ENVIRONMENTAL ASSESSMENT

MAMMAL DAMAGE MANAGEMENT IN PENNSYLVANIA

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SUMMARY

Pennsylvania's wildlife has many positive values and is an important part of life in the state. However, as human populations expand, and land is used for human needs, there is increasing potential for conflicting human/wildlife interactions. This Environmental Assessment (EA) analyzes the potential environmental impacts of alternatives for United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) involvement in the reduction of conflicts by mammals in Pennsylvania, including damage to property, agricultural and natural resources and risks to human and livestock health and safety. The proposed wildlife damage management activities could be conducted on public and private property in Pennsylvania when the property owner or manager requests assistance and/or when assistance is requested by an appropriate state, federal, tribal or local government agency.

The preferred alternative considered in the EA, would be to continue and expand the current Integrated Wildlife Damage Management (IWDM) program in Pennsylvania. The IWDM strategy encompasses the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, target and non-target species, and the environment. Under this action, WS could provide technical assistance and direct operational assistance including non-lethal and lethal management methods, as described in the WS Decision Model (Slate et al. 1992). When appropriate, non-lethal methods like physical exclusion, cultural practices, habitat modification, repellents or harassment would be recommended and utilized to reduce damage. In other situations, mammals would be removed as humanely as possible using shooting, trapping, snare/cable restraints, aerial shooting from aircraft (feral swine only), or registered euthanasia drugs. In determining the damage management strategy, preference would be given to practical and effective 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. Other alternatives examined in the EA include an alternative in which WS does not become involved in mammal damage management (MDM); and an alternative in which WS is restricted to the use and recommendation of only non-lethal MDM methods (Chapter 3). WS involvement in mammal damage management in Pennsylvania is closely coordinated with the Pennsylvania Game Commission (PGC) and all WS activities are conducted in accordance with applicable state, federal, and local laws and regulations.

The EA provides a detailed analysis of the impacts of each alternative on target mammal populations; non-target species including state and federally-listed threatened and endangered species; human health and safety; humaneness of the alternatives used; impacts on stakeholders, including impacts on aesthetic values, and impacts on regulated harvest of mammals.

ACRONYMS

AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CDC	Center for Disease Control
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DEA	Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FMD	Foot and Mouth Disease
FMIA	Federal Meat Inspection Act
FY	Fiscal Year (October 1, XXXX – September 30, XXXX)
HIA	Harrisburg International Airport
HPS	Hantavirus Pulmonary Syndrome
IWDM	Integrated Wildlife Damage Management
MDM	Mammal Damage Management
MIS	Management Information System
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	Natural Historic Preservation Act
NOA	Notices of Availability
NWRC	National Wildlife Research Center
PADCNR	Pennsylvania Department of Conservation and Natural Resources
PAFBC	Pennsylvania Fish and Boat Commission
PDA	Pennsylvania Department of Agriculture
PDH	Pennsylvania Department of Health
PGC	Pennsylvania Game Commission
PNHP	Pennsylvania Natural Heritage Program
SARAA	Susquehanna Area Regional Airport Authority
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
US	United States
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Department of the Interior, Fish and Wildlife Service
WDM	Wildlife Damage Management
WS	Wildlife Services

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CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION

Across the United States, wildlife 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 wildlife which increases the potential for conflicting human/wildlife interactions. This Environmental Assessment (EA) evaluates the potential environmental effects of alternatives for WS involvement in mammal damage management (MDM) in Pennsylvania.

Wildlife damage management (WDM) is the science of reducing damage or other problems associated with wildlife, and is recognized as an integral part of wildlife management (The Wildlife Society 2010). The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program is the federal agency authorized to protect American resources from damage associated with wildlife (the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c)). Human/wildlife conflict issues are complicated by the wide range of public responses to wildlife and wildlife 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 wildlife values and wildlife damage can be summarized in this way:

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

WS' activities are conducted to prevent or reduce wildlife damage to agricultural, industrial, natural resources, 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 IWDM approach (WS Directive 2.105[1]) in which a combination of methods may be used or recommended to reduce wildlife damage. These methods may include non-lethal techniques like alteration of cultural practices, habitat management, repellents, frightening devices, and physical exclusion to prevent or reduce damage. The reduction of wildlife damage may also require removal of individual animals, reducing the local animal populations through lethal means. In some instances, the goal may be to eradicate an invasive species. Program activities are not based on punishing offending animals but are conducted to reduce damage and risks to human and livestock health and safety, and are used as part of the WS Decision Model (Slate et al. 1992).

WS is a cooperatively funded, service-oriented program that receives requests for assistance with wildlife damage management from private and public entities, including tribes and other governmental agencies. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage

[1] The WS Policy Manual (http://www.aphis.usda.gov/wildlifedamage) provides guidance for WS personnel to conduct wildlife damage management activities through Program Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Appendix.

effectively and efficiently in accordance with applicable federal, state, and local laws and Memoranda of Understanding (MOUs) between WS and other agencies

WS chose to prepare this EA to facilitate planning, interagency coordination and the streamlining of program management, and to clearly communicate with the public the analysis of individual and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed and planned damage management program.

1.1 PURPOSE OF THIS EA

This purpose of this EA is to address and evaluate the potential impacts on the human environment from alternatives for WS involvement in the protection of agricultural and natural resources, property, livestock, and public health and safety from damage and risks associated with mammals in Pennsylvania. In addition, this EA will facilitate planning between WS, the USFWS, the Pennsylvania Game Commission (PGC), and Pennsylvania Fish and Boat Commission (PAFBC) to initiate funding mechanisms under grant programs administered by the Wildlife and Sport Fish Program for the conservation of native species, including threatened and endangered (T&E) species. Other federal funding mechanisms through the USFWS, including Endangered Species Act (ESA) recovery implementation funds or refuge project funds may also be evaluated and utilized.

