG has regulatory authority over the management of wildlife, including raccoons, and all removal by WS has occurred and would continue to occur only after authorization by the NHFG. The NHFG's oversight of WS, hunting/trapping seasons, and NWCOs or private pest control operator removal would ensure that the cumulative removal would not have a negative impact on the overall raccoon population.

Coyotes

Coyotes are distributed throughout New Hampshire and the NHFG has established a year round hunting season and a four month trapping season with no observed bag limits. Also, coyotes may be taken without a license on private land if the animal is in the act of causing damage or a damage threat. Coyotes are probably the most extensively studied carnivore, and considerable research has been conducted on population dynamics. Data from scent-station indices suggest that density increases from north to south. Coyote densities as high as 2/km^2 (5/mi^2) have been reported in the southwestern and west-central U.S., but are lower in other portions of the country including eastern North America, although few studies have accurately determined densities (Voigt and Berg 1987).

The average home range (the area an animal occupies, as opposed to its territory which is the area it defends) of a coyote in surrounding states varies drastically (2.2 –43.5 mi^2) (Mastro 2011). The number and density of coyotes on the landscape is primarily a function of food abundance on the landscape (Gier 1968, Clark 1972) mediated by social dominance and territoriality (Knowlton et al. 1999). The population density of coyotes in the greater mid-Atlantic region has been reported as ranging from 0.26 coyotes (New York) to 3.88 coyotes per square mile (South Carolina) (Schrecengost 2007, Frair et al. 2014). Using a coyote population density of 0.26 to 3.88 coyote/mi^2 and the total area of New Hampshire of 8,953 mi^2 (U.S. Census Bureau 2017), a statewide coyote population could be estimated at 2,328 to 34,738 coyotes.

Direct, Indirect, and Cumulative Effects:

To provide for a reasonable margin of error, this document will utlilize a population density of the lowest estimated population density determined by Frair et al. (2014). Using the lowest estimated population (0.26 coyotes/mi^2) the statewide coyote population would be estimated at 2,238 coyotes. In New Hampshire, the NHFG has no closed hunting season on coyotes and an unlimited harvest for both hunting and trapping seasons, which provides an indication the population of coyote is not likely to decline from overharvest. The permitting of the removal by the NHFG ensures removal would occur within population objectives established by theNHFG. Although the number of coyotes lethally taken in the state during the annual hunting season is unknown, 492 coyotes were removed annually (2013-2017) through combined efforts by recreational trappers and NWCOs (NHFG 2018b). WS proposes to remove no more than 100 coyotes annually to alleviate damage which would represent 4.46% of the estimated minimum statewide population.

Coyote populations can withstand a harvest of up to 70% of the population annually (Connolly and Longhurst 1975). Therefore, no significant cumulative impacts are expected when WS' removal is added to the average annual sportsman harvest. Based on the limited proposed removal by WS and the fact that the NHFG allows for unlimited harvest of coyotes, WS' activities are unlikely to have any significant

effects on statewide coyote populations. The unlimited harvest levels allowed by the NHFG during the length of the trapping and hunting seasons provide an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the coyote population would occur resulting in an undesired population decline. The NHFG's oversight of WS, annual trapping seasons, and NWCO removal would ensure that the cumulative removal would not have a negative impact on the overall coyote population.

Feral/Free Ranging Dog

Feral and free-roaming dogs are rare in New Hampshire due to RSA 466:30: *It is unlawful for any dog to run at large, except when accompanied by the owner or custodian, and when used for hunting, for guarding, working, or herding livestock, as defined in RSA 21:34-a, II(a)(4), for supervised competition and exhibition, or for training for such. For the purpose of this section, "accompanied" means that the owner or custodian must be able to see or hear, or both, or have reasonable knowledge of where the dog is hunting, where training is being conducted, where trials are being held, or where the dog is guarding, working, or herding livestock. Nothing herein provided shall mean that the dog must be within sight at all times.*

Free-ranging dogs can be either strays, abandoned or lost dogs without known owners, or dogs with owners that are either intentionally allowed to roam free or that have escaped from their property or their owner's immediate control. Feral or free-ranging domestic dogs can create a variety of problems. They may attack and/or kill livestock, poultry or pets. They may harass or kill native wildlife such as deer, rabbits, or T&E birds such as piping plovers (Lowry 1978, Green and Gipson 1994).

Domestic dogs may also access airports and create a threat to aviation safety. WS has not received any requests for assistance associated with domestic dogs in New Hampshire previously. However, WS in other northeastern States have had to capture free ranging dogs found roaming loose at airports. In New Hampshire, each town has either an animal control officer or multiple towns share a regional animal control officer, these officers have primary responsibility for managing issue regarding domestic dogs. However, if WS encounters feral or free-ranging domestic dogs either as a primary target or while conducting other control operations, all reasonable attempts would be made to capture the dog(s) and turn them over to local animal control or shelter. If capture is not possible, information on the dog(s) would be provided to the local animal control officer. WS would not intentionally lethally remove feral or free-ranging domestic dogs in New Hampshire. It is anticipated that no more than five feral or free-ranging dogs could be lethally taken in an emergency situation or if specifically authorized by the NHDAMF.

Free Ranging/Feral Cat

Free-ranging cats are socialized and can be strays, lost or abandoned pets, or pets with homes that are allowed to roam outside. Feral cats, in contrast, are not socialized to humans and are traditionally not kept as pets. 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 New Hampshire are currently available. Feral cats are considered a non-native species that often have adverse effects on native wildlife. Feral cats live-captured would be relinquished to the shelter and made available for adoption, if appropriate. For example, NH WS has assisted the NHFG and the USFWS with protecting nesting State-endangered piping plovers by

cage trapping feral cats and transferring the animals to designated shelters or organizations. 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 removal would occur and would not reach a magnitude where a decline in the feral cat population in the state would occur. Some local populations may be temporarily reduced as a result of live-capturing and removing feral cats at a local site. In those cases where feral cats are causing damage or are a nuisance and complete removal of the local population could be achieved, this would be considered as providing a benefit to the native environment since feral cats are a non-native species.

In future programs, WS may be requested to address damage or threats to human health and safety caused by free-ranging or feral cats anywhere in New Hampshire and to protect any resource being damaged or threatened. Cats, including feral and free-ranging cats, are not regulated by the NHFG, but are regulated by the NHDAMF Animal Population Control Program under New Hampshire General Laws (RSA 437). Control efforts by WS would typically be limited to live-trapping, primarily using cage traps, with subsequent transport and transfer of custody to a local animal control officer or state licensed animal shelter. In some circumstances, such as at airports or after a human bite which could result in exposure to rabies, WS may euthanize or use firearms to lethally removal free ranging/feral cats with the prior authorization of the NHDAMF. Feral cats would be removed in projects aimed at protecting human safety and alleviating damage or threats of damage to agricultural resources, property, and natural resources.

Direct, Indirect, and Cumulative Effects:

The limited live-removal of up to 50 feral cats would not adversely affect the cat population in New Hampshire even though they are an invasive 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' removal of feral cats to reduce threats at the facility would comply with Executive Oder 13112.

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 New Hampshire are 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 (DHHS 2016), 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 mammal strikes. Of the 3,572 reported terrestrial mammal strikes from 1990 to 2015 in the United States, 28.4% involved white-tailed deer with an estimated $45,749,554 in damages (Dolbeer et al. 2016).

The NHFG has estimated the statewide deer population at 100,000. White-tailed deer are classified as a big game animal in New Hampshire with annual hunting seasons. The number of deer the NHFG allows to be harvested by individual hunters during the length of the hunting season varies. However, at the time this EA was developed, up to three deer could be harvested by a hunter annually not including lottery

opportunities in Management Units M and L. During the 2018 hunting season, the NHFG reported that 14,075 deer were harvested, with an average of 11,866 deer harvested in the past five years (NHFG 2018b).

The authority for management of resident wildlife species is the responsibility of the NHFG which collects and compiles information on white-tailed deer population trends and harvest and uses this information to manage deer populations. The primary tool for the management of deer populations in New Hampshire is through adjusting the allowed lethal removal during the deer harvest season. The NHFG provides commercial agriculturalists with a minimum annual gross income of $2,500 and an actual or potential loss of this income from their cultivated agricultural crops the opportunity to reduce damage caused by deer when the firearms deer hunting seasons are closed under the Deer Crop Damage Permit Program. These permits are issued pursuant to NHFG Sections Fis 304.02, 304.03 and 304.04. Additionally, the NHFG may issue permits to allow removal of deer outside of established seasons in areas with unique deer management needs, such as airports (Section 304.07).

Although WS only removed one deer from 2014 to 2018, forecasted requests for service may result in the increased need to remove deer. WS received 925 requests for technical assistance from FY 2014-2018. All deer removal efforts would be authorized by the NHFG. Higher levels of deer removal would be most likely to occur in situations where there is a disease outbreak such as the detection of chronic wasting disease or bovine tuberculosis in deer, or where there is a need to remove/reduce high concentrations of deer from an airport, island or residential area.

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 200 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 the NHFG to assist with control or disease surveillance and sampling, as well as 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. Any involvement with the depopulation of deer confined inside a perimeter fence by WS would be at the request of the NHFG, NHDAMF and/or the NHDHHS. In those cases where WS is requested to assist with the removal of a captive deer herd, the removal would not exceed 200 deer for purposes of disease monitoring or surveillance. Deer confined inside perimeter fences for the purposes of non-traditional farming are not included in statewide deer population estimates. However, since removal of deer by WS for disease surveillance or monitoring could occur in free-ranging or captive herds, the potential removal of up to 200 deer for disease surveillance and monitoring by WS would be considered as part of the impact analysis on the statewide free-ranging deer population.

With a population estimated at 85,000 individuals, WS' possible removal of 200 deer would represent 0.25% of the estimated population. If WS' possible removal is combined with the estimated removal of deer during the regulated hunting seasons, cumulative removal would represent 14.2% of the estimated deer population.

With oversight of the NHFG, the magnitude of removal of deer by WS annually to resolve damage and threats would be low. The proposed removal of up to 200 deer by WS would not have a negative impact on the overall deer population in the State or the ability of hunters to harvest deer.

Feral Swine

Feral swine, also known as "*wild pigs,*" "*wild boars,*" and "*feral hogs,*" are medium to large sized hoofed mammals, and in some cases may look similar to domestic swine. Feral swine are the most prolific wild mammal in North America. Given adequate nutrition, a feral swine population can reportedly double in just four months (Barrett and Birmingham 1994) and may begin to breed as young as four months of age (Mayer and Brisbin 2009). Swine can breed throughout the year, typically producing one litter of three to eight piglets a year, but feral swine often produce two litters a year (West et al. 2009). Feral swine are found in variable habitat in most of the United States, with the highest densities occurring in the southern United States. Feral swine populations are usually clustered around areas with ample food and water supplies and 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).

Damage and disease threats may be addressed by the WS program in response to requests by federal agencies, state agencies, municipal agencies, or the public at any location in the state. Agricultural producers may request assistance with managing damage to standing crops or disease threats to domestic livestock. Natural resource managers may request assistance to protect natural areas, parks or recreation areas, or T&E species. Public health agencies may request assistance in reducing feral swine densities to prevent transmission of diseases to people.

Feral swine are a non-native species that are negatively affecting resources and causing extensive damage. Feral swine have no legal game status but are considered escaped private property and may only be hunted with permission by said property owner. Since 1949, feral swine have been defined in the state as animals "*Running at Large*" under RSA 467:3. Historically, feral swine populations have been either Eurasian wild boar or hybrids. Reports of feral swine have been documented as early as 1895 and continue today statewide, but are primarily found in Grafton, Sullivan, and Cheshire Counties. Although it is difficult to estimate the number of feral swine, the number of damage complaints and sightings has increased since 2009.

Activities would occur only when a request for assistance was received and a CSA, MOU, or comparable document had been signed by a cooperating agency or agencies and the property owner or property manager. Although the NHFG does not regulate the harvest of feral swine, any reduction in the feral swine population would be a collaborative effort. WS has the potential to work cooperatively with the NHFG, the NHDAMF, Veterinary Services (VS), and the Blue Mountain Forest Association (formerly Corbin Park) on the management of feral swine damage and threats to human, livestock and wildlife health from feral swine.

Direct, Indirect, and Cumulative Effects:

Although harvest records are not kept in the State, opportunistic hunters are thought to remove five to 50 feral swine annually. In addition to those feral swine harvested by hunters, WS has also been requested to assist with reducing damages associated with feral swine. WS employed lethal methods to alleviate damages and removed and/or assisted with the removal of 65 feral swine between FY 2010 and FY 2018. Based on previous requests for assistance and in anticipation of receiving additional requests for assistance in the future, WS anticipates that up to 500 feral swine could be removed annually in the State to alleviate damage or threats of damage.

Feral swine are a non-native species and not an essential component of native ecosystems and have negative impacts on the environment. Consequently, any reduction in feral swine populations would be

considered beneficial. Long-term objectives of the involved cooperators would include the suppression or complete removal of feral swine. Therefore, WS proposes to remove 500 feral swine annually statewide would occur within the management objectives of the NHFG and the NHDAMF. All activities to manage feral swine would be conducted by working with property owners of animals "*Running at Large*" pursuant to RSA 467:3 and from the direction of the NHFG and the NHDAMF, as well as additional affected cooperators.

To address any future requests for assistance associated with feral swine, the WS-New Hampshire Program may use any legal methods among those outlined by the APHIS National Feral Swine Damage Management Program as suitable for feral swine damage management to ensure that feral swine do not become established in New Hampshire. Feral swine damage management could involve a number of non-lethal and lethal strategies. Non-lethal methods such as fencing or using guard animals to protect livestock or property might be utilized, but in most cases are more expensive and less practical than lethal methods. The primary management method used would be live-capture/trapping which is the most effective and efficient means and would include the use of corral, box, cage style traps, drop traps, as well as wireless triggered trap designs. Cage trap designs may be constructed as a rectangular enclosure made of heavy-gauge wire livestock panels welded to angle iron or square tube framing which can be more easily transported. A corral trap can be designed to be stationary and easily expanded due to heavy gauge wire panels being attached to posts driven into the ground. Feral swine captured using live-capture methods would be subsequently euthanized pursuant to WS Directive 2.505 or in cases where the animal is a pet or raised for the purpose of agricultural production, WS would transfer custody of the animal to Animal Control within the county of capture. 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 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' lethal removal of feral swine would comply with this Executive Order.

In addition, feral swine could be fitted with a radio ear tag, radio collar or satellite-tracking device and released. Feral swine are social and will often locate other swine in the area once released. The tracking of feral swine movements can assist with locating other groups of feral swine responsible for causing damage and to understanding their movement patterns. Understanding movement patterns of feral swine can be used to more effectively apply methods and alleviate damage.

Beaver

Beavers are numerous in New Hampshire today and populations were at carrying capacity in 1955 after almost being eliminated from the state by over trapping in the late 1800's (NHFG 2015). Beavers occur mostly in family groups that are comprised of two parents with 2-6 offspring from the current or previous breeding season. Average family group size has been documented as ranging from 3.0 to 9.2 (Novak 1987). 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 managed by the NHFG as a furbearer game species and may be trapped from October 15 or November 1 through April 10 depending on the State Management Unit (NHFG 2018a). There is no limit on the number of beaver that can be harvested during the trapping season. The NHFG furbearer management program relies on trapper data to monitor furbearer populations. Furbearer population trends are monitored by trapper catch rates. More specifically, trapper catch per unit effort data (catch per 100

trap nights) are used as species-specific population indices. The reliance on catch per unit effort data as a population index is based on the widely held view that trapper efficiency is a function of species abundance. Based on data from the NHFG, beaver population values remained relatively stable and were well within historic norms ranging from 4.71 in 2012-2013 to 7.33 in 2016-2017 (catch per 100 trap nights; NHFG 2018b).

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. WS anticipates an increase in the need to address damage and threats associated with beaver at airports, on federal, state, municipal and private property, landfills, along road and railways, and to protect T&E species from beaver flooding, tree felling, and habitat manipulation. In addition, WS could manipulate the water levels impounded by beaver dams by removing, breaching, or installing water flow devices.

The intent of most dam removal operations is not to drain old established wetlands. With few exceptions, requests from public and private individuals and entities that WS receives involve dam removal 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 are conducted primarily on small watershed streams, tributary drainages and ditches. These activities can be described as small, exclusive projects conducted to restore water flow through previously existing channels. In the majority of instances, beaver dam removal is accomplished by manual methods. In some instances binary explosives are utilized to breach dams. WS personnel do not utilize heavy equipment such as trackhoes or backhoes for beaver dam removal. Only the portion of the dam blocking the stream or ditch channel is breached. In some instances, WS activities involve the installation of structures to manage water levels at the site of a breached beaver dam.

From 2014-2018, WS lethally removed 16 beaver and provided technical assistance for 594 requests. However, requests for assistance related to beaver damage continue to rise with more than a 100 complaints annually.

Based on the best available information on beaver densities and wetland habitat within the State, beaver maintain sufficient densities to allow for annual trapping seasons, which permit an unlimited number of beaver to be harvested during the open season. Between the 2013-14 and 2017-18 trapping seasons, 8,948 beavers were harvested by recreational trapping in New Hampshire with an average of 1,790 beaver harvested annually (NHFG 2018b). The fluctuating trend of beaver harvested annually is likely more of a function of declining fur values rather than indicating a declining population trend. The number of individuals harvested annually for fur is often a function of the value of pelts with harvest increasing as fur prices increase and harvest declining as fur prices decline. In addition to recreational trapping, an average of 1,239 beaver were taken annually the past five years by NWCOs outside the open trapping season (Kent Gustafson, NHFG, personal communication). When combined, licensed trappers and NWCOs have accounted for an average of 3,029 beaver.

Beaver can be found in watersheds across the state of New Hampshire; however, no population estimates are available. Therefore the best available information was used to estimate statewide populations. The National Wetlands Inventory of the USFWS estimated there is 290,000 acres of wetlands in New Hampshire, whereas, the National Resource Conservation Service (NRCS) determined an estimate of 576,386 acres (Tiner 2007). New Hampshire also has an estimated 16,984 miles of rivers and streams statewide (NHDES 2015). 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 population estimate for New Hampshire could be estimated at 25,476 beavers. This estimate could be

considered a minimum population estimate.