Under the Proposed Action, MDM could be conducted on private, federal, state, county, and municipal lands in Pennsylvania upon request. Several mammal species have potential to be the subject of WS MDM activities in Pennsylvania including: raccoons (*Procyon lotor*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), feral cats (*Felix* sp.), black bear (*Ursus americanus*), fisher (*Martes penanti*), river otter (*Lutra canadensis*), striped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale putorius*), mink (*Mustela vison*), least weasel (*Mustela rixosa*), long-tailed weasel (*Mustela frenata*), ermine/shorttail weasel (*Mustela ermine*), Eastern cottontail (*Sylvilagus floridanus*), snowshoe hare (Lepus americanus), feral and domestic rabbits (*Oryctolagus cuniculus*), fox squirrel (*Sciurus niger*), gray squirrel (*Sciurus carlolinensis*), red squirrel (*Tamiasciurus hudsonicus*), Eastern chipmunk (*Tamias striatus*), Southern flying squirrel (*Glaucomys volans*), woodchuck/groundhog (*Marmota monax*), porcupine (Erethizon dorsatum), beaver (*Castor canadensis*), muskrat (*Ondatra zibethica*), nutria (*Myocastor coypus*), brown (Norway) rat (*Rattus norvegicus*), Virginia opossums (*Didelphis virginianus*), and feral swine (*Sus scrofa*). This EA will also address limited take of miscellaneous small mammals, such as insectivores (shrews and moles) and rodents (mice, rats, and voles).

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

1.2 NEED FOR ACTION

Conflicts between humans and wildlife are common in Pennsylvania. WS has a long history of partnering with Pennsylvania Game Commission (PGC) and other agencies and cooperators on a wide variety of wildlife species causing damage to numerous resources (USDA 2013b). WS and the PGC receive requests for assistance with wildlife damage from the public, and state, federal and local government

agencies. Comprehensive surveys of mammal damage in Pennsylvania have not been conducted, but WS does maintain a Management Information System (MIS) database to document assistance that the program provides. Table 1-1 summarizes technical assistance projects (advice/recommendations) completed by the Pennsylvania WS program for Fiscal Years (FY) 2009-2013 for species covered by this EA. MIS data is limited to information that is collected from people who have requested services or information from WS. The data does not include requests received or responded to by local, state or other federal agencies or private companies. Consequently, the number of requests for assistance to WS does not reflect the full extent of need for action, but does provide an indication that needs exists.

The PGC has state management responsibility for resident mammals and conducts mammal management programs for furbearers, game species, and non-game mammals. The PGC provides technical assistance and issues damage management permits, but rarely provides any operational assistance. WS potential involvement in the area of mammal damage management would be to provide basic recommendations, refer callers to the PGC or private pest control companies as appropriate, or to provide direct management assistance with the implementation of mammal damage management programs upon request and as permitted or otherwise authorized by the PGC. To date, some examples of operational programs conducted by WS have included mammal hazard management at airports, reduction in mammal damage at landfills, protection of property, equipment, and natural resources from damage by mammal burrowing or habitat modification activities, health and safety concerns due to transmission of wildlife disease or aggressive behavior to humans, livestock, or pets, and damage to crops. Additionally, WS cooperates with state and federal agencies to assess and manage disease risks involving wild and feral mammals and captive wildlife. WS has provided information on species discussed to interested parties through over 1,900 technical assistance contacts during FY 2009-2013 (Table 1.1).

Table 1-1. WS' Technical assistance projects conducted in Pennsylvania FY 2009 - FY 2013.

Species	Projects	Species	Projects
Black Bear	21	**Beaver**	17
Bobcat	0	**Eastern Chipmunk**	10
Feral Cat	110	**Fox Squirrel**	0
Fisher	1	**Gray Squirrel**	26
Gray Fox	12	**Mice**	4
Mink	3	**Muskrat**	10
Raccoon	1,327	**Norway Rat**	4
Red Fox	90	**Nutria**	1
River Otter	1	**Porcupine**	2
Spotted Skunk	0	**Red Squirrel**	3
Striped Skunk	92	**Shrews and Moles**	0
Weasels	0	**Southern Flying Squirrel**	2
Virginia Opossum	28	**Voles**	6
Eastern Cottontail	11	**Woodchuck**	137
Feral/Domestic Rabbit	5	**Feral Swine**	49
Snowshoe Hare	2	**TOTAL**	**1,974**

Damages to property and agricultural resources associated with mammals that have been reported to or verified by WS have totaled $356,400 between FY 2009 and FY 2013. An additional $197,125 in damages to property and agricultural resources were documented during direct control activities

conducted by WS during the same period. Although monetary damages to natural resources and human safety have been reported and verified by WS, requests for assistance often address threats that mammals can pose to human safety and natural resources for which monetary losses are difficult to determine. For human safety, requests for WS' assistance have often been received to reduce the threat of disease transmission and the threat of aircraft striking mammals at airports.

Table 1-2. Resource types damaged by those mammal species addressed for FY2009 – FY2013.

Species	Resource[a]				Species	Resource			
	A	N	P	H		A	N	P	H
Black Bear			X	X	**Beaver**	X	X	X	X
Bobcat					**Eastern Chipmunk**		X	X	X
Feral Cat	X	X	X	X	**Fox Squirrel**				
Fisher	X				**Gray Squirrel**			X	X
Gray Fox		X	X	X	**Mice**	X			
Mink	X				**Muskrat**			X	
Raccoon	X	X	X	X	**Norway Rat**	X		X	X
Red Fox	X	X	X	X	**Nutria**		X		
River Otter	X				**Porcupine**	X			
Spotted Skunk		X		X	**Red Squirrel**			X	X
Striped Skunk					**Shrews and Moles**				
Weasels					**Southern Flying Squirrel**			X	X
Virginia Opossum		X	X	X	**Voles**	X		X	X
Eastern Cottontail			X	X	**Woodchuck**	X		X	X
Feral/Domestic Rabbit			X	X	**Feral Swine**	X		X	X
Snowshoe Hare				X					

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

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

1.2.1 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.