Direct, Indirect, and Cumulative Effects:

The WS removal of 500 beaver would represent 1.96% of the estimated statewide population. WS' removal combined with the average recreational trapper and NWCO harvest of 3,029 would represent 13.85% of the statewide population. The unlimited trapper harvest allowed by the NHFG during the length of the trapping season provides an indication that cumulative removal, including removal for damage management, would not reach a level where overharvest of the beaver population would occur resulting in an undesired population decline. The NHFG's oversight, trapping seasons and NWCOs would ensure that the cumulative removal would not have a negative impact on the overall beaver population. Based on the best scientific data, WS proposed take level will have no adverse direct or cumulative effects on beaver populations.

Woodchuck

Woodchucks (also known as groundhogs or whistle pigs) are found throughout much of the eastern and Midwestern U.S., with distribution across New Hampshire. 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 2006a). The NHFG is responsible for the management of the state's woodchuck population but does not conduct determine population annually for woodchucks or estimate hunter harvest. There are no restrictions on the harvest of woodchuck in New Hampshire meaning they can be hunted 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, or causing human health and safety issues, and may be legally hunted. The NHFG has no annual reporting requirements for woodchucks (NHFG 2018a). Woodchuck population trends are unknown.

Gas cartridges may be employed to fumigate woodchuck burrows in areas where damages are occurring. Gas cartridges act as a fumigant by producing carbon monoxide when ignited. The cartridges contain sodium nitrate, which when burnt, produces carbon monoxide gas. The cartridges 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 burrow systems used by woodchucks varies. Twichell (1939) found the number of entrances to burrow systems used by woodchucks ranged from two to six entrances in Missouri with the average number being 2.8 entrances. Other studies note the number of entrances per burrow system ranged from one to five entrances (Grizzell, Jr. 1955) to high of 11 entrances per system (Merriam 1971). Merriam (1971) found the mean number of entrances per burrow system was 2.98 entrances. 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 of woodchucks that could be lethally taken using gas cartridges could be estimated at approximately 333 woodchucks if 500 entrances were treated (500 burrow entrances / 3 entrances per borrow system = number of burrow systems x 2 individuals' per burrow system). The

removal of woodchucks would also occur using other methods, such as shooting, live traps, cable restraints and body-gripping traps. WS received 1,025 requests (average = 205/yr.) for assistance regarding woodchuck damage during FY 2014-2018. 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 removal, excluding the use of gas cartridges, was 31 animals annually (Table 3.1). The average number of burrows treated using gas cartridges was 213, with an estimated 118 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, WS could kill up to 600 woodchucks per year.

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 474,065 acres of currently active farmland in the state (NASS 2012). Based on Fergus (2006a), 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 474,065 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 474,065 woodchucks is likely low.

Direct, Indirect, and Cumulative Effects:

Based upon the above information and a proposed removal of 600 by WS, would represent 0.1% of the minimum statewide populations, and have no adverse impacts on overall woodchuck populations in New Hampshire. Woodchuck damage management activities would target single animals or local populations of the species where their presence is causing unacceptable damage to agriculture, human health or safety, natural resources, or property (i.e., airports, private property, or industrial operations). Some local populations may be temporarily reduced as a result of damage management activities conducted under the proposed action alternative aimed at reducing damage at a local site. The unlimited harvest of woodchucks, as regulated by NHFG provides an indication that densities are sufficient that overharvest is unlikely to occur.

Eastern Cottontail

Eastern cottontails are not distributed 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. Eastern cottontails are rarely found in dense forest or open grasslands, but fallow crop fields may provide suitable habitat. Within these habitats, rabbits spend their entire lives in an area of 10 acres or less. Occasionally they may move a mile or so from a summer range to winter cover or to a new food supply. In suburban areas, eastern cottontails are abundant and may occupy any "*empty*" habitat created when other rabbits are removed. Population densities vary with habitat quality, but 1 rabbit per 0.4 hectares (1 acre) is a reasonable average (Craven 1994). Eastern cottontails live 12 to 15 months, but are very prolific. Eastern cottontails can raise as many as six litters per year of one to nine young (usually four to six), with a gestation period of 28 to 32 days. If no young died, a single pair together with their offspring could produce 350,000 rabbits in five years (National Audubon Society 2000).

No population estimates are available for eastern cottontails in New Hampshire. Based on Census of Agriculture data for New Hampshire, there is 474,065 acres of land in farms (NASS 2012). Since eastern

cottontail populations appear to be distributed in the southern part of the State (Probert and Litvaitis 1996, DeGraff and Yamasaki 2001), Chesire, Hillsborough, Strafford, and Rockingham County data was analyzed. Using the conservative assumption that 50% of the land area in farms for those counties (177,682 acres) has sufficient habitat to support rabbits, home ranges do not overlap, and densities average one rabbit per acre (Craven 1994), a statewide population could be estimated at 88,841 rabbits. The population of rabbits is likely higher than given that they can occur at higher densities. Therefore, the population estimated at 88,481 rabbits would be considered a minimum population estimate.

The range of eastern cottontails (an introduced species in New England) remains fragmented and limited in New Hampshire with populations confined to southern part of the State. Eastern cottontails are considered a small game species by the NHFG and can be harvested in specific southern Wildlife Management Units during the regulated hunting season in the fall and winter, as well as a falconry season, with a daily bag limit of two cottontails and no season limit (NHFG 2018a). Certain areas in the southeast portion of the state are closed to the taking of eastern cottontails to protect remnant New England cottontail populations. The number of eastern cottontail rabbits harvested annually during the hunting season is currently unknown.

Eastern cottontail 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. Eastern cottontails also serve as prey attractants to raptors and mammalian predators that may pose serious threats to aircraft safety. Typically, removal is associated with small mammal trapping surveys at airports or with operational prey base management activities to reduce hazards created by avian or mammalian predators in the aircraft operations area.

New England Cottontail

The New England cottontail is the only native cottontail that occurs in the state and only found in small areas of southeastern New Hampshire. According to the NHFG, the New England cottontail is reported to occur in 13 towns. This species has experienced population declines throughout much of its range due to the competition for resources with the more abundant eastern cottontail and from loss of habitat. It is currently listed in New Hampshire as a State Endangered Species. The New England cottontail is virtually indistinguishable from the eastern cottontail by visual field marks. Closure areas have been established for taking eastern cottontails in certain areas to protect New England cottontail populations. Information regarding the closure area can be found through the following link: http://www.wildlife.state.nh.us/hunting/small-game-cottontail.html. Within the New England cottontail closure area, WS will consult with NHFG prior to performing wildlife damage management activities that may impact New England cottontail.

Direct, Indirect, and Cumulative Effects:

Based on the number of airports that have requested assistance from WS previously and potential requests to manage damage or monitor for disease, WS could lethally remove up to 100 eastern cottontails (not New England cottontails) annually to alleviate damage or threats of damage. If the population of eastern cottontail rabbits remains at least stable, WS' removal of up 100 eastern cottontails annually would represent 0.1% of the minimum estimated statewide population of 88,481 rabbits. Damages and threats of damages associated with eastern cottontails most often occur in urban/suburban areas and at airports where hunting is restricted or not allowed. Studies show that even if hunters harvest as many as 40% of the eastern cottontails available in autumn, the population the following year would not be adversely affected because of their tremendous reproductive potential (Fergus 2006b). Therefore, WS' proposed removal would not adversely affect the ability to harvest eastern cottontail rabbits during the annual regulated hunting season or result in adverse cumulative impacts to the statewide population.

Muskrat

This species is considered widespread and very common throughout most of the state. Muskrats will 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 as a furbearer by the NHFG with annual both trapping and hunting seasons occurring from October 15 through April 10 or November 1 through April 10 depending on the State Wildlife Management Unit (NHFG 2018a). The NHFG allows an unlimited number of muskrats to be harvested during the open season. In damage situations, property owners, dwelling occupants, farmers, and their agents, may kill muskrats via lawful procedures to alleviate damage to property, human health and safety and other resources. From 2013 through 2018, the previous five trapping seasons with harvest data available, the number of muskrats harvested annually in New Hampshire under trapper reports ranged from 528 to 1,743 for an average of 1,494 annually (NHFG 2018b). The fluctuating trend of muskrat harvested is likely more of a function of declining fur values rather than indicating a declining population trend. The number of individuals harvested annually for fur is often a function of the value of pelts with harvest increasing as fur prices increase and harvest declining as fur prices decline. Licensed trappers and NWCOs have accounted for an average of 1,532 muskrat over the past five years (Kent Gustafson, NHFG, personal communication).

No population estimates are available for muskrat in New Hampshire. Muskrat population densities have been reported at 48 muskrat per km in the Ware River watershed in Massachusetts and as low as 23 per km in Pennsylvania (Brooks and Dodge 1986) and Chulick (1979) reported 40 muskrats per km in streams adjacent to agricultural fields. Hunt (1986) estimated that muskrats inhabited 98,136.3 ha (242,500 acres) of 449,079.7 ha (21.85%) of wetlands in Maine, and. Hunt (1986) also noted that this was likely a low estimate and estimated the population density at 3.71 muskrats per ha (1.5 per acre).

The National Wetlands Inventory of the USFWS estimated there are 290,000 acres of wetlands in New Hampshire, whereas, the National Resource Conservation Service (NRCS) determined an estimate of 576,386 acres (Tiner 2007). New Hampshire also has an estimated 16,984 miles of rivers and streams statewide (NHDES 2015). Assuming 50% of the 16,984 miles of rivers and streams in New Hampshire are acceptable muskrat habitat and the low density estimate of 23 muskrats per km (0.62 miles) of rivers and streams would result in a statewide estimate of 315,026 muskrats in rivers and streams. Assuming 25% of the 290,000 acres of wetlands (minimum estimate) and 166,777 acres of lakes and ponds in New Hampshire are acceptable muskrat habitat and the density estimate of 3.71 muskrats per ha of wetlands, lakes and ponds would result in a statewide estimate of 171,450 muskrats in wetlands, lakes and ponds. The total statewide muskrat population could be estimated as 486,476.

Like many other mammal species, muskrats maintain sufficient population densities to allow for an annual trapping season. During the trapping season, there is no limit on the number of muskrats that can be harvested daily and no limit on the number of muskrats that can be lethally taken during the length of the season. A total of 5,727 muskrat have been harvested in the state from 2013-2017 trapping seasons averaging 1,494 annually (NHFG 2018b).

Direct, Indirect, and Cumulative Effects:

Based upon anticipated requests for WS' assistance, it is possible that WS could remove as many as 250 muskrats each year under the proposed action alternative. Removing 250 muskrats would represent 16.3% of the estimated statewide annual trapper and NWCO harvest and would be of low magnitude when compared to the estimated statewide population of muskrats. When combined, the average annual harvest (1,532) and WS' estimated annual removal of 250 muskrats would represent a cumulative removal of 1,782 muskrats annually. If the statewide population of muskrats was estimated at 486,476 individuals, the average cumulative removal of 1,782 muskrats would represent 0.4% of the estimated population. Based on the best scientific data, WS proposed take level will have no adverse direct or cumulative effects on muskrat populations.

Striped Skunk

Skunk densities vary widely by 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 sensitive to outbreaks of diseases like 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.

Striped skunks can be found in a variety of habitats across the State, however no population estimates are available for striped skunks. Therefore, a population estimate will be derived based on the best available information for skunks to provide an indication of the magnitude of removal proposed by WS. There are more than four million acres of rural land in New Hampshire (USDA 2013c). If only 50% of the rural lands throughout the State have sufficient habitat to support stripped skunks, skunks are only found in rural habitat, and skunk densities average one skunk per 77 acres, a statewide stripped skunk population could be estimated at 26,000 skunks. Skunks likely occupy more than 50% of the rural land area in the State. However, to determine the magnitude of the proposed removal by WS to alleviate or prevent damage, skunks occupying only 50% of the rural land area was used to provide a minimum population estimate.

Striped skunk are managed by the NHFG as a furbearer species with a hunting season that occurs from September 1 through March 31. Skunk may be trapped during the trapping season from October 15 through December 31 or from November 1 through January 15 depending on State Management Unit (NHFG 2018a). There is no daily or season harvest limit for either trapping or hunting of striped skunk. In damage situations, property owners, dwelling occupants, farmers, and their agents, may kill striped skunk (no State permit required) via lawful procedures to alleviate damage to property, agricultural resources (including livestock, crops, or poultry), and other resources. Information regarding the total number of skunks harvested annually is not available.

WS responded to 791 requests (average = 158/yr.) for technical assistance associated with striped skunk damage from FY 2014 through FY 2018 (see Table 1.1). Resources affected included human health and safety, general property, residential and non-residential buildings, livestock, pets, and landscaping. Damage also included burrowing/digging, odor, nuisance, rabies threats, and other threats. Most complaints were handled by providing technical assistance advice on methods for addressing damage. Damage threats related to human health and safety was the most commonly reported damage type at 62% of all requests for assistance. WS employed lethal methods to remove 24 striped skunks from 2014-2018. There is no data available for harvest numbers of striped skunk by recreational trappers; however, an average of 780 skunk were taken annually the past five years by NWCOs outside the open trapping season (Kent Gustafson, NHFG, personal communication).

WS has received an increasing number of requests for assistance with skunks. In association with the increasing number of requests for assistance is the likelihood that those persons requesting assistance will request WS address skunk damage using lethal methods. Therefore, the number of skunks taken annually by WS to address the increasing number of requests for assistance is also likely to increase. However, based on recent requests for assistance and in anticipation of receiving additional requests for assistance, WS could annually remove up to 250 skunks to alleviate damage or threats of damage associated with those requests.

Direct, Indirect, and Cumulative Effects:

With a statewide population estimated as 26,000 skunks, an annual removal of up to 250 skunks by WS would represent less than 1.0% of the population, if the population remains at least stable. The unlimited harvest allowed by the NHFG during the annual hunting and trapping seasons provides some indication the population of skunks in the State is not subject to overharvest during the annual harvest seasons and from damage management activities. Based on the best scientific data, WS proposed take level will have no adverse direct or cumulative effects on skunk populations.

Virginia Opossum

Since 2000, Virginia opossums have become common throughout New Hampshire. Opossums typically live for one to two years, with as few as 8% surviving into the second year in a study in Virginia (Seidensticker et al. 1987). In this same study a wide variation in opossum numbers was observed even though the habitat was considered excellent for the species. Those variations were observed seasonally and in different years. However, the mean density during the study was 10.1 opossum per square mile with a range of 1.3 opossum per square mile to 20.2 opossum per square mile (Seidensticker et al. 1987). This was comparable to other opossum population densities in similar habitats in Virginia. Verts (1963) found a density estimate of 10.1 opossum per square mile in farmland areas in Illinois while Wiseman and Hendrickson (1950) found a density of 6.0 opossum per square mile in mixed pasture and woodlands in Iowa. However, VanDruff (1971) found opossum densities in waterfowl nesting habitat as high as 259 opossum per square mile.

Today, opossums are common throughout New Hampshire in appropriate habitat; however, no population estimates are available. Therefore, a population estimate will be derived based on the best available information for opossum to provide an indication of the magnitude of removal proposed by WS to alleviate damage and threats of damage. The rural land area of New Hampshire covers four million acres (USDA 2013c). 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 as nearly 31,600 opossums. 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 4,060 opossum to a high of 63,000 opossum. Opossum can be found in a variety of habitats, including urban areas, so opossum occupying only 50% of the rural land area of the State 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 removal by WS to alleviate or prevent damage.

Opossums are managed by the NHFG as a furbearer species with a hunting season that occurs from September 1 through March 31. Opossum may also be trapped during the trapping season from October 15 through December 31 or from November 1 through January 15 depending on State Management Unit (NHFG 2018a). There is no daily or season harvest limit for either trapping or hunting of opossum. In

addition, opossum can be lethally taken when causing damage or posing a threat of damage without the need for a permit from the NHFG. However, the number of opossum lethally taken to alleviate damage and the number of opossum harvested during the annual harvest seasons is currently unknown. An average of 144 opossum were taken annually the past five years by NWCOs outside the open trapping season (Kent Gustafson, NHFG, personal communication).

Direct, Indirect, and Cumulative Effects:

WS received 177 technical assistance requests from FY 2014 through FY 2018 related to opossum damage or threats of damage. Requests for assistance were primarily related to human health and safety concerns. As part of damage management activities conducted by WS, three were removed during that time. Based on previous requests for assistance received by WS and in anticipation of additional requests for assistance, WS could lethally remove up to 100 opossums annually as part of efforts to reduce damage and threats of damage. Given the range of population estimates, the removal of 100 opossum by WS annually would represent from 0.2% to 2.5% of the estimated statewide population, if the overall population remains at least stable.

The NHFG allows an unlimited number of opossum to be harvested during the annual hunting and trapping season, which provides an indication the population of opossum, is not likely to decline from over harvest. Permitting by NHFG for removal ensures that removal would occur within population objectives established by the NHFG. 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 removal of up to 100 opossum annually by WS, would be of a low magnitude when compared to the actual statewide opossum population.

Red Fox

Red fox are managed by the NHFG as a furbearer game species and may be trapped from October 15 through December 31 or November 1 through January 15 depending on the State Wildlife Management Unit. Additionally, fox may be hunted from September 1 through March 31. This species is considered widespread and very common throughout most of the state. There is no daily or season harvest limit for either trapping or hunting red fox (NHFG 2018a). Moreover, in damage situations, property owners, dwelling occupants, farmers, and their agents, may kill fox, with no permit required, via lawful procedures to alleviate damage to property, agricultural resources (including livestock, crops, or poultry), and other resources.

Average annual harvest estimates for red fox by recreational trappers from seasons 2013-14 through 2017-18 are shown in Table 3.1. Trappers and NWCOs reported 1,029 red fox and had an average annual take of 205 red fox during those five trapping seasons. Often the number of individuals harvested annually for fur is often a function of the value of pelts with harvest increasing as fur prices increase and harvest declining as fur prices decline.