Zoonotic Diseases

Zoonotic diseases are diseases of animals which are communicable to humans. Some of the wild and feral mammals in Pennsylvania may carry disease causing organisms or parasites including viruses, bacteria, fungi, protozoans and rickettsial organisms which pose a risk to humans (Table 1.3). With the exception of arthropod-borne pathogens, disease transmission from wildlife to humans is uncommon with few documented occurrences. However, the infrequency of such transmission does not diminish the concerns of individuals requesting assistance that are fearful of exposure to a diseased animal because disease transmissions have been documented to occur. Usually, MDM is requested because of a perceived risk to human health or safety associated with wild animals living near humans, from animals acting out of character in human-inhabited areas during the day, or showing no fear when humans are present. 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. It is the goal of agricultural and human health programs to prevent disease/illness from occurring. It is the choice of the individual cooperator to tolerate the potential health risks or to seek to reduce those risks.

WS primary involvement in the management of zoonotic diseases would be to aid other governments and research entities in monitoring for the presence or absence of diseases in wildlife and advise on risk reduction methods. These data can be used to predict potential risks to human health and safety and aid agencies in directing management efforts. 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 during other damage management programs for tuberculosis, or may collect blood or tissue samples from foxes lethally taken in an airport setting. WS could sample feral hogs taken by hunters or during damage management activities to test for toxoplasmosis, swine brucellosis, or other diseases. In the unlikely event of a disease outbreak or an imminent realistic threat of an outbreak, WS could also be asked to conduct localized wildlife population reduction or removal of captive wildlife to prevent spread of disease to other areas.

This section includes examples of zoonotic diseases for which WS could provide surveillance or management assistance. This discussion on zoonoses is intended to briefly address the more common known zoonoses for those species specifically addressed in this EA but is not intended to be an exhaustive discussion of all potential zoonoses. The transmission of diseases from wildlife to humans is neither well documented nor well understood for most diseases. Determining a vector for a human infected with a disease known to occur in wildlife populations is often complicated by the presence of the known agent across a broad range of naturally occurring sources. For example, a person with salmonella poisoning may have contracted salmonella bacterium from direct contact with an infected pet, but may have also contracted the bacterium from eating undercooked meat or from other sources. Consequently, this list is not all-inclusive and new diseases may be identified in the future or may be introduced from foreign countries.

Table 1-3. Wildlife Diseases That Pose Potential Human Health Risks in the United States (modified from Davidson and Nettles 2006).

Disease	Causative Agent	Hosts
Anthrax	bacterium (*Bacillus antracis*)	cattle, sheep, horses, swine, white-tailed deer, dogs, cats
Dermatophilosis	bacterium (*Dermatophilus congolensis*)	mammals (wild and domestic)
Demodectic mange	mange mite (*Demodex odocoilei*)	White-tailed deer
Sarcoptic mange	mite (*Sarcoptes scabiei*)	red foxes, coyotes, domestic dogs
Swine brucellosis	bacterium (*Brucella suis*)	Swine
Trichinosis	nematode (*Trichinella spiralis*)	swine, bears, raccoons, foxes, rats
Rabies	virus (Rhabidovirus)	all mammals (high risk wildlife: raccoons, fox, skunks, bats)
Visceral larval migrans	nematode (*Baylisascaris procyonis*)	raccoons
Leptospirosis	bacteria (*Leptospira interrogans*) over 180 different serovars	all mammals
Echinococcus infection	tapeworm (*Echinococcus multilocularis*)	foxes, coyotes
Bovine brucellosis	bacterium (*Brucela abortus*)	cattle & captive bison(evidence from Texas that organism has infected coyotes that scavenged aborted fetuses and placentas of infected cattle)
Toxoplasmosis	protozoan parasite (*Toxoplasma gondii*)	cats, such as bobcats, are definitive hosts, mammals and birds are intermediate hosts
Spirometra infection	tapeworm, (*Spirometra mansonoides*)	bobcats, raccoons, foxes, dogs, cats
Murine typhus	bacteria (*Rickettsia mooseri* = R. typhi)	rats, mice, as hosts for primary flea, louse or mite host
Giardiasis	protozoan parasite (*Giardia lambia*, *G. duodenalis*, and other *Giardia* sp.-taxonomy controversial)	beavers, coyotes, dogs, cats
Hantavirus Pulmonary Syndrome	Hantaviruses	Rodents
Tularemia	Bacterium	rodents, rabbits, hares
Histoplasmosis	fungus (*Histoplasma capsulatum*)	fungus occurs in bat guano
Lyme Disease	spirocheate (*Borelia burgdorferi*)	Rodents
Plague	*Yersinia pestis*	Rodents
Rocky Mountain Spotted Fever	bacterium *(Rickettsii rickettsia)*	dogs and rodents

Hantavirus Pulmonary Syndrome (HPS) is caused by infection from certain species of hantaviruses. HPS was first recognized in North America when a cluster of cases was diagnosed in the southwestern United States. Infection in humans causes acute, severe respiratory disease with a mortality rate of 38% (CDC 2013a). Rodents are the natural hosts for all known hantaviruses, and the virus can be found in their urine, feces, and saliva (CDC 2006). Once these substances have dried, humans can become infected by inhaling the dried materials as dust particles. This is the most common way the infection is acquired in the United States. People can also become infected by a rodent bite, and possibly by ingesting food or water contaminated by rodents. There is no evidence that people can become infected with the North American strains of hantavirus from other humans, other animals, or from biting insects. In 1997, hantavirus was identified in Pennsylvania, causing two mortalities. Mice from the suspected exposure areas showed hantavirus antibodies (Rhodes et al. 2000). The risk of acquiring this infection in the eastern United States is extremely low although hantavirus is more prevelant in Pennsylvania than many other eastern states. As of July, 2013, the CDC reported four cases of confirmed HPS known to have been contracted in Pennsylvania. Hantavirus has also been confirmed in neighboring states, including West Virginia (3) and New York (5) during the same time period (CDC 2013a).

Tularemia, also known as "rabbit fever", is a disease caused by the bacterium *Francisella tularensis* (CDC 2013b). Tularemia typically infects animals such as rodents, rabbits, and hares. Usually, people become infected through the bite of infected ticks or tabanid flies, by handling infected sick or dead animals, by eating or drinking contaminated food or water, or by inhaling airborne bacteria. About 120 human cases of tularemia are reported each year in the U.S (CDC 2013b). Most cases occur in the southcentral and western states; however cases have been reported in every state except Hawaii. Cases have also resulted from laboratory accidents. Without treatment with appropriate antibiotics, tularemia can be fatal (CDC 2003). 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 may be infected (hares, rabbits, squirrels, muskrats, beavers, deer), and occasionally certain domestic animals can also be infected (sheep and cats). The rabbit is the species most often involved in disease outbreaks. The bacteria can also be found in ticks and deerflies. Tularemia in humans is relatively rare in Pennsylvania, with seven cases identified between 2003 and 2012 (CDC 2013b), and rarely occurs in wildlife with the last documented case occurring in Eastern cottontails in Philadelphia during 2006 (Sinclair et al. 2008).

Rabies is an acute, fatal viral disease of mammals most often transmitted through the bite of a rabid animal. Rabies is preventable, but it is fatal without prior vaccination or post-exposure treatment. All mammals, including man, are susceptible to rabies. Over the last 100 years, the vector of rabies in the United States has changed dramatically. About 90% or greater of all animal cases reported annually to CDC now occur in wildlife (Krebs et al. 2000, CDC 2013c). Before 1960, the majority of cases were reported in domestic animals. The principal rabies hosts today are wild omnivores and bats. The number of rabies-related human deaths in the United States has declined from more than 100 annually in the early 1900s to an average of one or two people per year in the 1990s. Modern day prophylaxis, which is the series of vaccine injections given to people who have been potentially or actually exposed, has proven nearly 100% successful in preventing mortality when administered promptly (CDC 2013c). In the United States, human fatalities associated with rabies occur in people who fail to seek timely medical assistance, usually because they were unaware of their exposure to rabies. Although human rabies deaths are rare, the estimated public health costs associated with disease detection, prevention, and control have risen, exceeding $300 million annually. Those costs include the vaccination of companion animals,

maintenance of rabies laboratories, medical costs such as those incurred for exposure case investigations, rabies post-exposure prophylaxis (PEP), and animal control programs (CDC 2013c).

In Pennsylvania, rabies has been monitored since 1944, with 24 terrestrial species documented as testing positive for rabies as well as numerous bat species (Herman 2010). Between 2003 and 2012, Pennsylvania has averaged over 425 rabies cases a year (PDA 2012a), and since rabies testing for cases not involving an exposure are voluntary, the number of potential rabies infected animals that the public encounters is likely much higher. The majority of animals testing positive for rabies in Pennsylvania are raccoons, where the raccoon variant strain of rabies has been documented in all counties. In 2012, raccoons accounted for 53.9% of positive rabies cases, with bats (combined species 13.4%), striped skunks (11.6%), and domestic/feral cats (10.1%) as the next three most common species that tested positive. Pennsylvania has been part of the National oral vaccination monitoring effort since 2001. Pennsylvania WS' involvement in rabies research and management is addressed in the WS nationwide EA on rabies management (USDA 2009). In a recent study, cats in Pennsylvanai accounted for 8-14% of all rabies positive cases in Pennsylvania from 1997-2011 (Campagnolo 2014).

Tick Borne Diseases. Numerous tick borne diseases have been documented as occurring in Pennsylvania including Lyme disease, babesiosis, ehrlichiosis, Rocky Mountain spotted fever, and Powassan virus (PDH 2011a, PDH 2012). Lyme disease has been documented in every county within the Commonwealth with 3,000 – 5,000 cases incurred per year between 2000 and 2012 (PDA 2011b, CDC 2013d). The tick infests a wide variety of animals, but is most commonly found on meadow voles, mice, and deer. Increases in cases of babesiosis have been reported in Pennsylvania through voluntarily submitted cases (PDA 2011c).

Raccoon Roundworm (*Baylisascaris procyonis*, BP) is a common roundworm found in the small intestine of raccoons which causes severe or fatal encephalitis in a variety of birds and mammals, including humans (CDC 2011). BP also causes eye and organ damage in humans. Humans become infected with BP by ingesting soil or other materials (e.g., bark or wood chips) contaminated with raccoon feces containing BP eggs. Young children are at particular risk for infection as a result of behaviors such as placing potentially contaminated fingers and objects like toys into their mouths (CDC 2011). Raccoons are the primary host for the roundworm, but other animals including birds and small mammals can also be infected. Predator animals including dogs may also become infected by eating animals that are infected. In some dogs, *Baylisascaris* may develop to adult worms and pass eggs in the dogs' feces (CDC 2011).

Raccoons infected with BP inhabit most of the United States; the highest prevalence of BP infection in raccoons occurs in the mid-west and mid-Atlantic states, northeast and parts of California. Despite the prevalence of infection in raccoons, infection of humans is rare and less than 25 cases have been documented in the U.S. Cases have been reported in California, Illinois, Louisiana, Massachusetts, Michigan, Minnesota, Missouri, New York, and Pennsylvania. As of 2008, there were 15 reported human neurological cases in the US; five of the infected persons died (CDC 2011).