There are no population or trend estimates available for red fox; however, they are believed to be common and abundant throughout the State. Red fox can be found in a variety of habitats, including both urban and rural environments. Therefore, a population estimate will be derived based on the best available information for red fox to provide an indication of the magnitude of removal proposed by WS. There is approximately 5.9 million acres of land in New Hampshire (USDA 2013c). If only 25% of the land throughout the State have sufficient habitat to support red fox, and fox densities average 2.6 per square mile, a statewide red fox population could be estimated at 6,034 fox. The population of foxes is likely much higher given that higher densities can occur. Therefore, the population estimated at 6,034 red fox would be considered a minimum population estimate.

Direct, Indirect, and Cumulative Effects:

WS provided technical advice for 912 requests (average = 182/yr.) for assistance with red fox damage in New Hampshire during FY 2014-2018 (see Table 1.1). Requests for assistance with red fox reported to WS included threats to human health and safety (48%) and threats related to property damage (21%). This species is considered widespread and very common throughout most of the State. WS-New Hampshire lethally removed 14 red fox in New Hampshire, 2014-2018. 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 50 red foxes annually while conducting MDM activities.

The WS removal of 50 red fox would represent 0.8% of the estimated statewide population. WS' removal combined with the average trapping harvest and NWCO take of 205 would represent 3.4% of the statewide population. Based on this low level of removal and no harvest limit during the annual trapping and hunting seasons, WS' lethal management activities are not expected to have any cumulative adverse effects on red fox populations in New Hampshire. The permitting by NHFG for removal ensures that any removal occurs within allowable harvest levels. Based on the best scientific data, WS proposed take level will have no adverse direct or cumulative effects on fox populations.

Miscellaneous Bats and Insectivores

Bats and insectivores (shrews and moles) may be removed by WS after an actual or potential human exposure, when found in occupied buildings where they pose a human health threat or during wildlife hazard management, assessment, and monitoring at airports and airbases because these species serve as attractants to birds such as raptors and mammalian carnivores, which create direct hazards to aircraft. Additionally, these species may be removed during wildlife disease outbreaks or monitoring to protect human health and safety or natural resources. WS may receive requests to alleviate damage or threats of damage associated with bats. Aside from technical assistance, direct operational bat damage management by WS is exclusively conducted at airports and involves reporting bat/aircraft strikes and post-strike sample collections. The majority of bat management (*i.e.,* removal from private residences) is left to the private sector.

Bats which may be the target of WS in occupied structures, during wildlife disease monitoring, and operational activities at airports and other locations include the big brown bat, eastern pipistrelle, eastern red bat, eastern small-footed bat, hoary bat, little brown bat, big brown bat, northern long-eared bat, tricolored bat, and silver-haired bat. When providing direct operational assistance to cooperators, WS would attempt to survey the bats to identify the species involved. If WS' personnel identified threatened or endangered bats associated with a request for assistance, WS would recommend the property owner or manager contact the USFWS and the NHFG Nongame Department or WS' personnel would contact these agencies directly to determine the appropriate action. Depending on the appropriate action, if WS continued to provide assistance, WS would conduct further consultation with the USFWS or obtain the appropriate permits when required.

Other WS MDM may occur in areas that are adjacent to or in close proximity to habitats used by bats. These management activities are not expected to result in the removal of any trees or occur in any mines or caves, areas bats tend to occupy. Additionally, shooting and audio scaring devices are used almost exclusively at airports and in agricultural settings where habitat is primarily open fields and noise levels are already elevated.

Insectivores which may be the target of WS activities at airports and other locations include eastern mole, hairy-tailed mole, star-nosed mole, northern short-tailed shrew, long-tailed shrew, masked shrew, pygmy

shrew, smoky shrew, American water shrew, and least shrew. Insectivore species are very prolific: eastern moles have one or two liters per year with two to five young each. Hairy-tailed mole litter size averages four to five (Eadie 1948, Conner 1960), but may be as high as eight (Richmond and Roslund 1949). Hairy-tailed moles litter size ranges from four to five young (Saunders 1988). Star-nosed mole females probably bear but one litter of 2-7 (average 5) young between late April and early July, a few as late as August (Saunders 1988). Northern short-tailed shrews have two to three liters with 5-7 young each (Godin 1977). Masked shrew litter size ranges from four to ten, averaging seven and young are weaned at approximately 20 days (Merritt 1995). Smoky shrew females produce two to three litters per year that range in size from two to eight, averaging six (Owens 1984). American water shrew litter size is five to seven and females may bear two or three litters per year.

Direct, Indirect, and Cumulative Effects:

The primary method of lethal removal for bat species by WS would be euthanasia with AVMA approved methods after hand capture or live capture with hand or mist nets. Primary method of lethal removal of insectivores would be through snap trapping. Removal of these species by WS would be done at specific isolated sites (e.g., airports, orchards, etc.). Impacts of the levels of removal to bat and insectivore populations would be minimal due to the low level of removal for bat species, the relatively high reproductive rates of insectivore species, and because damage management recommended and conducted by WS would be at a limited number of specific local sites within the range of these species. Based upon the above information, no more than 40 bats that are not federally or state listed as threatened or endangered would be removed and up to 200 insectivores. Although temporary reductions may occur at the specific local sites where WS works, no adverse direct or cumulative impacts on overall populations of the species in New Hampshire would be observed.

Miscellaneous Rodents

Native Species: Rodents (squirrels, chipmunks, mice, voles, and rats) may be taken by WS during wildlife hazard management, assessment, and monitoring at airports and airbases because these species serve as attractants to birds such as raptors and mammalian carnivores, 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 blueberry bushes, in or near parks, and other structures to protect human health and safety, or natural resources.

Native rodents which may be the target of WS monitoring and operational activities at airports and other locations include the eastern gray squirrel, red squirrel, northern flying squirrel, southern flying squirrel, eastern chipmunk, white-footed mouse, deer mouse, meadow vole, rock vole, southern red-backed vole, southern bog lemming, northern bog lemming, meadow jumping mouse, and woodland jumping mouse. Large population fluctuations are characteristic of many small rodent populations and are highly prolific. For example, meadow voles may have up to 17 litters annually, typically with four to five young per litter, white-footed mice have multiple liters averaging five young each, and deer mice have three to four litters with four to six young each (Burt and Grossenheider 1980, National Audubon Society 2000).

Direct, Indirect, and Cumulative Effects:

WS anticipates removing no more than 100 individuals of each species of chipmunk, lemmings and squirrels, as well as, no more than 200 individuals of each species of mice and voles. WS also does not anticipate on removing more than 1,500 individuals for all miscellaneous native rodent species combined in New Hampshire. The primary method of lethal removal for these species by WS would be trapping or toxicants. Removal of these species by WS would be done at specific isolated sites (e.g., airports, orchards, etc.). Impacts of the levels of removal 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 within the range of these species. Based upon the above information, WS limited lethal removal of 1,500 small rodents may cause temporary reductions at the specific local sites where WS works, but would have no adverse direct or cumulative impacts on overall populations of the species in New Hampshire.

Non-native Species: Black rats, Norway rats, and house mice are not native to North America and were accidentally released into this country. The impacts of these species are seen by many as entirely detrimental (Burt and Grossenheider, 1980). Executive Order 13112 states that each federal agency whose actions may affect the status of invasive species shall, to the extent practical and permitted by law; 1) reduce invasion of exotic species and 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. Although removal of these species up to and including extirpation could be seen as desirable, because of the productivity and distribution of the species and the limited nature of WS work, WS is unlikely to ever do more than limit populations at specific local sites. Based on the above information and WS limited lethal removal of Norway rats, WS should have minimal effects on rat populations.

Captive non-native ungulates and game animals

Red deer, fallow deer, elk, bison, sika deer, and wild boar or feral swine are not native to New Hampshire and were brought into the State and confined within a high-fence and kept as part of a hunting operation, game farm or alternative farming operation. These animals do not have established wild populations in New Hampshire and their interaction with native white-tailed deer due to escape and close contact along enclosures may increase risks associated with disease exposure. Therefore, any removal of red deer, fallow deer, elk, bison sika deer, wild boar 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 the NHFG or the NHDAMF.

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' removal of exotic ungulates would comply with Executive Oder 13112.

Other Target Species

Target species, in addition to the mammals analyzed above, have been lethally taken in small numbers by WS or could be lethally taken when requested to resolve damage or threats of damage. WS could lethally remove the following species not to annually exceed the number associated with each species: black bear (30), river otter (30), fisher (30), mink (30), long-tailed weasel (30), short-tailed weasel (30), bobcat (10), moose (10), snowshoe hare (30), feral/domestic rabbit (30), gray fox (30), North American porcupine (30), and pine marten (10). None of these mammal species are expected to be taken by WS at any level

that would adversely affect overall statewide mammal populations. 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 removal 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.

Wildlife Disease Surveillance and Monitoring

The ability to efficiently conduct surveillance for and detect diseases is dependent upon rapid detection of the pathogen if it is introduced. Effective implementation of a surveillance system will facilitate planning and execution at regional and state levels, and coordination of surveillance data for risk assessment. It will also facilitate partnerships between public and private interests, including efforts by federal, state, and local governments as well as non-governmental organizations, universities, and other interest groups. 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 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 in the United States, WS' implementation of those sampling strategies would not adversely affect mammal populations in the State. Sampling strategies that could be employed involve sampling live-captured mammals that could be released on site after sampling occurs. The sampling (*e.g.*, drawing blood, 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 removal 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 removal 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 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
- 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 – Non-lethal Mammal Damage Management Only by WS

Under this alternative, WS would not intentionally remove 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, 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 MDM 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 NHFG, 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 Management on Non-target Wildlife Species Populations, Including T&E Species

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

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

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

WS personnel are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. 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 NHFG to determine the potential risks to federally and state listed threatened and endangered species in accordance with the ESA and state laws. Non-lethal methods are given priority when addressing requests for assistance (WS Directive 2.101). Non-target animals captured in traps are released unless it is determined that the animal would not survive and or that the animal cannot be safely released. WS would only employ methods in response to a request for assistance after the property owner or manager has signed a document agreeing to allow specific methods be used on property they own and/or manage. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 2. Despite the best efforts to minimize non-target lethal removal during program activities, the potential for adverse impacts to non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Non-Lethal Methods

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

Other non-lethal methods available for use under any of the alternatives are live-capture traps (see Appendix B). WS would use and recommend the use of target-specific attractants and place them or recommend they be placed in areas where target species are active to reduce the risk of capturing non-targets. WS would monitor or recommend traps be monitored frequently so non-target species can be released unharmed.

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 nest is considered "*take*" as defined by the Bald and Golden Eagle Protection Act. WS has reviewed those methods available under the proposed action / no action alternative and the use patterns of those methods. WS determined that the SOPs that WS uses while conducting damage management

activities reduces the likelihood that eagles would be lethally removed (e.g., prohibiting placement of a snare within 50 feet of a carcass which may attract eagles).

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 non-targets. Additionally, suppressed firearms would be used when appropriate to minimize noise impacts to non-targets.

Euthanasia - Non-target species captured during the implementation of non-lethal capture methods can usually be released prior to euthanasia which occurs subsequent to live-capture.

Snare (cable device) - WS would use snares in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives to minimize risks to non-targets.

Bodygrip Trap (e.g., Conibear) - WS would use bodygrip traps in compliance with applicable federal, state and local laws and regulations (WS Directive 2.210) as well as WS Directives to minimize risks to non-targets.

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

Fumigants - Only fumigants and toxicants registered with the EPA and the NHDAMF 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 non-target 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 non-target wildlife species.

Direct, Indirect, and Cumulative Effects:

The persistent use of non-lethal methods would likely result in the dispersal or abandonment of those areas where non-lethal methods are employed of both target and non-target species. Therefore, any use of non-lethal methods has similar results on both non-target and target species. However, the potential impacts to non-targets, like the impacts to target species, are expected to be temporary. WS would not employ or recommend these methods be employed over large geographic areas or at such intensity that essential resources would be unavailable and that long term adverse impacts to non-target populations would occur. Non-lethal methods are generally regarded as having minimal impacts on populations because individuals are unharmed. Therefore, non-lethal methods would not have any significant adverse impacts on non-target populations of wildlife including threatened and endangered species under this alternative.

Only those repellents registered with the EPA and the NHDAMF 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 non-target species when used according to label requirements. Most repellents for mammals pose a very low risk to non-targets when exposed to or when ingested.

Mammals could still be lethally removed during the regulated harvest season, when causing damage, and through the issuance of permits by the NHFG 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, snares, 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 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 non-targets 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 non-target domestic species such as dogs are not exposed.

While every precaution is taken to safeguard against taking non-targets during operational use of methods and techniques for resolving damage and reducing threats caused by mammals, the use of such methods can result in the incidental 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 non-target species during activities to reduce damage or threats to human safety associated with mammals is expected to be extremely low to non-existent. Between FY 2012 and FY 2016, only one non-target mammal, a river otter, was unintentionally lethally removed by WS in New Hampshire. WS would monitor the lethal removal of non-target species to ensure program activities or methodologies used in MDM do not adversely impact non-targets. Methods available to resolve and prevent mammal damage or threats when employed by trained, knowledgeable personnel are selective for target species. WS would annually report to the NHFG any non-target lethal removal to ensure lethal removal by WS is considered as part of management objectives established. The potential impacts to non-targets are similar to the other alternatives and are considered to be minimal to non-existent.

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 3 of this EA.

Federally Listed Species - The current list of species designated as threatened and endangered in New Hampshire as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix C contains the list of species currently listed in the state along with common and scientific names. 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 F). 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 NHFG was obtained and reviewed during the development of the EA (see Appendix C). 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 and species of special concern would require prior authorization by the NHFG through permitting or specific authorization. The NHFG has concurred with WS' determination for listed species.

Summary of Non-target 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 non-targets. Additionally, WS consults as required with the USFWS and the NHFG 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 non-target lethal removal by WS is considered as part of management objectives. Furthermore, WS has partnered with NHFG and will provide biological samples or data for monitoring and research for both non-target and target species (*e.g.* New England cottontail). Potential direct and cumulative impacts to non-targets, including threatened and endangered species, from the recommendation of methods by WS under this alternative would be expected to be insignificant. No indirect effects were identified for this issue.

Alternative 2 – Non-lethal Mammal Damage Management Only by WS

Under this alternative, risks to non-target species from WS actions would likely be limited to the use of frightening devices, exclusionary devices, and the risks of unintentional capture of a non-target in a live-capture device as outlined under Alternative 1. Although the availability of WS assistance with non-lethal 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 non-target 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 because WS would be unable to access lethal techniques if non-lethal 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 non-target animal. However, given that these devices would be applied with provisions to keep the target animal alive, the risks to non-target species are very low and would not result in adverse impacts on non-target species populations.

If mammal damage problems were not effectively resolved by non-lethal 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 non-target wildlife than the proposed action. For example, shooting by persons not proficient at mammal identification could lead to killing of non-target 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 non-target 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.

Effects on T&E species: WS' impacts on T&E species would be similar to the non-lethal 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 non-lethal MDM techniques. WS, with the assistance of NHFG, 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 MDM activities. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Mammals would continue to be lethally removed under permits issued by the NHFG, 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 non-targets 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 non-targets would be minimal to non-existent. If methods available were applied incorrectly or applied without knowledge of mammal behavior, risks to non-target 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 non-targets 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 non-target wildlife (e.g., White et al. 1989, USFWS 2001, FDA 2003). Therefore, adverse direct, indirect, or cumulative impacts to non-targets, including T&E species, could occur under this alternative; however WS does not anticipate any significant cumulative impacts.

Effects on T&E species: 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 Management 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 are evaluated below by each of the alternatives for the methods.

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

WS would use the 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. The use of non-lethal methods as part of an integrated approach to managing damage that would be employed as part of direct operational assistance by WS would be similar to those risks addressed by the other alternatives.

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.*, conibear 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 NHFG.

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.

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 temporarily handle and transport animals to lessen the animal's distress. 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 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 NHDAMF are licensed as pesticide applicators. 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. 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. Risks to human safety associated with the use or recommendation 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, a mixture of ketamine and xylazine, telazol sodium pentobarbital, potassium chloride, and Beuthanasia-D. Meeting the requirements of the Animal Medicinal Drug Use Clarification Act should prevent any significant adverse impacts on human health with regard to this issue. SOPs include:

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

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

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

No adverse direct or indirect effects to human safety have occurred from WS' use of methods to alleviate mammal damage from FY 2012 through FY 2016. The risks to human safety from the use of non-lethal 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 non-lethal 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 – Non-lethal 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 MDM 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 non-lethal 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 MDM 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 non-lethal and lethal methods integrated into direct operational assistance. Under this alternative, non-lethal methods would be used by WS which are generally regarded as humane. Non-lethal methods would include resource management methods (*e.g.*, crop selection, habitat modification, modification of human behavior), exclusion devices, frightening devices, reproductive inhibitors, cage traps, nets, and repellents.

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" (AVMA 2007). AVMA (2013) notes, "While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as appropriate for a particular species may not be available or may become less than an ideal choice due to differences in circumstances. Conversely, when settings are atypical, methods normally not considered appropriate may become the method of choice. Under such conditions, the humaneness (or perceived lack thereof) of the method used to bring about the death of an animal may be distinguished from the intent or outcome associated with an act of killing. Following this reasoning, it may still be an act of euthanasia to kill an animal in a manner that is not 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 (i.e., distinguishes between euthanasia and methods

that are more accurately characterized as humane killing). Because of the variety of situations that may be encountered, it is difficult to strictly classify methods for termination of free-ranging wildlife as acceptable, acceptable with conditions, or unacceptable. Furthermore, classification of a given method as a means of euthanasia or humane killing may vary by circumstances. These acknowledgments are not intended to condone a lower standard for the humane termination of wildlife. The best methods possible under the circumstances must be applied, and new technology and methods demonstrated to be superior to previously used methods must be embraced."

Direct, Indirect, and Cumulative Effects:
The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. These methods would include shooting, trapping, toxicants/chemicals, and snares. Despite SOPs and state trapping regulations designed to maximize humaneness, the perceived stress and trauma associated with being held in a trap or snare 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 non-lethal damage management methods are not practical or effective. No indirect or cumulative adverse impacts were identified for this issue.

Alternative 2 – Non-lethal 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 resolve damage and threats caused by mammals.

3.2 ISSUES NOT CONSIDERD 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 NHFG), 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 Such a Large Area

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 New Hampshire 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 NHFG, the best available data for analysis is often based on statewide population dynamics. For example, an EA on a 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 New Hampshire and only targets those mammals identified as causing damage or posing a threat. Therefore, MDM 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 the NEPA processes is a concern that a threshold of loss should be established before employing lethal methods to resolve damage and that wildlife damage should be a cost of doing business. Some damage and economic loss can be tolerated by cooperators until the damage reaches a threshold where damage becomes an economic burden. The appropriate level of allowed tolerance or threshold before employing lethal methods would differ among cooperators and damage situations. Therefore the threshold of damage or economic loss that can be tolerated is also unique to the individual. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations.

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. The remainder of the WS program is mostly 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 reasoned choice among the alternatives being considered. However, the methods determined to be most effective to reduce damage and threats to human safety caused by mammals and that prove to be the most cost effective would receive the greatest application. As part of an integrated approach, evaluation of methods would continually occur to allow for those methods that are most effective at resolving damage or threats to be employed under similar circumstance where mammals are causing damage or pose a threat. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. The cost effectiveness of methods and the effectiveness of methods are linked.

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). Since the risks of lead exposure occur primarily from ingestion of bullet fragments, the retrieval and proper disposal of mammal carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a mammal, if misses occur, or if the mammal carcass is not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns 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 (EPA 2013). Since the lethal removal of mammals can occur during regulated hunting seasons or through the issuance of permits by the NHFG, WS' assistance with removing mammals would not be additive to the environmental status quo since those mammals removed with 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 removed humanely 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 would be retrieved and disposed of properly to limit the availability of lead in the environment, and to prevent the ingestion of lead in carcasses by scavengers. Based on current information, the risks associated with lead bullets that are deposited into the environment from WS' activities due to misses, the

bullet passing through the carcass, or from mammal carcasses that may be irretrievable would be below any level that would pose any risk from exposure or significant contamination of water.

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

Another issue commonly identified is a concern that MDM 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 include: beaver, black bear, coyote, Eastern cottontail rabbit, Eastern gray squirrel, moose, fisher, gray fox, long-tailed weasel, mink, muskrat, raccoon, red fox, red squirrel, river otter, short-tailed weasel, snowshoe hare, striped skunk, Virginia opossum, and white-tailed deer.

Potential impacts could arise from the use of non-lethal or lethal damage management methods. Non-lethal 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 non-lethal or lethal methods often disperses mammals from areas where damage is occurring to areas outside the damage area which could serve to move those mammal species from those less accessible areas to places 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 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 can result in the establishment of new wetlands over time. 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, 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 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 trackhoes 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 from the USACE prior to removing a blockage. WS' personnel determine the proper course of action upon inspecting a beaver dam impoundment and in certain situations may contact the NHFG and New Hampshire Department of Environmental Services to seek consultation.

3.3 SUMMARY

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 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.

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APPENDIX B: METHODS AVAILABLE FOR RESOLVING OR PREVENTING MAMMAL DAMAGE BY THE NEW HAMPSHIRE WS PROGRAM

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 non-target species, local environmental conditions and impacts, social and legal aspects, and relative costs of damage reduction options. The cost of damage reduction may sometimes be a secondary concern because of the overriding environmental, legal, and animal welfare considerations. These factors 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 in New Hampshire 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 in New Hampshire.

Non-chemical Wildlife Damage Management Methods

Nonchemical management methods consist primarily of tools or devices used to repel, capture or kill a particular animal or local population of wildlife to alleviate damage and conflicts. Methods may be non-lethal (e.g., fencing, frightening devices, etc.) or lethal (e.g., firearms, body gripping traps, snares, etc.). If WS personnel apply these methods on private lands, an *Agreement for Control on Private Property* must be signed by the landowner or administrator authorizing the use of each damage management method. Non-chemical methods used or recommended by WS include:

Exclusion pertains to preventing access to resources through fencing or other barriers. Fencing of small critical areas can sometimes prevent animals which cannot climb from entering areas of protected resources. Fencing, especially if it is installed with an underground skirt, can prevent access to areas for many mammal species which dig, including fox, feral cats, and striped skunks. Areas such as airports, yards or hay meadows may be fenced. Hardware cloth or other metal barriers can sometimes be used to prevent girdling and gnawing of valuable trees and to prevent the entry of mammals into buildings through existing holes or gaps. Exclusion and one-way devices such as netting or nylon window screening can be used to exclude 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 or fences to

deter animals from entering a protected area, or planting lure crops on fringes of protected crops. Removal of trees from around buildings can sometimes reduce damage associated with raccoons. Some mammals which cause damage in urban environments are attracted to homes by the presence of garbage or pet food left outside and unprotected. Removal or sealing of garbage in tight trash receptacles, and elimination of all pet foods from outside areas can reduce the presence of unwanted mammals. If raccoons are a problem, making trash and garbage unavailable, and removing all pet food from outside during nighttime hours can reduce their presence.

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

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

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

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.

Beaver dam removal may be recommended or executed by WS. 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 or heavy machinery. Dam removal shall be allowed without a permit under NHFG RSA 482-A if machinery does not enter the water and filling or dredging in or adjacent to surface water, wetlands, or their banks does not occur. Removal shall be done in a gradual manner that does not allow a sudden

release of impounded water so as to cause erosion, siltation, or a safety hazard downstream.

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 snares, nets, foothold traps, and other methods to capture some species of mammals for the purpose of translocating them for release to wild sites. Unless specifically requested by the NHFG, WS does not use or recommend this method to resolve mammal damage in New Hampshire. Additionally, translocation of all wildlife requires written permission of landowner where wildlife is to be released as stated by the NHFG (Fis 805.02: Permits To Release Wildlife).

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 non-target animals. Effective trap placement and adjustment and the use and placement of appropriate baits and lures by trained WS personnel also contribute to the foothold trap's selectivity. An additional advantage is that foothold traps can allow for the on-site release of non-target animals. The use of foothold traps requires more skill than some methods, but they are indispensable in resolving many damage problems.

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

Cage Traps come in a variety of styles to live-capture animals. The most commonly known cage traps are box traps, culvert traps for bears, clover traps for deer, and corral traps for feral swine. *Box traps* are usually rectangular and are made from various materials, including metal, wire mesh, plastic, and wood and consist of a treadle in the middle of the cage that triggers the door to close behind the animal being trapped. These traps are used to capture animals alive and can often be used where many lethal tools are impractical. These traps are well suited for use in residential areas and work best when baited with foods attractive to the target animal. Box traps are generally portable and easy to set-up. A *culvert trap* is typically cylindrical shaped made from a metal culvert pipe with a sold metal guillotine drop door. It is usually mounted on a low trailer for easy transport. A *clover trap* is a steel-pipe frame surrounded with netting that can absorb shock of a struggling animal reducing injuries. It commonly uses a rat trap as a trigger mechanism and the trap is modified to pivot at the corners and allow handlers to collapse the trap flat to the ground once a deer is captured. *Corral traps* for feral swine are generally large circular traps consisting of panels anchored to the ground using steel posts with a door allowing entrance. Side panels are typically woven metal

fencing referred to as swine panels or cow panels. The entrances into the traps generally consist of a door that allows entry into the trap but prevents exit. The doors are often designed to allow swine to continually enter the trap, which allows for the possibility of capturing multiple swine. Corral traps are triggered by trip wires, root triggers or wireless remote systems. Cage traps would be available to all entities to alleviate damage.

Body-grip (e.g., Conibear-type) Traps 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.

Hancock/Bailey (e.g., suitcase/basket-type) traps 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.

Snares (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, snares are equipped with integrated stops that permit snaring, but do not choke the animal. *Cable foot restraints* (e.g., Aldrich or Fremont brands) are spring activated and could be in situations that preclude the use of culvert traps to capture black bears or the use Belisle powered cable foot restraints could be used to trap coyotes. The cable foot restraint is a non-lethal device activated when an animal places its foot on the throwing arm trigger. When triggered, the spring-activated cable tightens around the foot and holds the animal.

Bow nets are small circular net traps used for small 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 or by use of wireless remote.

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 gun and net launcher are devices that project a net over a target animal using a specialized gun that incorporates .308 caliber blanks as the energy source for propulsion through a manifold system

and using 4 weights attached to a lightweight net. Some newer design handheld net guns are discharged with the use of a CO_2 cartridge.
Cannon/Rocket Nets are deployed with either a net packed in a specially designed plywood box or the net is folded and laid out on the ground. These nets are fired using mortar projectiles to propel a net up and over wildlife which have been baited to a particular site.

Drop nets are nylon or cloth nets that would be suspended above an area actively used by an animal or group of animals where target individuals have been conditioned to feed. The area would be baited and once feeding occurs under the net, the net would be released. Drop nets require constant supervision by personnel to drop the net when target individuals were present and when animals were underneath the net. Nets are used to live-capture target individuals and if any non-target animals are present, they can be released on site unharmed. Drop nets allow for the capture of several animals during a single application.

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. 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 and trapped animals humanely euthanized or released (the glue can be deactivated with vegetable oil). Placement is along travel corridors used by the target species. Safety hazards and risks to humans are very low.

Harp Trap are designed to catch flying bats without damaging their wings. They consist of a frame that supports two rows of fine thread, and a catching bag at the base. If a bat detects the first row and swerves to pass through, it collides with the second row and tumbles into the collecting bag.

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 (FLIR) 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).

Denning is the practice of locating coyote or fox dens and lethally removing the young, adults, or both to stop an ongoing predation problem or prevent future depredation of livestock. Denning is used in coyote and fox damage management, but is limited because dens are often difficult to locate and den use by the

target animal is restricted to about 2 to 3 months during the spring. Coyote and red fox depredations on livestock often increase in the spring and early summer due to the increased food requirements associated with feeding and rearing litters of pups (Till and Knowlton 1983, Till 1992). Removal of pups will often stop depredations even if the adults are not taken (Till 1992). Pups are typically euthanized in the den using a registered gas fumigant cartridge or by digging out the den and euthanizing the pups with sodium pentobarbital. When the adults are removed at or near a known den location, it is customary to euthanize the pups to prevent their starvation because they would be unable to survive on their own. Denning is labor intensive. Denning is very target-specific and is most often used in open terrain where dens are comparatively easy to find. WS Directive 2.425 provides guidelines for the use of denning by WS' personnel to manage animal damage.

Hunting/Trapping can be recommended to resource owners to consider legal methods 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.

Remote-Controlled Vehicles (RCV)/Unmanned Aerial Vehicles (UAV) or drones may be used by WS for surveillance and or harassment of mammals.

Trained Dogs are frequently used in to locate, pursue, or decoy animals, primarily coyotes and feral swine. The WS program could use trailing/tracking, decoy, and trap-line companion dogs. Training and maintaining suitable dogs requires considerable skill, effort, and expense. WS Directive 2.445 establishes standards and responsibilities for WS' use of trained dogs to assist in accomplishing activities. When using trained dogs, WS' personnel would adhere to WS Directive 2.445.

> **Tracking Dogs** or trailing dogs are commonly used to track and "*tree*" or "*bay*" target wildlife species, such as bobcats, bears, raccoons, and feral swine. Although not as common, they sometimes are trained to track coyotes (Rowley and Rowley 1987, Coolahan 1990). Dogs commonly used are different breeds of hounds, such as blue tick, red-bone, and Walker. They become familiar with the scent of the animal they are to track and follow, and the dogs strike (howl) when they detect the scent. Tracking dogs are trained not to follow the scent of non-target species. Personnel of WS

typically find the track of the target species in areas with fresh damage or at a location where recent predation has occurred. Personnel would then put their dogs on the tracks of the target animal. Typically, if the track is not too old, the dogs can follow the trail. The animal usually seeks refuge up a tree, in a thicket on the ground, on rocks or a cliff, or in a hole. The dogs stay with the animal until personnel arrive and dispatch, tranquilize, or release the animal, depending on the situation. A possibility exists that dogs could switch to a fresher trail of a non-target species while pursuing the target species. This could occur with any animal that they have been trained to follow, and could occur with an animal that is similar to the target species. For example, dogs on the trail of a coyote could switch to a fox, if they cross a fresher track. With this said, this risk can be minimized greatly by the personnel of the WS looking at the track prior to releasing the dogs and calling them off a track if it is determined that they have switched tracks.

Decoy Dogs are primarily used in coyote damage management in conjunction with calling. Dogs are trained to spot and lure coyotes into close shooting range for personnel of WS. Decoy dogs are especially effective for territorial pairs of coyotes. Decoy dogs are typically medium-sized breeds that are trained to stay relatively close to personnel.

Trap-line Companion Dogs could accompany personnel of WS in the field while they were setting and checking equipment. They would be especially effective in finding sites to set equipment by alerting their owners to areas where coyotes or other predators have traveled, urinated, or defecated, which are often good sites to make sets. Trap-line companion dogs stay with personnel and most always have no effect on non-target animals. Trap-line dogs may increase the selectivity towards territorial coyotes by identifying territorial canine scent locations.

Chemical Wildlife Damage Management Methods

All pesticides used by WS are registered under the FIFRA and administered by the EPA and NHDAMF. All WS personnel in New Hampshire who apply restricted-use pesticides are certified pesticide applicators by NHDAMF and have specific training by WS for MDM pesticide application. The EPA and NHDAMF require pesticide applicators to adhere to all certification requirements set forth in the FIFRA. Pharmaceutical drugs, including those used in wildlife capture and handling, are administrated by FDA and/or 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 animals that is very manageable and in a good state of analgesia. Medetomidine sedative effects can be reversed by yohimbine, tolazoline, or atipamezole.

Tiletamine-zolazepam (Telazol) is a dissociative anesthetic. 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).

Atipamezole (Atipamezole HCL) is an alpha-2 antagonist used to reverse the sedative effects of medetomidine and xylazine. Absorption of atipamezole is rapid which producing 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 HCI) 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 is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are DEA restrictions on who can possess and administer this drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA and state regulations.

Potassium Chloride used in conjunction with prior general anesthesia is used as a euthanasia agent for animals, and is considered acceptable and humane by the AVMA (Beaver 2001). Animals that have been euthanized with this chemical experience cardiac arrest followed by death, and are not toxic to predators or scavengers.

Beuthanasia-D combines pentobarbital with another substance to hasten cardiac arrest. Intravenous (IV) and intracardiac (IC) are the only acceptable routes of injection. As with pure sodium pentobarbital, IC injections with Beuthanasia-D are only acceptable for animals that are unconscious or deeply anesthetized. With other injection routes, there are concerns that the cardiotoxic properties may cause cardiac arrest before the animal is fully unconscious. It is a Schedule III drug, which means it can be obtained directly from the manufacturer by anyone with a DEA registration. However, Schedule III drugs are subject to the same security and record-keeping requirements as Schedule II drugs.

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

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.

Zinc phosphide is a toxicant used to kill rodents, lagomorphs and nutria. Zinc phosphide decomposes slowly and releases phosphine gas (PH3) when exposed to moisture. When zinc phosphide treated bait encounters acids in the stomach, bait releases phosphine (PH3) gas, which may account in a large part for observed toxicity. Animals that ingest lethal amounts of bait usually succumb overnight with terminal symptoms of convulsions, paralysis, coma, and death from asphyxia. If death is prolonged for several days, intoxication that occurs is similar to intoxication with yellow phosphorous, in which the liver is heavily damaged. Prolonged exposure to phosphine can produce chronic phosphorous poisoning.

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

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

Anticoagulant Rodent Baits 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 NHFG before applying rodenticides at airports in order to confirm that no state-listed threatened or endangered rodents would be harmed in the process.

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. Repellents are non-lethal chemical formulations used to discourage or disrupt particular animal behaviors. Olfactory repellents must be inhaled to be effective. These are normally gases, or volatile liquids and granules, and require application to areas or surfaces that need protecting. Taste repellents are compounds (*e.g.*, liquids, dusts, granules) that are normally applied to trees, shrubs, and other materials that are likely to be eaten or gnawed by the target species.

Only a few repellents are commercially available for mammals, and are registered for only a few species. Repellents would not be available for many species that may present damage problems, such as some predators or furbearing species. For example, Miller et al. (2014) found a commonly available mammal repellent was not effective at repelling coyotes. Repellents are variably effective and depend largely on the resource to be protected, time and length of application, and sensitivity of the species causing damage. Acceptable levels of damage control would usually not be realized unless repellents were used in conjunction with other techniques. Repellents often contain different active ingredients with most ingredients occurring naturally in the environment. The most common ingredients of repellents are coyote urine, putrescent whole egg solids, capsaicin, or sand (Silica) mixed with a non-toxic carrier for application to surfaces. Repellents for animals are not generally restricted-use products; therefore, a person does not need a pesticide applicators license to purchase or apply those products. People generally apply repellents directly to affected resources, which elicits an adverse taste or texture response when the target animal ingests the treated resource or the ingestion of the repellent causes temporary sickness (*e.g.*, nausea). Products containing coyote urine or other odors associated with predatory wildlife are intended to elicit a fright response in target wildlife by imitating the presence of a predatory animal (*i.e.*, wildlife tend to avoid areas where predators are known to be present). If repellents were registered for use in the State to reduce damage caused by mammals, WS could employ or recommend for use those repellents that were available.

Gas cartridges (EPA Reg. No. 56228-21, EPA Reg. No. 56228-2) are often used to treat dens or burrows of coyotes, fox, skunks, or woodchucks. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the burrow or den. Sodium nitrate is the principle active chemical in gas cartridges and is a naturally occurring substance. Although stable under dry conditions, it is readily soluble in water and likely to be highly mobile in soils. In addition, dissolved nitrate is very mobile, moving quickly through the vadose zone to the underlying water table (Bouwer 1989). However, burning sodium nitrate, as in the use of a gas cartridge as a fumigant in a rodent burrow, is believed to produce mostly simple organic and inorganic gases, using all of the available sodium nitrate. In addition, the human health drinking water tolerance level for this chemical is 10 mg / L, a relatively large amount, according to EPA Quality Criteria for Water (EPA 1986, Wallace 1987). The gas along with other components of the cartridge, are likely to form oxides of nitrogen, carbon, phosphorus, and sulfur. Those products are environmentally non-persistent because they are likely to be metabolized by soil microorganisms or they enter their respective elemental cycles. In rodent cartridges, sodium nitrate is combined with seven additional ingredients: sulfur, charcoal, red phosphorus, mineral oil, sawdust, and two inert ingredients. None of the additional ingredients in this formulation is likely to accumulate in soil, based on their degradation into simpler elements by burning the gas cartridge. Sodium nitrate is not expected to accumulate in soils between applications, nor does it accumulate in the tissues of target animals (EPA 1991). The EPA stated sodium nitrates "*...as currently registered for use as pesticides, do not present any unreasonable adverse effects to humans*" (EPA 1991).