The risk for BP infection is greatly reduced by avoiding direct contact with raccoons and their urban habitats, by removing raccoon access to food and potential denning sites, excluding raccoons from children's play areas, and by limiting human exposure to areas and materials that might be contaminated by raccoon feces.

Foreign Animal Diseases. International trade and travel and the popularity of exotic pets have resulted in an ongoing risk of foreign animal disease introduction. In some cases, these diseases may be transmissible to humans. For example, 39 individuals in Wisconsin and 42 individuals in five other

midwestern states were reported as having contracted monkeypox from pet prairie dogs and/or other exotic rodents in 2003 (CDC 2009a). Symptoms of monkeypox in humans included fever, cough, rash and swollen lymph nodes. The prairie dogs were believed to have contracted the disease from African rodents imported for sale as pets. As part of the investigation of the incident, WS was requested to conduct surveillance in wild rodent populations around the residences of individuals with infected prairie dogs to see if native rodents had been exposed to the virus. In the event of a foreign animal disease outbreak in Pennsylvania, WS could be requested to provide similar assistance and/or aid USDA Veterinary Services or state animal and human health authorities in the management of animals involved in the outbreak.

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

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

Most of the zoonoses known to infect cats that are infectious to humans are not life-threatening if diagnosed and treated early. However, certain societal segments are at higher risks if exposed to zoonoses. Gerhold (2011) and Gerhold and Jessup (2012) reviewed many of the risks that feral cats pose to human populations. It is well documented that women who are pregnant, people receiving chemotherapy for immunologic diseases and organ transplants, and those with weakened immune systems are at increased risk of clinical disease if exposed to toxoplamosis (AVMA 2004). In 1994, five Florida children were hospitalized with encephalitis that was associated with cat scratch fever (AVMA 2004). The daycare center at the University of Hawaii in Manoa was closed for two weeks in 2002 because of concerns about potential transmission of murine typhus (*Rickettsia typhi*) and flea (*Ctenocephalides felis*) infestations afflicting 84 children and faculty. The fleas were from a feral cat colony that had grown from 100 cats to over 1,000, despite a trap, neuter, and release effort (AVMA 2004). In 2010, contaminated cat feces was responsible for at least seven confirmed and eight unconfirmed human hookworm infections in Miami-Dade County from contaminated beaches (Gerhold and Jessup 2012), and a similar incident

occurred in 2006 where 22 people were diagnosed with hookworm at a children's camp in Miami where feral cats were observed around a contaminated sandbox (CDC 2007).

Feral swine are potential reservoirs for at least 30 viral and bacterial diseases (Davidson and Nettles 2006, Samuel et al. 2001, Williams and Barker 2001) and 37 parasites (Forrester 1991) that are transmissible to humans. Brucellosis, salmonellosis, toxoplasmosis, trichinosis, tuberculosis, and tularemia are some of the common diseases that can be carried by feral swine that are also known to infect humans (Stevens 1996, Hubalek et al. 2002, Seward et al. 2004). Infection may result from direct exposure to swine by handling carcasses (CDC 2009b), through contamination of food crops (California Food Emergency Response Team 2007), or through secondary infection of a third host (West et al. 2009). When diseases are transmitted through a third host, feral swine transmit the diseases to other wild mammals, birds, and reptiles, which in turn may transmit them to domestic livestock or humans. In Louisiana, feral swine have been implicated as the cause of elevated waterborne bacteria levels in streams, including levels which exceeded thresholds for the protection of human health (Kaller et al. 2007). Results from DNA fingerprinting indicated that feral swine were the primary source of the *E. coli* in the stream. Feral swine can pose a threat to human safety from disease transmission, from aggressive behavior, and from being struck by vehicles and aircraft. Feral swine may act as reassortment vessels for such viruses as the highly pathogenic H5N1 influenza virus found throughout Europe, Asia, Africa and the Middle East (Hutton et al 2006). The reassortment of viruses could lead to new strains of influenza viruses that would become easily transferrable from mammals to humans (Brown 2004). Hutton et al. (2006) stated that feral swine can be the location for the reassortment of the H5N1 virus into a virus that is easily transmitted from human to human. Although incidence of disease transmission from feral swine to humans is relatively uncommon, some diseases like brucellosis, tuberculosis, and tularemia can be fatal.

Mammal Hazards to Public Safety 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 et al. 2012). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety, result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995).

Pennsylvania has more than 135 public use airports, 16 of which are subject to Federal Aviation Administration (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 to be able to maintain their certification. Although a greater number of wildlife strikes with aircraft involve birds, mammals are also considered serious hazards. Although deer have been found to be the most significant mammal hazard at airports, numerous other mammal species pose threats to safety and aviation (Dolbeer et al. 2012). Animals such as fox, skunks, opossums, and raccoons often venture onto airfields and become a direct threat to planes both landing and taking off. Although rare visitors, more rural airfields may deal with black bears 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, cause strike risks, or act as prey for mammalian and avian predators compounding strike risks.

WS assists airports in Pennsylvania with the management of wildlife problems including the removal of mammals from the airfields, under buildings, and from common areas where people work or congregate. WS commonly follows procedures recommended in the "Wildlife Hazard Management at Airports: a Manual for Airport Personnel" (Cleary et al 2005). Pennsylvania WS has assisted over 16 airports in between 2003 -2013 in the management of non-cervid mammal threats to aviation. This has included the removal of skunks from hangers and around buildings, removal of foxes that have crossed runways and taxiways while foraging for rodents, reduction in flooding caused by beaver, and removal of groundhogs digging around airfield equipment. Airports throughout Pennsylvania have reported a total of 81 mammal strikes from 2003-2013, involving nine different species of mammals (FAA Wildlife Strike Database 2013). It is estimated that only 20 to 25% of all bird strikes are reported (Conover et al. 1995, Dolbeer et al. 2012, Linnell et al. 1996, Linnell et al. 1999), and it's likely that mammal strikes are also underreported, especially if they involve smaller mammal species. Consequently, the number of mammal strikes in Pennsylvania is most likely much higher than FAA records indicate.