WS would only use gas cartridges in dens or burrows that show signs of active target animal use to minimize risks to non-target species.

APPENDIX C: SPECIES THAT ARE LISTED AS THREATENED, ENDANGERED, OR OF SPECIAL CONCERN IN THE STATE OF NEW HAMPSHIRE

Common Name	Scientific Name	NH Status	Federal Status
VERTEBRATES[a]:			
Fish			
American Brook Lamprey	*Lampetra appendix*	E	
Shortnose Sturgeon	*Acipenser brevirostrum*	E	E
Atlantic Sturgeon	*Acipenser oxyrinchus*	T	
Alewife (sea run only)	*Alosa psuedoharengus*	SC	
American Eel	*Anguilla rostrata*	SC	
American Shad	*Alosa sapidissima*	SC	
Bridle Shiner	*Notropis bifrenatus*	T	
Northern Redbelly Dace	*Phoxinus eos*	SC	
Blueback Herring	*Alosa psuedoharengus*	SC	
Rainbow Smelt (sea run only)	*Osmerus mordax*	SC	
Sea Lamprey	*Petromyzon marinus*	SC	
Banded Sunfish	*Enneacanthus obesus*	SC	
Finescale Dace	*Phoxinus neogaeus*	SC	
Lake Whitefish	*Coregonus clupeaformis*	SC	
Redfin Pickeral	*Esox americanus*	SC	
Round Whitefish	*Prosopium cylindraceum*	T	
Swamp Darter	*Etheostoma fusiforme*	SC	
Amphibians			
Jefferson Salamander	*Ambystoma jeffersonianum*	SC	
Blue-Spotted Salamander	*Ambystoma laterale*	SC	
Marbled Salamander	*Ambystoma opacum*	E	
Fowler's Toad	*Anaxyrus fowleri (formerly Bufo)*	T	
Northern Leopard Frog	*Lithobates pipiens (formerly Rana)*	SC	
Reptiles			
Wood Turtle	*Glyptemys insculpta*	SC	
Spotted Turtle	*Clemmys guttata*	T	
Black Racer	*Coluber constrictor*	T	
Smooth Green Snake	*Opheodrys vernalis*	SC	
Blanding's Turtle	*Emydoidea blandingii*	E	
Eastern Hognose Snake	*Heterodon platirhinos*	E	
Eastern Box Turtle	*Terrapene carolina*	E	
Timber Rattlesnake	*Crotalus horridus*	E	
Birds			
Common Loon	*Gavia immer*	T	
Pied-Billed Grebe	*Podilymbus podiceps*	T	
Golden Eagle	*Aquila chrysaetos*	E	
Common Nighthawk	*Chordeiles minor*	E	
Upland Sandpiper	*Bartramia longicauda*	E	
Spruce Grouse	*Falcipennis canadensis*	SC	
Least Bittern	*Ixobrychus exilis*	SC	
Bald Eagle	*Haliaeetus leucocephalus*	SC	
Northern Harrier	*Circus cyaneus*	E	
Peregrine Falcon	*Falco peregrinus*	T	

American Kestrel	*Flco sparverius*	SC	
Olive-sided Fltcatcher	*Contopus cooperi*	SC	
American Three-toed Woodpecker	*Picoides dorsalis*	SC	
Sora	*Porzana carolina*	SC	
Piping Plover	*Charadrius melodus*	E	T
Willet	*Tringa semipalmata*	SC	
Red Knot	*Calidris canutus*	T	T
Roseate Tern	*Sterna dougallii*	E	E
Common Tern	*Sterna hirundo*	T	
Arctic Tern	*Sterna paradisaea*	SC	
Least Tern	*Sternula antillarum*	E	
Chimney Swift	*Chaetura pelagica*	SC	
Common Gallinule	*Gallinula galeata*	SC	
Horned Lark	*Eremophila alpestris*	SC	
Cerulean Warbler	*Dendroica cerulea*	T	
Purple Martin	*Progne subis*	T	
Bank Swallow	*Riparia*	SC	
Cliff Swallow	*Petrochelidon pyrrhonota*	T	
Bicknell's Thrush	*Catharus bicknelli*	SC	
American Pipit	*Anthus rubescens*	SC	
Grasshopper Sparrow	*Ammodramus savannarum*	T	
Vesper Sparrow	*Pooecetes gramineus*	SC	
Saltmarsh Sparrow	*Ammodramus caudacutus*	SC	
Nelson's Sparrow	*Ammodramus nelsoni*	SC	
Eastern Meadowlark	*Sturnella magna*	T	
Rusty Blckbird	*Euphagus carolinus*	SC	
Mammals			
New England Cottontail	*Sylvilagus transitionalis*	E	
Canada Lynx	*Lynx canadensis*	E	T
Eastern Wolf	*Canis lupus*	E	E
Pine Marten	*Martes americana*	SC	
Big Brown Bat	*Eptesicus fuscus*	SC	
Eastern Red Bat	*Lasiurus borealis*	SC	
Hoary Bat	*Lasiurus cinereus*	SC	
Silver-haired Bat	*Lasionycteris noctivagans*	SC	
Northern long-ear bat	*Myotis septentrionalis*	E	T
Tricolored Bat	*Perrimyotis subflavus*	E	
Small-footed Bat	*Myotis leibii*	E	
Little Brown Bat	*Myotic lucifugus*	E	
Northern Bog Lemming	*Synaptomys borealis sphagnicolai*	SC	
Long-tailed or Rock Shrew	*Sorex dispar*	SC	

INVERTEBRATES[a]:

Mussels			
Dwarf Wedge Mussel	*Alasmidonta heterodon*	E	E
Brook Floater Mussel	*Alasmidontavaricosa*	E	
Eastern Pondmussel	*Ligmia nasuta*	T	
Insects			

Ringed Boghaunter	*Williamsonia lintneri*	T	
Kennedy's Emerald	*Somatochlora kennedyis*	SC	
Coppery Emerald	*Somatochlora geogiana*	SC	
Rapids Clubtail	*Gomphus quadricolor*	SC	
Skillet Clubtail	*Gomphus ventricosus*	SC	
Scarlet Bluet	*Enallagma pictum*	SC	
Pine Barrens Bluet	*Enallagma recurvatum*	SC	
Cobblestone Tiger Beetle	*Cicindela marginipennis*	E	
Puritan Tiger Beetle	*Cicindela puritana*	E	T
Appalachian Tiger Beetle	*Cicindela ancocisconensis*	SC	
Margined Tiger Beetle	*Cicindela marginata*	SC	
Frosted Elfin Butterfly	*Callophrys irus*	E	
Monarch Butterfly	*Danaus plexippus*	SC	
Karner Blue Butterfly	*Lycaeides melissa samuelis*	E	E
Hessel's Hairstreak	*Callophrys hesseli*	T	
Edward's Hairstreak	*Satyrium edwardsii*	SC	
Pine Pinion Moth	*Lithophane lepida*	T	
Phyllira Tiger Moth	*Grammia phyllira*	SC	
Cora Moth (Bird Dropping Moth)	*Cerma cora*	SC	
White Mountain Arctic Butterfly	*Oeneis Melissa semidea*	T	
Monarch Butterfly	*Danaus plexippus*	SC	
White Mountain Fritillary	*Boloria titania montinus*	E	
Persius Duskywing Skipper	*Erynnis persius*	E	
Barrens Itame	*Speranza exomerata*	SC	
(Broad Sallow Moth) Barrens Xylotype	*Xylotype capax*	SC	
Pine Barrens Zanclognatha Moth	*Zanclognatha martha*	SC	
Rusty-patched Bumble Bee	*Bombus affinis*	E	E
Yellow Bumble Bee	*Bombus ferivdus*	SC	
Yellow-banded Bumble Bee	*Bombus terricola*	SC	
American Bumble Bee	*Bombus pensylvanicus*	SC	
Phyllira Tiger Moth	*Grammia phyllira*	SC	
Sleepy Duskywing	*Erynnis brizo*	SC	
A Noctuid Moth	*Zale lunifera*	SC	

PLANTS[a,b]:

Common Name	**Scientific Name**	**NH Status**	**Federal Status**
Adder's-mouth, green	*Malaxis unifolia*	T	
Adder's-mouth, white	*Malaxis monophyllos* ssp. *brachypoda*	E	
Agalinis, saltmarsh	*Agalinis maritima*	E	
Allegheny-vine	*Adlumia fungosa*	E	
Alpine-azalea	*Kalmia procumbens*	T	
American-aster, late purple	*Symphyotrichum patens*	T	
American-aster, Lindley's	*Symphyotrichum ciliolatum*	T	
American-aster, perennial saltmarsh	*Symphyotrichum tenuifolium*	E	

Arctic-cudweed, alpine	*Omalotheca supina*	E	
Arnica, lance-leaved	*Arnica lanceolata*	T	
Arrowhead, northern	*Sagittaria cuneata*	E	
Arrowhead, quill-leaved	*Sagittaria teres*	E	
Arrowhead, Sessile-fruited	*Sagittaria rigida*	E	
Arrowhead, Spongy-leaved	*Sagittaria montevidensis* ssp. *spongiosa*	E	
Arrowwood, Downy	*Viburnum rafinesquianu*	E	
Asphodel, Sticky False	*Triantha glutinosa*	E	
Avens, White Mountain	*Geum peckii*	T	
Azalea, Pink	*Rhododendron periclymenoides*	E	
Baked-apple-berry	*Rubus chamaemorus*	T	
Barren-strawberry, Appalachian	*Geum fragarioides*	T	
Beaksedge, needle	*Rhynchospora capillacea*	E	
Bearberry, Alpine	*Arctous alpina*	E	
Bedstraw, blunt-leaved	*Galium obtusum*	E	
Bedstraw, Hairy	*Galium pilosum*	E	
Bedstraw, Limestone Swamp	*Galium brevipes*	E	
Beggar-ticks, northern	*Bidens hyperborea*	E	
Beggar-ticks, smooth	*Bidens laevis*	E	
Bellwort, Large-flowered	*Uvularia grandiflora*	E	
Bellwort, Perfoliate	*Uvularia perfoliata*	E	
Bindweed, upright false	*Calystegia spithamaea*	E	
Birch, bog	*Betula pumila*	E	
Birch, dwarf	*Betula minor*	T	
Birch, glandular	*Betula glandulosa*	T	
Birch, River	*Betula nigra*	T	
Bistort, alpine	*Bistorta vivipara*	E	
Bitter-cress, alpine	*Cardamine bellidifolia*	E	
Bitter-cress, bulbous	*Cardamine bulbosa*	E	
Bitter-cress, Long's	*Cardamine longi*	E	
Blackberry, sand	*Rubus cuneifolius*	E	
Bladdernut, American	*Staphylea trifolia*	T	
Bladderwort, resupinate	*Utricularia resupinata*	E	
Blazing Star, Northern	*Liatris novae-angliae*	E	
Blue grass, alpine Kentucky	*Poa pratensis ssp. alpigena*	E	
Bluebells, seaside	*Mertensia maritima*	--	
Blueberry, dwarf	*Vaccinium cespitosum*	T	
Blueberry, northern	*Vaccinium boreale*	T	
Blue-eyed-grass, needle-tipped	*Sisyrinchium mucronatum*	E	
Bluejoint, Harsh	*Calamagrostis canadensis var. langsdorfii*	E	
Bluet, long-leaved	*Houstonia longifolia*	E	
Bog-clubmoss, appressed	*Lycopodiella appressa*	E	

Bog-clubmoss, Foxtail	*Lycopodiella alopecuroides*	--	
Bog-orchid, northern tubercled	*Platanthera flava var. herbiola*	E	
Brome, hairy wood	*Bromus pubescens*	E	
Brome, Kalm's	*Bromus kalmii*	E	
Brookweed, seaside	*Samolus valerandi ssp. parviflorus*	E	
Bulrush, Georgia	*Scirpus georgianus*	E	
Bulrush, Leafy	*Scirpus polyphyllus*	E	
Bulrush, Long's	*Scirpus longii*	E	
Bulrush, Northeastern	*Scirpus ancistrochaetus*	E	E
Bulrush, rufous	*Scirpus pendulus*	E	
Bur-reed, arctic	*Sparganium natans*	T	
Bur-reed, branched	*Sparganium androcladum*	E	
Bur-reed, great	*Sparganium eurycarpum*	T	
Bush-clover, Slender	*Lespedeza virginica*	E	
Bush-clover, Trailing	*Lespedeza procumbens*	E	
Butterwort, violet	*Pinguicula vulgaris*	E	
Camphorweed, sweet-scented	*Pluchea odorata var. succulenta*	E	
Campion, Moss	*Silene acaulis*	E	
Campion, Wild	*Silene caroliniana ssp. pensylvanica*	E	
Chives, wild	*Allium schoenoprasum*	E	
Cinquefoil, coast	*Potentilla litoralis*	E	
Cinquefoil, Robbins'	*Potentilla robbinsiana*	E	
Clearweed, Lesser	*Pilea fontana*	--	
Cliff-brake, purple	*Pellaea atropurpurea*	E	
Clubsedge, Bashful	*Trichophorum planifolium*	E	
Colic-root, White	*Aletris farinosa*	E	
Coral-root, fall	*Corallorhiza odontorhiza*	E	
Corydalis, Golden	*Corydalis aurea*	E	
Cottonsedge, tall	*Eriophorum angustifolium*	E	
Crabgrass, Slender	*Digitaria filiformis var. filiformis*	E	
Crabgrass, smooth slender	*Digitaria filiformis var. laeviglumis*	E	
Crane's-bill, Carolina	*Geranium carolinianum*	E	
Crowfoot, early	*Ranunculus fascicularis*	E	
Crowfoot, water-plantain	*Ranunculus ambigens*	E	
Diapensia	*Diapensia lapponica*	T	
Dock, seabeach	*Rumex pallidus*	E	
Dodder, Buttonbush	*Cuscuta cephalanthi*	--	
Dragon's-mouth	*Arethusa bulbosa*	E	
Dropseed, Sand	*Sporobolus cryptandrus*	E	
Dropseed, Small	*Sporobolus neglectus*	E	
Duckweed, ivy-leaved	*Lemna trisulca*	E	
Duckweed, Pale	*Lemna valdiviana*	E	

Dwarf-bulrush, small-flowered	*Lipocarpha micrantha)*	E	
Dwarf-gentian, stiff	*Gentianella quinquefolia*	E	
Eared-rockcress, hairy	*Arabis pycnocarpa*	E	
Elder, Marsh	*Iva frutescens*	T	
Eyebright, Oakes'	*Euphrasia oakesii*	E	
Fairy-slipper	*Calypso bulbosa ssp. americana*	E	
False pimpernel, unpretentious yellow-seeded	*Lindernia dubia var.*	E	
Featherfoil, American	*Hottonia inflata*	E	
Fern, American climbing	*Lygodium palmatum*	E	
Fern, Appalachian bristle	*Trichomanes intricatum*	E	
Fern, blunt-lobed cliff	*Woodsia obtusa*	E	
Fern, fragrant wood	*Dryopteris fragrans*	T	
Fern, male wood	*Dryopteris filix-mas ssp. brittonii*	E	
Fern, narrow-leaved glade	*Diplazium pycnocarpon*	E	
Fern, Netted Chain	*Woodwardia areolata*	E	
Fern, northern adder's-tongue	*Ophioglossum pusillum*	E	
Fern, smooth cliff	*Woodsia glabella*	E	
Fescue, Proliferous	*Festuca prolifera*	E	
Firmoss, Mountain	*Huperzia appressa*	E	
Firmoss, Northern	*Huperzia selago*	E	
Flat-topped-goldenrod, white	*Oligoneuron album*	E	
Flax, Grooved Yellow	*Linum sulcatum*	E	
Foxglove, Downy False	*Aureolaria virginica*	E	
Fringed-gentian, greater	*Gentianopsis crinita*	T	
Garlic, meadow	*Allium canadense*	E	
Ginseng, American	*Panax quinquefolius*	T	
Glasswort, Dwarf	*Salicornia bigelovii*	E	
Glasswort, Perennial	*Salicornia ambigua*	E	
Goat's-rue, wild	*Tephrosia virginiana*	E	
Goldenrod, Cutler's	*Solidago leiocarpa*	T	
Goldenrod, licorice	*Solidago odora*	E	
Goldenrod, rough-leaved	*Solidago patula*	E	
Goldenrod, Showy	*Solidago speciosa*	E	
Goosefoot, Fogg's	*Chenopodium foggii*	E	
Goosefoot, red	*Chenopodium rubrum*	E	
Graphephorum	*Graphephorum melicoides*	E	
Grass, Alpine Sweet	*Anthoxanthum monticola*	T	
Grass, American beach	*Ammophila breviligulata*	T	
Grass, American lyme	*Leymus mollis*	E	
Grass, arctic hair	*Vahlodea atropurpurea*	E	
Grass, Canada mountain-rice	*Piptatherum canadense*	E	
Grass, Coast Barnyard	*Echinochloa walteri*	E	