Other Mammal Hazards to Public Health and Safety

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

Human encroachment into wildlife habitat increases the likelihood of human-wildlife interactions. Several predatory and omnivorous wildlife species thrive in urban habitat due to the availability of food, water, and shelter. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting the act in many areas. The constant presence of human created refuse, readily available water supplies, and abundant rodent populations found in urban areas often increases the survival rates and carrying capacity of wildlife species that are adaptable to those habitats (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 confounded by the overabundance of wildlife congregated into a small area that can be created by the seemingly unlimited amount of food, water, and shelter found within urban habitats.

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

Often, wildlife exhibiting threatening behavior or a loss of apprehensiveness to the presence of humans is a direct result and indication of an animal inflicted with a disease. Requests for assistance are caused by

both a desire to reduce the threat of disease transmission and from fear of aggressive behavior either from an animal that is less apprehensive of people or induced as a symptom of disease. For example, 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, individuals 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.

Emergency Response Efforts

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

1.2.2 Need for Mammal Damage Management to Protect Agricultural Resources

Pennsylvania is an agricultural state with 62,100 farms and over 7.6 million acres in farm production (NASS 2013). Pennsylvania cash receipts from farm marketing totaled $5.7 billion in 2012. Livestock and dairy production in Pennsylvania contribute substantially to the State's economy. As of August 21, 2013, there were an estimated 1.6 million head of beef and dairy cattle on Pennsylvania farms. In 2012, Pennsylvania's milk cows produced 10.5 billion pounds of milk. Additionally in 2012, an estimated 25 million laying hens produced 7.1 billion eggs, and 7 million turkeys, 1.1 million hogs, 56,000 goats, 86,000 sheep and lambs were on Pennsylvania farms (NASS 2012). The state produces many agricultural commodities that are in the top ten ranking for production in the nation such as fruit crops (apples, cherries, grapes, peaches, and pears), sweet corn, pumpkins, strawberries, maple syrup, and Christmas trees (NASS 2012).

The PGC and WS receive requests for assistance from citizens experiencing agricultural damage caused by mammals, including, but not limited to the following: 1) predation on livestock (including poultry) by black bears, raccoons and foxes; 2) threat and occurrence of damage to crops and stored feed by feral swine, black bear, raccoons and rodents; and 3) risk of disease transmission. WS could conduct and assist in management efforts with various mammals, coordinated by or with the PGC, PDA, USDA/APHIS/Veterinary Services (VS) and/or other federal, state, and local agencies, to study, monitor and/or control the occurrence and spread of animal diseases to protect livestock and other agricultural resources. WS may also be asked to assist with management of animals housed at enclosed hunting facilities that pose a threat to agricultural resources. Feral swine are a common species found at facilities, and diseases identified in animals housed at the site may pose threats to other species within the enclosure or livestock on adjacent lands, or with property damage from escaped stock.

Damage to Crops

Damage to crops by mammal species is a major concern to the agricultural community. Species such as raccoons, skunks, fox, groundhog, and feral swine can cause significant damage to crops. WS provides technical assistance related to these damage events and refers many to the PGC for assistance in obtaining permits. At the request of landowners or cooperating agencies, WS may respond to requests for assistance if necessary. WS has worked cooperatively with the PGC to help remove feral swine from agricultural landscapes. Woodchucks (commonly referred to as groundhogs) are routinely reported to cause damage to field crops such as row and forage crops, orchards, nursery plants, and commercial gardens. Cottontail rabbits and voles are reported to damage orchard trees by gnawing at the base of the tree. Trees are badly damaged or the bark is girdled and trees die when feeding by rabbits and voles is severe. Similar damage occurs in nurseries, which grow landscape ornamentals and shrubs.

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 in Pennsylvania 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 rates of damages from raccoons (Beasley and Rhodes 2008). Damage also occurs to stored crops, such as corn silage, when raccoons tear open silage bags and/or burrow into silos resulting in losses from spoilage and contamination with feces.

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

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 Pennsylvania agricultural and natural resource interests could include wildlife damage management activities conducted by WS in cooperation with the VS program, PGC, or other governmental 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.

Toxoplasmosis. The domestic cat has been found to transmit the protozoan parasite, *Toxoplasma gondii* to both domestic and wild animal species. Cats have been found to be important reservoirs and the only species known to allow for the completion of the life cycle for *T. gondii* (Dubey 1973; Teutsch et al. 1979). Both feral and domesticated cats may be infected by this protozoan, but this infection is more common in stray cats. Fitzgerald et al. (1984) documented that feral and free-ranging cats transmitted *T. gondii* to sheep in New Zealand, resulting in abortion in ewes. Dubey et al. (1986) found cats to be a major reservoir of *T. gondii* on swine farms in Illinois. The main sources for infecting cats are thought to be birds and mice.

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. Foot and Mouth Disease 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. Foot and Mouth Disease 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 known to be susceptible to FMD include white-tailed deer, feral pigs, bison, moose, antelope, musk ox, caribou, sheep, and elk. However, 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 vulnerable to FMD and 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 disease outbreak in Pennsylvania, state or federal officials could contact WS to request assistance in management and surveillance efforts.

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

Pseudorabies 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. However, pseudorabies is still found in feral swine and these animals serve as a potential source of infection for domestic animals. In 2008, pseudorabies was detected in two captive feral swine herds in Bulter and Venango Counties. The Butler site was completely depopulated of all swine, while the Venango site had a portion of the swine depopulated and others put under quarantine by PDA until they could be tested to determine their PRV status. In 2009, a tagged feral swine was killed in Bedford County by a hunter and tested positive for PRV. It was not determined where the animal had come from and surrounding swine facilities (domestic and feral) were investigated for possible exposure by PDA. The area where the animal was killed was investigated and it was determined that there were no other feral swine in the vicinity.

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 United States 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.

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

Predation and Livestock

Predation by medium sized mammals is common at smaller farms, especially related to poultry which may be penned or free-ranging and raised for meat or egg production. Species such as red fox, raccoons, fisher, mink, and bobcat have all been identified in Pennsylvania through requests for assistance. A variety of trout species and other types of fish are raised in Pennsylvania for both commercial purposes and for conservation /restoration. In 2012, the total value for all trout sold and distributed was more than 6.2 million dollars ranking Pennsylvania third in trout production (NASS 2012). River otter, mink, bear, fisher, and to a lesser extent raccoons may prey on fish and other cultured species at hatcheries and aquaculture facilities (Bevan et al. 2002). WS has received requests for operational assistance in the past to reduce predation incidents at aquaculture facilities.

1.2.3 Need for Mammal Damage Management to Protect Property

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

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

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

In addition to the risks to human health and safety discussed in Section 1.2.1, mammals can also cause considerable damage to property at airports. Foxes, skunks, and raccoons venture onto airfields and become a direct threat to planes both landing and taking off. Nationwide, during the period of 1990-

2011, there have been 2,754 strikes involving civil aircraft and terrestrial mammals resulting in more than $41million in damage (Dolbeer et al. 2012). Damage to aircraft was reported for 35% of the terrestrial mammal strikes. Thirty-two species of terrestrial mammal were reported as being involved in strikes. Airports throughout Pennsylvania have experienced a total of 81 terrestrial mammal strikes from 2003-2013, involving nine different species. Of those 81 mammal strikes, the majority involved species addressed in this EA. Not all documented strikes have corresponding damage costs associated (FAA Wildlife Strike Database 2013).

Pennsylvania has long history of black bears causing damage to property. Bears can present problems anywhere, but are most common in the northern part of the state. Bear complaints are often associated with increased human development, recreational activity, and agricultural expansion in northern Pennsylvania, and included complaints about bears feeding on garbage (at residences, restaurants, and campgrounds), apiaries (beehives), crops, livestock and property damage, and general nuisance. WS refers bear complaints to the PGC which handles the vast majority of bear issues, although WS is available to assist if requested.

1.2.4 Need for Mammal Damage Management to Protect Natural Resources

Natural resources may be described as those assets belonging to the public which are usually managed and held in trust by government agencies for citizens. Such resources may be plants, animals and their habitats, including threatened and endangered species and historic properties. Examples of natural resources in Pennsylvania are historic structures and places, parks and recreation areas, natural areas, including unique habitats or topographic features, threatened and endangered plants or animals, and any plant or animal populations which have been identified by the public as a natural resource.

One example of mammal damage to natural resources is ground-nesting game bird populations with low and/or declining productivity and survivorship because of predation by species like raccoons, skunks, or foxes. For example, raccoons are considered a major predator of ground-nesting upland bird nests and poults (Speake 1980, Speake et al. 1985, Speake et al. 1969). Balser et al. (1968) recommended that predator damage management programs target the entire predator complex or compensatory predation may occur by a species not under control, a phenomena also observed by Greenwood (1986). Trautman et al. (1974) concluded that a single species predator damage management program showed some promise for enhancing ring-necked pheasant (*Phasianus colchicus*) populations. Avian species considered threatened or species of special concern in Pennsylvania may be impacted by mammalian predators through direct predation or nest destruction. As well nest predation on reptiles is a common problem associated with raccoons and other medium sized predators (Marchland et al. 2002, Wirsing et al. 2012).

Scientists estimate that cats kill hundreds of millions of birds and more than a billion small mammals, such as rabbits, squirrels, and chipmunks, each year nationwide. The American Bird Conservancy (ABC) states that "*cats often kill common* [bird] *species such as cardinals, blue jays, and house wrens, as well as rare and endangered species such as piping plovers, Florida scrub-jays, and California least terns*" (ABC 2011). Some feral and free-ranging cats kill more than 100 animals each year. For example, at a wildlife experiment station, a roaming, well-fed cat killed more than 1,600 animals over 18 months, primarily small mammals (ABC 2011). Researchers at the University of Wisconsin coupled their four-year cat predation study with the data from other studies, and estimated that rural feral and free-ranging cats kill at least 7.8 million and perhaps as many as 21 million birds a year in Wisconsin (Coleman et al. 1997). Churcher and Lawton (1989) estimated that 30% to 50% of a cat's catch were birds and that the cats had adversely affected house sparrow populations within the study village. Based on information

acquired in the study, Churcher and Lawton (1989) estimated that more than 20 million birds are killed by cats in Britain each year with more than 70 million animals overall being taken by cats annually. 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.

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

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

Feral swine can compete with and prey upon native wildlife and severely damage wildlife habitats. Feral swine are omnivorous and feed on a wide variety of items, many of which are staples for native fauna. One of the more important seasonal food resources used by feral swine is wild fruit and nut crops, especially oak mast (Wood and Roark 1980). Oak mast is also an important food source for deer and wild turkey. When feral swine actively compete for mast, resident deer and wild turkey may enter the winter with inadequate fat reserves, thus threatening the viability of these native wildlife species (Beach 1993). Feral swine also predate native wildlife, especially young animals and ground nesting birds, their nestlings, and eggs (Beach 1993).