Grass, Eight-flowered Six-weeks	*Vulpia octoflora* var. *tenella*	E	
Grass, floating manna	*Glyceria septentrionalis*	E	
Grass, glaucous blue	*Poa glauca*	E	
Grass, neglected reed	*Calamagrostis stricta* ssp. *stricta*	E	
Grass, Nuttall's reed	*Calamagrostis cinnoides*	E	
Grass, sharp-flowered manna	*Glyceria acutiflora*	E	
Grass, Tundra Alkali	*Puccinellia pumila*	E	
Grass, wavy blue	*Poa laxa* ssp. *fernaldiana*	E	
Grass-leaved-goldenrod, coastal plain	*Euthamia caroliniana*	T	
Grass-of-Parnassus, fen	*Parnassia glauca*	T	
Grasswort, eastern	*Lilaeopsis chinensis*	E	
Green-dragon	*Arisaema dracontium*	E	
Ground-cedar, Sitka	*Diphasiastrum sitchense*	E	
Groundsel, balsam	*Packera paupercula*	T	
Groundsel, running	*Packera obovata*	E	
Hawkweed, narrow-leaved	*Hieracium umbellatum*	E	
Hawkweed, Robinson's	*Hieracium robinsonii*	E	
Hawthorn, Faxon's	*Crataegus faxonii*	--	
Hawthorn, Oakes'	*Crataegus oakesiana*	E	
Hawthorn, Poplar	*Crataegus populnea*	--	
Heather, Golden	*Hudsonia ericoides*	E	
Hempvine, climbing	*Mikania scandens*	E	
Horned-pondweed	*Zannichellia palustris*	E	
Horsebalm, northern	*Collinsonia canadensis*	E	
Horse-gentian, orange-fruited	*Triosteum aurantiacum*	E	
Horsetail, Marsh	*Equisetum palustre*	E	
Hound's-tongue, wild	*Cynoglossum virginianum* ssp. *boreale*	E	
Huckleberry, Dwarf	*Gaylussacia bigeloviana*	T	
Hudsonia, Hairy	*Hudsonia tomentosa*	T	
Iris, slender blue	*Iris prismatica*	E	
Juniper, Creeping	*Juniperus horizontalis*	E	
Knotweed, Douglas'	*Polygonum douglasii*	T	
Knotweed, prolific yellow-flowered	*Polygonum ramosissimum* ssp. *prolificum*	E	
Knotweed, Slender	*Polygonum tenue*	E	
Knotweed, upright	*Polygonum erectum*	E	
Ladies'-tresses, Case's	*Spiranthes casei*	E	
Ladies'-tresses, shining	*Spiranthes lucida*	E	
Lady's-slipper, greater yellow	*Cypripedium parviflorum* var. *makasin*	E	
Lady's-slipper, large yellow	*Cypripedium parviflorum* var. *pubescens*	T	

Lady's-slipper, ram's-head	*Cypripedium arietinum*	E	
Lady's-slipper, showy	*Cypripedium reginae*	E	
Lily, Turk's-cap	*Lilium superbum*	E	
Lobelia, brook	*Lobelia kalmii*	T	
Lobelia, Great	*Lobelia siphilitica*	E	
Lovegrass, sandbar	*Eragrostis frankii*	E	
Lovegrass, teel	*Eragrostis hypnoides*	E	
Lupine, Wild	*Lupinus perennis*	T	
Maple, Black	*Acer nigrum*	T	
Mare's-tail, common	*Hippuris vulgaris*	T	
Meadow-rue, anemone	*Thalictrum thalictroides*	E	
Meadow-rue, waxy-leaved	*Thalictrum revolutum*	--	
Mermaid-weed, comb-leaved	*Proserpinaca pectinata*	E	
Milk-vetch, Alpine	*Astragalus alpinus* var. *brunetianus*	--	
Milk-vetch, Jesup's	*Astragalus robbinsii* var. *jesupii*	E	E
Milkweed, butterfly	*Asclepias tuberosa*	E	
Milkweed, clasping	*Asclepias amplexicaulis*	T	
Milkweed, Four-leaved	*Asclepias quadrifolia*	E	
Milkweed, Purple	*Asclepias purpurascens*)	E	
Milkwort, Drum-heads	*Polygala cruciata* ssp. *aquilonia*	E	
Monkey-flower, musky	*Mimulus moschatus*	E	
Moonseed, Canada	*Menispermum canadense*	E	
Moss, Peat	*Sphagnum andersonianum*	T	
Moss, Peat	*Sphagnum angermanicum*	E	
Moss, Peat	*Sphagnum brevifolium*	E	
Moss, Peat	*Sphagnum contortum*	T	
Moss, Peat	*Sphagnum flavicomans*	E	
Moss, Peat	*Sphagnum lindbergii*	E	
Moss, Peat	*Sphagnum majus* ssp. *norvegicum*	T	
Moss, Peat	*Sphagnum pylaesii*	T	
Moss, Peat	*Sphagnum riparium*	T	
Moss, Peat	*Sphagnum subfulvum*	E	
Moss, Peat	*Sphagnum wulfianum*	T	
Moss-plant	*Harrimanella hypnoides*	E	
Mountain-heath, purple	*Phyllodoce caerulea*	T	
Mountain-mint, hoary	*Pycnanthemum incanum*	E	
Mountain-mint, Torrey's	*Pycnanthemum torrei*	E	
Mountain-mint, Virginia	*Pycnanthemum virginianum*	E	
Mountain-sorrel	*Oxyria digyna*	E	
Mud-plantain, grass-leaved	*Heteranthera dubia*	T	
Mudwort, Atlantic	*Limosella australis*	E	
Muhly, rock	*Muhlenbergia sobolifera*	E	
Muhly, slender	*Muhlenbergia tenuiflor*	E	

Nutsedge, Few-flowered	*Scleria pauciflora* var. *pauciflora*	E	
Nutsedge, Netted	*Scleria reticularis*	E	
Oak, Mossy-cup	*Quercus macrocarpa*	E	
Orache, saline	*Atriplex subspicata*	E	
Orchid, Loesel's wide-lipped	*Liparis loeselii*	T	
Orchid, round-leaved	*Amerorchis rotundifolia*	E	
Orchid, showy	*Galearis spectabilis*	T	
Orchid, Three-birds	Orchid, Three-birds	T	
Painted-cup, northern	*Castilleja septentrionalis*	E	
Painted-cup, Scarlet	*Castilleja coccinea*	--	
Panicgrass, Philadelphia	*Panicum philadelphicum*	E	
Pearlwort, boreal knotted	*Sagina nodosa* ssp. *borealis*	E	
Pine, Jack	*Pinus banksiana*	T	
Pine-drops	*Pterospora andromedea*	E	
Pinweed, narrow-leaved	*Lechea tenuifolia*	E	
Pogonia, Large Whorled	*Isotria verticillata*	E	
Pogonia, Small Whorled	*Isotria medeoloides*	T	T
Pond-lily, small-leaved	*Nuphar microphylla*	E	
Pondweed, blunt-leaved	*Potamogeton obtusifolius*	E	
Pondweed, Budding	*Potamogeton gemmiparus*	E	
Pondweed, flat-stem	*Potamogeton zosteriformis*	E	
Pondweed, Leafy	*Potamogeton foliosus*	E	
Pondweed, long-leaved	*Potamogeton nodosus*	T	
Pondweed, reddish	*Potamogeton alpinus*	E	
Pondweed, Richardson's	*Potamogeton richardsonii*	--	
Pondweed, Sago false	*Stuckenia pectinata*	E	
Pondweed, thread-leaved false	*Stuckenia filiformis*	E	
Pondweed, Vasey's	*Potamogeton vaseyi*	E	
Pondweed, white-stemmed	*Potamogeton praelongus*	E	
Prickly-ash, common	*Zanthoxylum americanum*	E	
Pygmy-weed	*Crassula aquatica*	E	
Quillwort, Acadian	*Isoetes acadiensis*	E	
Quillwort, Canada shore	*Isoetes riparia* var. *canadensis*	E	
Quillwort, Engelmann's	*Isoetes engelmannii*	E	
Quillwort, lake	*Isoetes lacustris*	E	
Rabbit-tobacco, Weatherby's	*Pseudognaphalium micradenium*	E	
Rattlebox, arrow-head	*Crotalaria sagittalis*	E	
Rattlesnake-root, Boott's	*Nabalus boottii*	E	
Rattlesnake-root, lion's-foot	*Nabalus serpentarius*	E	
Redtop-panicgrass, Long-leaved	*Coleataenia longifolia* ssp. *longifolia*	E	
Reed grass, northern neglected	*Calamagrostis stricta* ssp. *inexpansa*	T	

Reed, American	*Phragmites americanus*	--	
Rhododendron, Giant	*Rhododendron maximum*	T	
Rock-brake, slender	*Cryptogramma stelleri*	E	
Rockcress, green	*Boechera missouriensis*	T	
Rockcress, sicklepod	*Boechera canadensis*	T	
Rockcress, smooth	*Boechera laevigata*	E	
Rose, bristly	*Rosa acicularis* ssp. *sayi*	E	
Rosebay, Lapland	*Rhododendron lapponicum*	E	
Rose-mallow, swamp	*Hibiscus moscheutos*	E	
Rosette-panicgrass, round-fruited	*Dichanthelium sphaerocarpon*	E	
Rush, forked	*Juncus dichotomus*	E	
Rush, lopsided	*Juncus secundus*	E	
Rush, Moor	*Juncus stygius* ssp. *americanus*	E	
Rush, northern green	*Juncus alpinoarticulatus* ssp. *americanus*	E	
Rush, northern wood	*Luzula confusa*	E	
Rush, small-headed	*Juncus brachycephalus*	E	
Rush, spiked wood	*Luzula spicata*	E	
Sandbur, long-spined	*Cenchrus longispinus*	E	
Sandgrass, purple	*Triplasis purpurea*	E	
Sandmat, seaside	*Euphorbia polygonifolia*	--	
Sandplant, Appalachian	*Minuartia glabra*	E	
Sandplant, Michaux's	*Minuartia michauxii*	E	
Sanicle, Canada	*Sanicula canadensis*	E	
Sanicle, clustered	*Sanicula odorata*	E	
Sanicle, large-fruited	*Sanicula trifoliata*	T	
Saxifrage, alpine-brook	*Saxifraga rivularis*	E	
Saxifrage, Nodding	*Saxifraga cernua*	E	
Saxifrage, white mountain	*Saxifraga paniculata* ssp. *neogaea*	E	
Sclerolepis	*Sclerolepis uniflora*	E	
Screwstem, Purple	*Bartonia iodandra*	E	
Screwstem, Twining	*Bartonia paniculata*	E	
Sea-blite, American	*Suaeda calceoliformis*	E	
Sea-blite, Rich's herbaceous	*Suaeda maritima* ssp. *richii*	E	
Seaside-sandwort	*Honckenya peploides* ssp. *robusta*	--	
Sedge, Back's	*Carex backii*	E	
Sedge, Bailey's	*Carex baileyi*	T	
Sedge, beaked	*Carex rostrata*	E	
Sedge, Bigelow's	*Carex bigelowii*	T	
Sedge, blue	*Carex glaucodea*	E	
Sedge, bristle-leaved	*Carex eburnea*	E	
Sedge, Broad-winged	*Carex alata*	E	
Sedge, brown bog	*Carex buxbaumii*	E	

Sedge, bur-reed	*Carex sparganioides*	E	
Sedge, button	*Carex bullata*	E	
Sedge, Canadian single-spike	*Carex scirpoidea*	T	
Sedge, capitate	*Carex arctogena*	E	
Sedge, Chestnut	*Carex castanea*	E	
Sedge, clustered	*Carex cumulata*	T	
Sedge, crested	*Carex cristatella*	E	
Sedge, dry land	*Carex siccata*	E	
Sedge, elk	*Carex garberi*	T	
Sedge, Fescue	*Carex festucacea*	E	
Sedge, Golden-fruited	*Carex aurea*	T	
Sedge, Gray's Umbrella	*Cyperus grayi*	E	
Sedge, Hair-like	*Carex capillaris* ssp. *fuscidula*	E	
Sedge, Hairy-fruited	*Carex trichocarpa*	E	
Sedge, Hitchcock's	*Carex hitchcockiana*	E	
Sedge, Houghton's Umbrella	*Cyperus houghtonii*	E	
Sedge, Incurved Umbrella	*Minuartia glabra*	E	
Sedge, lesser tussock	*Minuartia michauxii*	T	
Sedge, limestone-meadow	*Sanicula canadensis*	E	
Sedge, Livid	*Sanicula odorata*	E	
Sedge, meager	*Sanicula trifoliata*	E	
Sedge, parasol	*Saxifraga rivularis*	E	
Sedge, red-root umbrella	*Saxifraga cernua*	E	
Sedge, Reflexed	*Saxifraga paniculata* ssp. *neogaea*	E	
Sedge, Rigid	*Sclerolepis uniflora*	--	
Sedge, rope-root	*Bartonia iodandra*	E	
Sedge, scabrous black	*Bartonia paniculata*	E	
Sedge, smooth black	*Suaeda calceoliformis*	E	
Sedge, sparse-flowered	*Suaeda maritima* ssp. *richii*	E	
Sedge, Summer	*Honckenya peploides* ssp. *robusta*	E	
Sedge, Swarthy	*Carex backii*	E	
Sedge, Thin-leaved	*Carex baileyi*	T	
Sedge, Troublesome	*Carex rostrata*	E	
Sedge, variable	*Carex bigelowii*	E	
Sedge, Walter's	*Carex glaucodea*	E	
Sedge, weak stellate	*Carex eburnea*	E	
Sedge, white bear	*Carex alata*	E	
Sedge, Wiegand's	*Carex buxbaumii*	E	
Senna, northern wild	*Carex sparganioides*	E	
Sensitive-pea, wild	*Carex bullata*	E	
Shinleaf, pink	*Carex scirpoidea*	E	
Sibbaldia	*Carex arctogena*	E	
Silverling	*Carex castanea*	T	

Silverweed, common	*Carex cumulata*	--	
Smartweed, stout dotted	*Carex cristatella*	E	
Speedwell, American alpine	*Carex siccata*	E	
Spikesedge, few-flowered	*Carex garberi*	E	
Spikesedge, little-headed	*Carex festucacea*	T	
Spikesedge, long-tubercled	*Carex aurea*	E	
Spikesedge, mudflat	*Cyperus grayi*	E	
Spikesedge, one-glumed	*Carex capillaris* ssp. *fuscidula*	T	
Spikesedge, ovoid	*Carex trichocarpa*	E	
Spikesedge, Pease's blunt	*Carex hitchcockiana*	--	
Spikesedge, quill	*Eleocharis nitida*	E	
Spikesedge, red-footed	*Eleocharis erythropoda*	E	
Spikesedge, Wright's	*Eleocharis diandra*	E	
Spleenwort, walking	*Asplenium rhizophyllum*	E	
Sprangletop, bearded	*Leptochloa fusca ssp. fascicularis*	E	
Spurred-gentian, American	*Halenia deflexa*	T	
St. John's-Wort, Great	*Hypericum ascyron*	E	
Star-grass, common	*Hypoxis hirsuta*	T	
Stickseed, Nodding	*Hackelia deflexa* ssp. *americana*	E	
Stickseed, Virginia	*Hackelia virginiana*	E	
Sweet-cicely, mountain	*Osmorhiza berteroi*	E	
Sweet-coltsfoot, northern	*Petasites frigidus* var. *palmatus*	E	
Thistle, Yellow	*Cirsium horridulum*	E	
Thoroughwort, hairy	*Eupatorium pubescens*	E	
Thoroughwort, upland	*Eupatorium sessilifolium*	E	
Threeawn, red	*Aristida longespica* var. *geniculata*	E	
Threeawn, seaside	*Aristida tuberculosa*	E	
Three-seeded-Mercury, Virginia	*Acalypha virginica*	E	
Tick-trefoil, large-bracted	*Desmodium cuspidatum*	E	
Tick-trefoil, round-leaved trailing	*Desmodium rotundifolium*	T	
Tick-trefoil, smooth small-leaved	*Desmodium marilandicum*	E	
Tick-trefoil, stiff	*Desmodium obtusum*	E	
Timothy, mountain	*Phleum alpinum*	E	
Toadflax, false	*Geocaulon lividum*	E	
Toothcup	*Rotala ramosior*	E	
Toothwort, cut-leaved	*Cardamine concatenata*	E	
Toothwort, Large	*Cardamine maxima*	T	
Twayblade, Auricled	*Neottia auriculata*	E	
Twayblade, Broad-leaved	*Neottia convallarioides*	T	
Twayblade, Heart-leaved	*Neottia cordata*	T	
Valerian, Marsh	*Valeriana uliginosa*	E	
Violet, bird-foot	*Viola pedata*	T	
Violet, northern bog	*Viola nephrophylla*	E	

Violet, northern marsh	*Viola palustris*	T	
Violet, Palmate	*Viola palmata*	E	
Virgin's-bower, purple	*Clematis occidentalis*	E	
Water-awlwort, American	*Subularia aquatica* ssp. *americana*	E	
Waterleaf, eastern	*Hydrophyllum virginianum*	T	
Water-marigold, Beck's	*Bidens beckii*	T	
Waterwort, American	*Elatine americana*	E	
Wedgescale, prairie	*Sphenopholis obtusata*	E	
Weed, hollow Joe-Pye	*Eutrochium fistulosum*	E	
White-topped-aster, narrow-leaved	*Sericocarpus linifolius*	E	
Whitlow-mustard, Canescent	*Draba cana*	E	
Whitlow-wort, smooth forked	*Paronychia canadensis*	E	
Wild-rye, early	*Elymus macgregorii*	E	
Willow, Bearberry	*Salix uva-ursi*	T	
Willow, Bog	*Salix pedicellaris*	--	
Willow, Labrador	*Salix argyrocarpa*	E	
Willow, Sandbar	*Salix exigua* ssp. *interior*	E	
Willow, satiny	*Salix pellita*	E	
Willow, snow-bed	*Salix herbacea*	E	
Willow, Tea-leaved	*Salix planifolia*	T	
Willow-herb, Hornemann's	*Epilobium hornemannii*	T	
Willow-herb, pimpernel	*Epilobium anagallidifolium*	E	
Willow-herb, white-flowered	*Epilobium lactiflorum*	E	
Windflower, long-headed	*Anemone cylindrica*	E	
Winterberry, evergreen	*Ilex glabra*	E	
Wormwood, field	*Artemisia campestris* ssp. *caudata*	E	
Yellow-loosestrife, tufted	*Lysimachia thyrsiflora*	T	
Yellow-rattle, Greenland little	*Rhinanthus minor* ssp. *groenlandicus*	E	
Yellow-rocket, American	*Barbarea orthoceras*	E	

[a]Information provided by the New Hampshire Fish and Game Department (NHFG 2017).
[b]Information provided by the New Hampshire Division of Forest and Lands, New Hampshire Natural Heritage Bureau (NHNHB 2013).

APPENDIX D: STATE LAWS AND REGULATIONS REGARDING NUISANCE MAMMALS IN NEW HAMPSHIRE

New Hampshire RSA (NHRSA) Title 28 contains fish, game, and wildlife law for the State of New Hampshire. Mammal damage-related laws and regulations are summarized below; State of NH laws (RSA) and NHFG Agency Rules (Fis):

1. NHRSA 207:3(a) - It is unlawful for a person to discharge a firearm or to shoot with a bow and arrow or crossbow and bolt within 300 feet of a permanently occupied dwelling without permission of the owner or the occupant of the dwelling or from the owner of the land on which the person discharging the firearm or shooting the bow and arrow or crossbow and bolt is situated. Whoever violates the provisions of this section shall be guilty of a violation if a natural person, or guilty of a misdemeanor if any other person.
2. NHRSA 207:14(1) - No person shall import, possess, sell, exhibit, or release any live marine species or wildlife, or the eggs or progeny thereof, without first obtaining a permit from the executive director except as permitted under title XVIII. The executive director shall have the authority to determine the time period and any other conditions governing the issuance of such permit. The executive director may refuse to issue a permit if he determines that such issuance may pose significant disease, genetic, ecological, environmental, health, safety, or welfare risks to persons, marine species or wildlife.
3. NHRSA 207:22-c Wildlife Damage Control Program; Administration. – There is established a wildlife damage control program which shall be administered by the executive director in cooperation with the United States Department of Agriculture and the New Hampshire department of agriculture, markets, and food. The program shall emphasize a comprehensive approach that integrates wildlife management and wildlife control methods and strategies and shall respond to conflicts between wildlife and human populations by stressing the importance of prevention of damage by initiating one or more of the following courses of action:
   I. A general wildlife damage mitigation program:
      a) The general wildlife damage mitigation program shall address conflicts between wildlife and human populations by disseminating educational and technical information, and providing assistance. The program may make available various repellents, institute the loan of direct control devices and materials including electric fences and frightening devices, and make referrals to nuisance wildlife cooperators.
      b) Actions under this paragraph shall be of a temporary nature and may include any other nuisance control methods available, as determined by the executive director, or designee.
   II. A cooperative fencing program:
      a) Commercial growers may participate in a cost-share-fencing program where the state pays for the full cost of fencing materials only. Under this program, the executive director may provide payment from funds designated for this program in the fish and game fund to an eligible commercial grower for the purchase of fencing materials.
      b) Commercial growers desiring to participate in the cost share program shall submit written applications to the executive director in such manner as prescribed by the executive director on or before April l of each year.
      c) Construction and maintenance costs of installed fences shall be the responsibility of the applicant.
      d) The failure of a commercial grower to properly install and maintain fencing purchased under this paragraph shall make the commercial grower ineligible to participate in this program until approved by the executive director.
      e) The executive director shall adopt rules pursuant to RSA 541-A to implement and execute the cooperative fencing program, which may include but not be limited to eligibility criteria, fencing specifications, funding levels, and inspection procedures.

f) The provisions and penalties of RSA 641 concerning false statements shall apply to all reporting and documentation required pursuant to this paragraph.
g) For purposes of this paragraph, a "commercial grower" means any person who grows an agricultural or horticultural crop from which the person has derived, or reasonably expects to derive, an annual gross income from the sale of crops normally produced of at least $2,500.

III. A depredation permit program:
a) The executive director shall adopt rules, pursuant to RSA 541-A, regulating the issuance of depredation permits to kill animals causing damage to commercial crops or which pose a threat to human health and safety. Such rules shall address the method and manner of taking animals, the disposition of animals taken under such permits, as well as the qualifications necessary to participate in the program. Such qualifications shall include, but not be limited to, the provision of information concerning the history of damage, the record of preventative methods used in the past, and the public hunting access history.
b) The depredation permit program shall include the issuance of pre-damage deer kill permits to commercial growers as defined in RSA 207:22-c, II(h) upon request to the director. Issuance of pre-damage deer kill permits will facilitate protection of qualifying crops at the onset of deer visitation to said crops. Any deer taken under this provision shall be subject to investigation by the local conservation officer to determine whether or not the potential existed at the time of taking for damage to have occurred. Depredation permits shall be issued following the procedures in this paragraph.

4. NHRSA 207:23-a – A person who suffers loss or damage to livestock, bees, orchards or growing crops, by bear or mountain lion, shall, if he claims damage therefor, notify the executive director of fish and game in writing of such damage. The executive director or his agent shall investigate such claim within 30 days from the receipt by him of notice of such damage, and within one year determine whether such damage was caused by bear or mountain lion, and appraise the amount to be paid. The executive director, immediately upon making any appraisal of damage thereof, shall present his certificate of the amount of appraisal to the governor, who is authorized to draw his warrant upon any money in the treasury not otherwise appropriated in payment therefor.
5. NHRSA 207:26 - A person may pursue, wound or kill, on land owned or occupied by such person, any unprotected bird or wild animal which the person finds in the act of doing actual and substantial damage to poultry, crops, domestic animals, or the person's property, and may authorize a family member, employee, or other person requested to do so under the provision of a depredation permit issued by the executive director pursuant to RSA 207:22-c, III.
6. NHRSA 207:27 - The person by whom or under whose direction any game or fur-bearing animal is wounded or killed shall, within 12 hours, report all facts relative thereto to the nearest conservation officer or to the executive director. Such report shall state the time and place of wounding or killing and the nature and amount of property destroyed.
7. NHRSA 207:29 - Any game or fur-bearing animal killed or wounded as provided in this subdivision shall, in the discretion of the executive director, be returned to the person who killed the same, be given to some charitable institution, or otherwise disposed of.
8. NHRSA 207:30 - The provisions of this subdivision shall not impair the constitutional rights of persons to protect themselves or their property from injury or destruction by wild birds, game, or fur-bearing animals, protected by the laws of this state.
9. NHRSA 208:1-b - No person shall, at any time, shoot, hunt, take, or possess, any mountain lion or any part of the carcass, taken in this state. However, this section shall not apply to a person acting in self-protection or protecting such person's property.
10. NHRSA 208:1-c - The executive director may, should mountain lions become a nuisance in any part of the state, take and authorize such measures as the executive director deems necessary for control of this animal.

11. NHRSA 208:1-d - No person shall, at any time, shoot, hunt, take or possess, any animal of the species known as Canadian Lynx or part of the carcass thereof, taken in this state. However, this section shall not apply to a person acting in self-protection or protecting such person's property.
12. NHRSA 210:3-b - It shall be unlawful for any person to possess or take any marine mammals except as provided for in the Marine Mammal Protection Act and under the rules adopted by the executive director pursuant to RSA 207:14 and RSA 211:62. Notwithstanding any provisions to the contrary, whoever violates this section shall be guilty of a violation.
13. NHRSA 210:4 - No person shall at any time destroy or injure a muskrat house, den or burrow, or place a trap within 15 feet thereof. No person shall at any time injure or destroy the house, den or burrow used by any game animal or fur-bearing animal.
14. NHRSA 210:9 – I. No person shall destroy or disturb or interfere in any manner with the dams or houses of beaver, without first obtaining a special permit from the executive director.

    II. Notwithstanding paragraph I or any other provision of law or rule of the executive director or the department of environmental services, a landowner, the landowner's agent, or any town or municipal or state official or employee, may destroy beaver, remove beaver dams, or install beaver pipes or beaver fences on property under their control to protect property, public highways, or bridges from damage or submersion. Dam removal shall be allowed without a permit under RSA 482-A if machinery does not enter the water and filling or dredging in or adjacent to surface water, wetlands, or their banks does not occur. Removal shall be done in a gradual manner that does not allow a sudden release of impounded water so as to cause erosion, siltation, or a safety hazard downstream.

    II-a. For purposes of paragraph II, the term "beaver pipes" means no more than 3 temporary structures with the widest dimension no larger than 15 inches that is placed in a beaver dam to allow water passage to maintain a specific water surface elevation, and the term "beaver fences" means posts and fencing installed at culverts in such a manner as to either encourage or discourage beaver damming against the fence.

    III. The executive director may require the reporting of beaver taken pursuant to paragraph II by rules made in accordance with RSA 541-A.

    IV. Skins or unskinned carcasses taken under this section shall be sealed pursuant to RSA 210:8 before such skins or unskinned carcasses are sold or given away.

    V. The executive director or his agents shall provide advice relative to beaver control techniques when requested.
15. NHRSA 210:11 – I. No person shall set, arrange or tend any trap upon any land or from the shores of any waters of which he is not the owner or occupant, except such traps as may be placed under water from a boat or canoe or through the ice on any public body of water as defined in RSA 271:20 or on the following named rivers, Androscoggin, Ammonoosuc, Ashuelot, Bear Camp, Contoocook, Connecticut, Cocheco, Exeter, Lamprey, Mascoma, Merrimack, Merrymeeting, Islinglass, Pemigewasset, Pine, Saco, Soucook, Suncook, Winnipesaukee and their navigable tributaries, until he has secured from the owner or occupant a permit in writing signed by said owner or occupant, and until he shall have filed with the conservation officer in whose district said person is going to trap, a copy thereof, together with a description of the land on which trapping is to be done. Navigable tributary as used in this section shall be defined as those waters from the mouth of said tributary to a point upstream where a person can row a boat or paddle a canoe when the water in the stream is in its ordinary condition.

    II. All metal traps shall have the name of the person setting them, either stamped or engraved in a legible and permanent manner on the trap or on a durable tag securely affixed to the metal trap or chain holding said trap.

    III. No person shall set or arrange any trap in a public way, cart road or path commonly used as a passageway by human beings or domestic animals.

    IV. The executive director, with the approval of the commissioner of the department of transportation in the case of Class I, II or III highways, and of the municipality in the case of Class IV, V or VI highways, is authorized to issue special permits allowing the setting of traps for a specified period of time and in a specific location under or in the vicinity of bridges or in

artificial or natural ditches or drainage systems or in the vicinity of any combination of such within the limits of the right-of-way of any public highway if such trapping is desirable to protect the highway.

16. NHRSA 210:13 - Notwithstanding any other law to the contrary, a person shall visit his traps at least once in each calendar day, provided, however, that a person trapping for beaver through the ice during the open season therefor, shall visit his traps once in each 72 hours. Trappers shall be permitted to use artificial lights during the hours of darkness to facilitate the checking of traps under this section, subject to the following restrictions: no person shall check traps at night by the use of a rifle, revolver, or pistol larger than a .22 caliber long rifle or by use of shotgun shells carrying shot larger than number 4 birdshot; and checking traps by the use of lights from a motor vehicle shall be prohibited. Only a person whose name is either stamped or engraved on the traps or on a durable tag securely affixed to the traps shall have the authority to tend the traps. In case of an emergency, the owner of the traps may grant written permission to another duly licensed trapper to tend the traps.
17. NHRSA 210:16 - No person shall set or use at any time any device, the object of which is to discharge a firearm, for the purpose of taking game or fur-bearing animals.
18. NHRSA 210:17 - The executive director may adopt rules, under RSA 541-A, relative to the use of snares for the taking of wildlife.
19. NHRSA 210:24-b - I. The executive director may adopt rules, under RSA 541-A, for the licensure and regulation of wildlife control operators engaged in the practice of the trapping of nuisance animals. Such rules may include, but shall not be limited to:
    (a) The establishment of license types and fees.
    (b) Minimum license requirements.
    (c) The manner and method of taking.
    (d) The wildlife species which may be controlled.
    (e) Transportation and disposition of the wildlife.
    (f) Reporting and sale requirements.
    (g) Exceptions to RSA 210:11.
    (h) License reciprocity.

    II. The provisions of this section, and any rules adopted under this section, shall not apply to officers and employees of the department, the state, or of a municipality, where such persons are acting in their official capacity.

20. Fis 303.12: Restrictions on Certain Traps -
    (a) No foothold trap with auxiliary teeth added shall be allowed.
    (b) No foothold trap shall be set on land with an inside jaw spread greater than 6½ inches, measured between the inside edges of the opened jaws, across the trap trigger, and perpendicular to the trap base plate.
    (c) Body gripping traps with an inside jaw spread greater than or equal to 6½ inches, measured inside the jaws perpendicular to the trap's pivoting joints, shall only be set:
    Five feet or more above the ground or surface of the snow unless there was a snowstorm during the previous 24 hours; or
    (2) In water for beaver or otter.
    (d) Deadfalls, a device constructed of any material(s) utilizing material weight as the holding or killing method, shall be prohibited.
    (e) Notwithstanding the provisions of Fis 308, no person shall set a snare on land.
    (f) When set, all traps shall be securely attached to the ground, to a fixed object, to a drag, or to a slide wire.
    (g) Traps shall not be set within 50 feet of exposed bait, as defined in (h), but may be set any distance from a covered bait, as defined in (i).
    (h) "Exposed bait" means bait that is the body of any animal, including fish, or parts thereof including meat, organs, viscera, bones, or any other parts of an animal, that is visible from

above, but does not include meat, organs, viscera, or bones totaling 4 ounces or less, or skin, hair or feathers 25 square inches or less, droppings, urine, or living or dead animals held in a trap as the result of lawful trapping activity.

"Covered bait" means bait that is the body of any animal, including fish, or parts thereof including meat, organs, viscera, bones, or any other parts that are covered so as to not be visible from above, where cover includes, but is not limited to, brush, branches, leaves, soil or snow and is constructed in a manner to withstand wind and normal environmental conditions. "Covered bait" includes baits less than one-half pound when placed in a dirt hole 6 inches in diameter or less at a depth of 6 inches or greater, and baits of less than 5 pounds placed on pole sets 5 or more feet above ground are also considered covered bait.

(j) The following restrictions on traps shall apply while trapping in WMU's A, B, C1, C2, D1, D2East, E and F:

All foothold traps set on land must have one swivel in the chain/cable and one swivel connection to the trap;

(2) Body gripping traps with an inside jaw spread of 4 inches or greater and less than or equal to 5 inches, measured inside the jaws perpendicular to the trap's pivoting joints, which are set on the ground shall only be set as follows:

Set in water at all times;

Set under overhanging stream banks; and

Set as a blind set with no bait or attractant;

(3) Body gripping traps, measured inside the jaws perpendicular to the trap's pivoting joints, with an inside jaw spread 4 inches or greater which are set off the ground shall only be set as follows:

Five feet or more above the ground or surface of the snow, unless there was a snowstorm during the previous 24 hours;

b. Affixed to a leaning section of a pole or tree, no greater than 4 inches in diameter that is free of branches and angled 45 degrees or greater in its entirety;

Excluding branch removal the pole or tree shall not have planed or altered sides;

The area within 4 feet of the trap shall be free of trees, poles or other objects greater than 4 inches in diameter;

The areas within 4 feet of the trap shall be free of trees or poles that are angled less than 45 degrees to the ground at any point between the ground elevation and the elevation of the trap; and

The area within 4 feet of the trap shall be free of banks, bluffs, rocks or immediate rise in ground elevation; and

(4) Body gripping traps with an inside jaw spread greater than 5 inches and less than 6½ inches, measured inside the jaws perpendicular to the trap's pivoting joints, which are set on the ground, shall only be set:

Recessed in the den entry of nuisance wildlife with the den entry covered by wire mesh with openings that do not exceed 1 ½ inches side-to-side and wire gauge shall be 16 gauge or less or wire diameter 0.05 inches or greater;

b. If placed in a lynx exclusion device, as follows:

The trap jaws shall be completely within the device, but the trap springs may be outside of the device;

The lynx exclusion device shall not have an opening greater than 6 inches by 8 inches;

The opening shall not be directly in front of the trap, but shall be either on the top or side of the device;

The trap set within the device shall be a minimum of 18 inches from the closest edge of the opening to the trap;

The back of the device shall be secured to withstand heavy pulling;

If using wire mesh with a wood box, the wire mesh shall wrap around 2 opposite sides of the box and be secured;

There shall be at least 2 attachment points for each side of the device where there is a joint, or where panels come together;

The exclusion device shall be constructed of wood, or wire mesh that does not exceed 1½ inch openings from side to side;
The wire gauge shall be 16 gauge or less or a wire diameter of 0.05 inches or greater;
The opening slot in the device that allows the trap springs to extend outside the device shall be no more than 7½ inches wide and a height of no more than 1½ inches; and
The trap shall be anchored outside of the device.

21. Fis 308 WILDLIFE CONTROL OPERATORS

Fis 308.01 Definitions.

(a) "Level I wildlife control operator" means a person who is a licensed trapper and who is also engaged in the practice of trapping nuisance animals under RSA 210:24-b.

(b) "Level II wildlife control operator" means a person who is engaged in the commercial practice of trapping nuisance animals under RSA 210:24-b.

(c) "Nuisance animal" means wildlife that a landowner wants excluded or removed to protect their family or their property from injury or destruction by the animal specified in Fis 308.02(e).

Fis 308.02 Licensing Requirements.

(a) A wildlife control operator shall obtain a level I or level II wildlife control operator's license.

(b) All wildlife control operators shall meet the requirements of RSA 214:11-b relative to education.

(c) Wildlife control operators may trap, in the performance of their licensed activities, nuisance wildlife outside the regular trapping seasons.

(d) Wildlife control operators shall not trap endangered or threatened species, protected birds, deer, moose, bear, or turkey.

(e) Wildlife control operators may only trap the following:

(1) Beaver;
(2) Otter;
(3) Mink;
(4) Fisher;
(5) Porcupine;
(6) Raccoon;
(7) Bobcat;
(8) Grey and red fox;
(9) Weasel;
(10) Skunk;
(11) Muskrat;
(12) Grey, red and flying squirrel;
(13) Rabbit and hare;
(14) Coyote;
(15) Opossum;
(16) Woodchuck;
(17) Chipmunks;
(18) Mice, rats, voles, moles, and shrews; and
(19) Snakes.

(f) Bats shall be controlled by exclusion techniques as described in Fis 1001.05 (d) and (e).

(g) Wildlife control operators may remove individual bats from portions of structures occupied by humans or livestock at any time of year.

(h) Any person trapping under a wildlife control operator license shall be exempt from the written landowner permission required under RSA 210:11, but shall be restricted to the property of that landowner for whom they are working.

(i) Wildlife control operator licenses shall expire on June 30 each year.

Fis 308.03 Trapping Restrictions.

(a) Traps shall be checked at least once in a calendar day pursuant to RSA 210:13 and the landowner or their agent may check box traps only for the wildlife control operator.

(b) Snares shall only be used by wildlife control operators after completing a training course in the use of snares.

(c) Trappers or wildlife control operators shall have held a trapping or wildlife control operator license for at least 3 years since 2000 before enrolling in the snaring course.

(d) A training course for the use of snares shall be approved by the executive director and include legal requirements, equipment review, methods and techniques for use, target selection, and humane considerations.

(e) Snares shall be non-locking relaxing snares equipped with a deer stop and a durable tag with the name of the person setting them stamped or engraved in a legible manner.

(f) Any domestic dog killed in a trap or a snare shall be reported to the department within 24 hours.

(g) Body gripping traps shall be set in accordance with Fis 303.12.

(h) Any non-targeted wildlife, incidentally killed, that has no open season shall be reported to the department within 72 hours.

(i) Fisher and otter taken by wildlife control operators shall be sealed within 10 days and may be sold.

(j) During the open season for fisher and otter the limit for fisher and otter shall be in accordance with the season limits specified in Fis 303.02(c) and Fis 303.04(c).

(k) Nuisance bobcat shall only be captured in live traps and released unharmed.

(l) The wildlife control operator may relocate and release wildlife only after the wildlife control operator has obtained written permission of the landowner where the wildlife is to be released.

(m) Wildlife control operators may release wildlife on state owned or managed lands for which they hold a valid trapping permit issued pursuant to Fis 303.13.

Fis 308.04 Level I Wildlife Control Operator.

(a) Any licensed trapper who holds a level I wildlife control operators license may trap nuisance animals outside the regular trapping seasons.

(b) Level I wildlife control operator licensees may only charge for services for trapping furbearers, woodchucks, coyote, opossums, and porcupines but shall not charge for services for trapping other nuisance wildlife.

(c) Level I wildlife control operators may keep and sell the hide of any furbearer currently permitted under the trapping license.

(d) Level I wildlife control operator shall report as follows:

(1) Report all furbearing animals killed during the open season for trapping wildlife on their trapping report as specified in Fis 303.08; and

(2) Report all nuisance furbearing animals killed outside the open trapping season on a wildlife control operator report as specified in Fis 308.07(c).

(e) The license fee shall be $10. However, as of July 1, 2016, the license fee shall be $15.00.

Fis 308.05 Level II Wildlife Control Operator.

(a) Applicants for a level II wildlife control operators license shall have completed a 6-hour workshop, or be certified by the National Wildlife Control Operators Association (NWCOA) or have held a previous level II wildlife control operators license.

(b) A workshop shall include the following topics:

(1) Laws and rules;

(2) Wildlife biology and ecology;

(3) Best management practices;

(4) Exclusionary methods, to include training on devices such as repellants, one-way doors, habitat modification and live traps;

(5) Consideration of humane issues of wildlife;
(6) Site evaluation;
(7) Non-lethal or lethal resolutions to wildlife problems;

(8) Techniques to prevent reoccurrence of the problem;
(9) Capture, transport and handling of wildlife;
(10) Euthanasia;
(11) Landowner relations; and
(12) Disease, hazards and risks.

(c) The level II wildlife control operators may utilize persons employed by them, and under their supervision to assist in carrying out their business.

(d) The wildlife control operator shall not use assistants who do not have the ability, knowledge and training to capably perform the tasks assigned to them.

(e) Each assistant shall carry a copy of their supervisor's level II wildlife control operator license.

(f) Level II wildlife control operators shall submit a report as specified in Fis 308.07(c).

(g) In addition to (f), a level II wildlife control operator who also holds a regular trapping license for the purpose of trapping furbearers during the regular trapping seasons shall report all furbearing animals taken during the open season for trapping on the annual trappers report as described in Fis 303.08.

(h) The level II license fee shall be $100 for residents and $300 for nonresidents. However, as of July 1, 2016, the license fee shall be $135 for residents and $400 for nonresidents.

Fis 308.07 Wildlife Control Operator Forms.

(a) A person requesting a wildlife control operator's license shall provide:
(1) Name and address;
(2) Date of birth;
(3) Height and weight;
(4) Telephone number;
(5) Business name and address, if operating a business;
(6) Level of license;
(7) A current NH trapping license number, if applying for a level I license;
(8) Proof of completion of a trapper education course if the applicant does not possess a trapping license and the applicant is applying for a level II license;
(9) Previous level II wildlife control operator's license or proof, as specified in (b) below, that the requirements of Fis 308.05(b) have been met if the applicant is applying for a level II license;
(10) If the applicant wishes to use snares, proof of completion of a snaring workshop as required in Fis 308.03(b);
(11) An indication as to whether the licensee would like his or her name and contact information provided on a list of wildlife control operators provided by the department; and
(12) Signature of the applicant subject to the penalties for making unsworn false statements under RSA 641:3.

(b) Proof that the requirements of Fis 308.05(b) have been met shall include a certificate or letter from NWCOA or certificate or letter from NH, Massachusetts, Connecticut, or any other state or province or organization conducting a similar workshop stating that the individual has completed the workshop.

(c) Level I and Level II operators shall include on the "Wildlife Control Operator Reporting Form" the following:
(1) The licensee's name, phone number, home and business address;
(2) The level of license and license number held;
(3) The time period covered by report;
(4) Whether or not nuisance wildlife was trapped;

(5) The number of nuisance furbearing animals by species killed in each town and wildlife management unit during the reporting period; and

(6) Licensee's signature subject to the penalties for making unsworn false statements under RSA 641:3.

(d) Level II operators shall also report for all bats that are excluded, the following information:

(1) Date of exclusion;

(2) Species of bat excluded;

(3) Estimated number of bats in the colony;

(4) Type of structure bats were excluded from;

(5) Town where exclusion was done;

(6) If exclusions were performed between May 15 and August 15, whether pups were present as specified in Fis 1001.05(b)(2);

(7) If exclusions were performed between August 1 and August 15, whether pups were flying for 2 weeks or more prior to the exclusion as specified in Fis 1001.05(b)(3); and

(8) Note any public health related exclusions.

22. Fis 310.01 Control of Nuisance Black Bears.

(a) No person shall use, place, provide, give, expose, deposit, scatter or distribute any material that results in attracting black bears after being noticed by the executive director or his designee to cease the activity because the activity might result in injury to a person, damage to property or create a public nuisance.

23. Fis 805.02 Permits To Release Wildlife.

(a) No live wildlife designated as controlled, the eggs or progeny thereof, shall be released without a permit to release wildlife or except as otherwise permitted under Fis 805.02(e), RSA 207:1-a, 214:34-d, or 209-A:3, IV, or unless the release of wildlife is specifically permitted under another permit such as birds for regulated shooting areas or individual training and shooting permits or fish for kid's tournaments under this chapter.

(b) No person shall release or allow to be released any wildlife that is diseased or suspected of being diseased.

(c) No wildlife shall be released on the property of another without written landowner permission.

(d) A permit to release shall be valid from date of issuance to the end of the calendar year in which the permit was issued or the expiration of the health certificate, whichever is sooner.

(e) No permit to release wildlife shall be required to release indigenous wildlife captured or trapped by a landowner, as long as the release is on the landowner's own land or on another landowners' land and only with written permission of the other landowner.

24. Fis 1001.05 Bats in Structures.

(a) Except as set forth in this section, no person shall take a bat listed in Fis 1001.01 or Fis 1001.02.

(b) Between the dates of May 15 and August 15, inclusive, in any year, no bat listed in Fis 1001.01 or Fis 1001.02 shall be removed or excluded from any structure occupied by humans or livestock unless:

(1) Action is taken pursuant to (c) below;

(2) Between the dates of May 15 and August 15, inclusive, in any year a licensed wildlife control operator reports in writing to the department that no bat pups were present in the structure at the time removal or exclusion techniques were employed; or

(3) Between the dates of August 1 and August 15, inclusive, in any year a licensed wildlife control operator reports in writing to the department that bat pups were observed flying for two weeks or more prior to the time removal or exclusion techniques were employed.

(c) Pursuant to RSA 212-A:7, II and 50 C.F.R. Part 17.40(o), individual bats, including those listed in Fis 1001.01 and Fis 1001.02 above, may be removed or excluded at any time from any man-made structure in order to:

(1) Protect the health and safety of the occupant(s);

(2) Prevent the transmission of disease; or

(3) To comply with the requirements of 21 U.S.C. Section 331, et. seq. and regulations at 21 C.F.R. Part 507.17 and 507.19 designed to prevent the contamination of food or agricultural products meant for human or animal

(d) Unless acting pursuant to Fis 1001.05 (c), bats shall be controlled exclusively by exclusion techniques.

(e) All persons acting to exclude bats shall do so in accordance with the publication "Acceptable Management Practices for Bat Control Activities in Structures - A Guide for Nuisance Wildlife Control Operators", dated April 1, 2015, available as noted in Appendix A.

(f) Any action taken by a wildlife control operator licensed pursuant to Fis 308 on a bat shall be reported to the department as required by Fis 308.06, including information as to whether the specimen was transmitted to the Department of Health and Human Services for testing, and the result of the test.

APPENDIX E: CRITERIA FOR BEAVER DAM BREACHING/REMOVAL

Beaver dam breaching/removal is generally conducted to maintain existing stream channels and drainage patterns and/or to reduce flood waters. Beaver dams are often made from natural debris such as logs, sticks, and mud. Dams also might contain man-made materials such as tires, plastic pipe, or plywood. Beaver are opportunistic when it comes to materials used for dam building. Approximately the center of the dam or area closest to the existing channel is dislodged during a beaver dam breaching operation. Impoundments that WS removes are normally from recent beaver activity and have not been in place long enough to take on the factors of a true wetland (i.e., hydric soils, hydrophytic vegetation, hydrology). Beaver dam breaching/removal by hand or with binary explosives does not affect the substrate or the natural course of the stream and returns the area back to its preexisting condition with similar flows and circulations. Because beaver dams involve waters of the United States, dam breaching/removal is regulated under Section 404 of the Clean Water Act (CWA).

Wetlands are recognized by three characteristics: hydric soils, hydrophytic vegetation, and general hydrology. Hydric soils are either composed of, or have a thick surface layer of, decomposed plant materials (muck); sandy soils have dark stains or streaks from organic material in the upper layer where plant material has attached to soil particles. Hydric soils may be bluish gray or gray below the surface or brownish black to black and have the common smell of rotten eggs. Wetlands also have hydrophytic vegetation present such as cattails, bulrushes, willows (Salix spp.), sedges (Carex spp.), and water plantains (Alismataceae). A final indicator is general hydrology which includes standing and flowing water or waterlogged soils during the growing season; high water marks often are present on trees and drift lines of small piles of debris are usually present. Beaver dams usually will develop a layer of organic material at the surface. Silt deposits can occur rapidly, but aquatic vegetation and high water marks (a new high water mark is created by the beaver dam) are usually not present. However, cattails and willows can show up rapidly if they are in the vicinity, but most hydrophytic vegetation takes time to establish.

In most beaver dam breaching/removal operations, the material that is displaced is exempt from permitting or included in a Nationwide Permit (NWP) in accordance with Section 404 of the CWA (33 CFR Part 323). A permit would be required if the impoundment caused by a beaver dam was not covered under a NWP or permitting exemption and was a true wetland. WS' biologists and specialists survey the beaver dam site and impoundment to determine if conditions exist for classifying the site as a true wetland. If wetland conditions exist, the landowner or cooperator is asked the approximate age of the dam or how long he/she has known of its presence. This information is useful in determining if Swampbuster, Section 404 permit exemptions, or nationwide permits will allow breaching/removal of the beaver dam. If it is determined that a dam cannot be removed or breached under provisions provided by Swampbusters, 404 permit exemption or NWP, the landowner or cooperator is responsible for obtaining a Section 404 permit before the dam could be breached/removed by WS.

The following explains Section 404 exemptions and conditions that pertain to the breaching/removal of beaver dams:

33 CFR 323 - Permits For Discharges of Dredged or Fill Material into Waters of the United States. This regulation provides guidance to determine whether certain activities require permits under Section 404.

Part 323.4 Discharges not requiring permits. This section establishes exemptions for discharging certain types of fill into waters of the United States without a permit. Certain minor drainage activities connected with normal farming, ranching, and silvicultural practices do not require a permit as long as these drainages do not include the immediate or gradual conversion of a wetland (i.e., beaver ponds greater than 3 years old) to a non-wetland. Specifically, part (a)(1)(iii)(C)(i) states, "...fill material incidental to connecting upland drainage facilities (e.g., drainage ditches) to waters of the United States,

adequate to effect the removal of excess soil moisture from upland croplands...". This indicates that beaver dams that block ditches, canals, or other structures designed to drain water from upland crop fields can be breached without a permit.

Moreover, (a)(1)(iii)(C)(iv) states the following types of activities do not require a permit. "The discharges of dredged or fill materials incidental to the emergency removal of sandbars, gravel bars, or other similar blockages which are formed during flood flows or other events, where such blockages close or constrict previously existing drainage ways and, if not promptly removed, would result in damage to or loss of existing crops or would impair or prevent the plowing, seeding, harvesting or cultivating of crops on land in established use for crop production. Such removal does not include enlarging or extending the dimensions of, or changing the bottom elevations of, the affected drainage way as it existed prior to the formation of the blockage. Removal must be accomplished within one year of discovery of such blockages in order to be eligible for exemption." This allows the breaching of beaver dams in natural streams to restore drainage of agricultural lands within one year of discovery.

Part 323.4 (a)(2) allows "Maintenance, including emergency reconstruction of recently damaged parts, of currently serviceable structures such as dikes, dams, levees, groins, riprap, breakwaters, causeways, bridge abutments or approaches, and transportation structures. Maintenance does not include any modification that changes the character, scope, or size of the original fill design. Emergency reconstruction must occur within a reasonable period of time after damage occurs in order to qualify for this exemption." This allows beaver dams to be breached without a permit where they have resulted in damage to roads, culverts, bridges, or levees if it is done in a reasonable amount of time.

33 CFR 330 - NWP Program. The U.S. Army Corp of Engineers (USACE), Chief of Engineers is authorized to grant certain dredge and fill activities on a nationwide basis if they have minimal impact on the environment. NWPs are listed in Appendix A of 33 CFR 330 and permittees must satisfy all terms and conditions established to qualify for their use. Individual beaver dam breaching by WS may be covered by any of the following NWPs if not already exempted from permit requirements by the regulations discussed above. WS complies with all conditions and restrictions placed on NWPs for any instance of beaver dam breaching/removal done under a specific NWP.

Nationwide permits can be used except in any component of the National Wild and Scenic River System such as waterways listed as an "Outstanding Water Resource", or any water body which is part of an area designated for "Recreational or Ecological Significance".

NWP 3 authorizes the rehabilitation of those structures, such as culverts, homes, and bridges, destroyed by floods and "discrete events," such as beaver dams, provided that the activity is commenced within 2 years of the date when the beaver dam was established.

NWP 18 allows minor discharges of dredged and fill material, including the breaching of beaver dams, into all waters of the United States provided that the quantity of discharge and the volume of excavated area does not exceed 10 cubic yards below the plane of the ordinary high water mark (this is normally well below the level of the beaver dam) or is in a "special aquatic site" (wetlands, mudflats, vegetated shallows, riffle and pool complexes, sanctuaries, and refuges). The District Engineer must be "notified" (general conditions for notification apply), if the discharge is between 10-25 cubic yards for a single project or the project is in a special aquatic site and less than 1/10 of an acre is expected to be lost. If the values are greater than those given, a permit is required. Beaver dams rarely would exceed 2 or 3 cubic yards of backfill into the waters and probably no more than 5 cubic yards would ever be exceeded. Therefore, this stipulation is not restrictive. Beaver dams periodically may be breached in a special aquatic area, but normally the aquatic site will be returned to normal. However, if a true wetland exists, and beaver dam breaching/removal is not allowed under another permit, then a permit must be obtained from the District Engineer.

NWP 27 provides for the discharge of dredge and fill for activities associated with the restoration of wetland and riparian areas with certain restrictions. On non-federal public and private lands, the owner must have: a binding agreement with USFWS or Natural Resources Conservation Service (NRCS) to conduct restoration; a voluntary wetland restoration project documented by NRCS; or notify the District Engineer according to "notification" procedures. On federal lands, including USACE and USFWS, wetland restoration can take place without any contract or notification. This NWP "...applies to restoration projects that serve the purpose of restoring "natural" wetland hydrology, vegetation, and function to altered and degraded non-tidal wetlands and "natural" functions of riparian areas. This NWP does not authorize the conversion of natural wetlands to another aquatic use..." If operating under this permit, the breaching/removal of a beaver dam would be allowed as long as it was not a true wetland. Non-federal public and private lands require the appropriate agreement, project documentation, or notification to be in place.

A quick response without delays resulting from permitting requirements can be critical to the success of minimizing or preventing beaver damage. Exemptions contained in the above regulations or NWPs provide for the breaching/removal of the majority of beaver dams that New Hampshire WS encounters. The primary determination that must be made by WS' personnel is whether a beaver impounded area meets the criteria to be classified as a true wetland or is the area a more recently flooded site lacking true wetland characteristics. Flexibility allowed by these exemptions and NWPs is important for the efficient and effective resolution of many beaver damage problems. Damage often escalates the longer an area remains flooded. In addition, NHFG has also established Best Management Practices for handling human-beaver conflicts that are intended to protect water quality and wetlands while providing guidance on alleviating damage to property associated with beaver activity. WS personnel will conform to those BMP when responding to requests for assistance related to beaver damage in New Hampshire.

APPENDIX F: USFWS PROGRAMMATIC BIOLOGICAL OPINION FOR CANADA LYNX AND ATLANTIC SALMON

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
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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

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