In addition to competition for food discussed above, feral swine foraging also causes problems for forest regeneration through consumption of hard mast (e.g., acorns and hickory nuts) and uprooting and consumption of seedlings (Campbell and Long 2009, West et al. 2009). Areas disturbed by feral swine rooting are also vulnerable to colonization by non-native invasive plant species. Rooting also accelerates plant decomposition and loss of soil nutrients (Campbell and Long 2009). The rooting and foraging behavior of feral swine can completely destroy the understory in forests and make trees less stable during windstorms.

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

range. Impacts to native vegetation can be significant (Bounds et al. 2003), directly impacting wetlands and many of the species that use these areas.

1.2.5 Need to Protect T&E Species

Some of the species listed as threatened or endangered under the Endangered Species Act of 1973 and Pennsylvania's Endangered and Threatened Species Laws managed by the PGC, PAFBC, and PADCNR (State Code Title 34 Part 2167, Section 2305 of the Fish and Boat Code, Wild Resource Conservation Act, act of June 23, 1982 (P.L. 597, No. 170), 32 P.S. §§ 5301-5314)), may be impacted by predation or competition from a wide range of mammal species. Raccoons, opossums, striped skunks, red fox, weasels, mink and other mammals are known to prey on birds, eat eggs, and cause disturbances at nesting sites, impacting ground and shrub nesting species (National Biological Survey 1990, Melvin et al. 1992, Messmer et al. 1997). Species of special concern in Pennsylvania such as the dickcissel (*Spiza americana*, state endangered), sedge wren (*Cistothorus platensis*, state endangered), Piping plover (*Charadrius melodus*, federally threatened, state endangered), upland sandpiper (*Bartramia longicauda*, state endangered), black tern (*Childonias niger*, state endangered), and common tern (*Sterna hirundo*, state endangered) may be negatively affected by increased predation or disturbance. Mammalian species like the Northern flying squirrel (*Glaucomys sabrinus macrotis*, state endangered) and Allegheny woodrat (*Neotoma magister*, state threatened) may be prey for mammal species, but also impacted in other ways. For example, the Northern flying squirrel is being out competed for resources by the more abundant Southern flying squirrel (Weigl 1978) or they are infected with parasites through interactions (Price et al. 1988, Pauli et al. 2004) in many areas where both species overlap.

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

1.3 DECISION TO BE MADE

This EA evaluates the environmental impacts of alternatives for WS involvement in mammal damage management in Pennsylvania. 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. Wildlife management is a complex issue requiring coordination among state and federal agencies. The PGC, PDA, and USFWS were consulting agencies in the preparation of this EA.

Based on the scope of the EA, the lead and consulting agencies worked together to address the following questions in the EA:

- How can WS best respond to the need to reduce mammal damage in Pennsylvania?

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

1.4 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

1.4.1 Actions Analyzed

This EA evaluates mammal damage management by WS to protect: property, agricultural resources, natural resources, and public health and safety in Pennsylvania wherever such management is requested from the WS program. Protection of other resources or other program activities would be addressed in additional NEPA analysis, as appropriate.

1.4.2 Period for which this EA is Valid

If it is determined that an EIS is not needed, this EA would remain valid until the WS program in Pennsylvania and other appropriate agencies determine that new needs for action, changed conditions, or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. Review of the EA would be conducted each year to ensure that the EA adequately addresses current and anticipated future program activities.

1.4.3 Site Specificity

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

This EA analyzes the potential impacts of mammal damage management based on previous activities conducted on private and public lands in Pennsylvania, where WS and the appropriate entities have entered into a MOU, cooperative service agreement, or other comparable document. 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 mammal damage management efforts could occur. Thus, this EA anticipates the potential expansion and analyzes the impacts of such efforts as part of the alternatives.

Many of the mammal species addressed in this EA can be found statewide and are active 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 other federal or agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they would occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, and insurance companies. This EA emphasizes major issues as those issues relate to specific areas whenever possible; however, many issues apply wherever mammal damage and the resulting management actions occurs and are treated as such.

Chapter 2 of this EA identifies and discusses issues relating to mammal damage management in Pennsylvania. 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[2] and Standard Operating Procedures (SOPs) described in this EA, as well as relevant laws and

[2] At the time this EA was prepared, WS' Directives could be found on the web at http://www.aphis.usda.gov/wildlifedamage.

regulations.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Pennsylvania. 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.

1.4.4 Public Involvement

Issues related to mammal damage management as conducted by WS in Pennsylvania were initially developed by WS with assistance from the cooperating and consulting agencies and tribes. As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS' NEPA implementing regulations, this document is being made available for public review and input through a legal notice published in the, through direct mailings to parties that have requested to be notified or have been identified to have an interest in the reduction of threats and damage associated with mammals in the State, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/regulations/ws/ws_nepa_environmental_documents.shtml.

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

1.5 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS

Environmental Assessment: White-tailed deer damage management in Pennsylvania. WS completed an EA that evaluated white-tailed deer and captive cervid damage management in the state of Pennsylvania in 2003. This Mammal Damage Management EA will not include white-tailed deer and captive cervid management. An EA Supplement to the 2003 EA was completed in May 2012.

Environmental Assessment: Shooting white-tailed deer to assist the City of Philadelphia, Fairmount Park Commission in achieving deer population reductions on park properties located in the Pennsylvania counties of Delaware, Montgomery and Philadelphia. WS completed an EA that evaluated the potential impacts of deer damage management on properties owned by the City of Philadelphia in 2000. Management of damage by white-tailed deer at this site will not be addressed in this EA.

Environmental Assessment: Integrated wildlife damage management of coyotes and feral dogs in Pennsylvania. WS completed an EA that evaluated coyote and feral dog damage management in the state of Pennsylvania in 2005. Coyote and feral dog conflicts and associated damage management will not be addressed in this EA.

Environmental Assessment: Oral Vaccination to Control Specific Rabies Virus Variants in Raccoons, Gray Foxes, and Coyotes in the United States. Management of rabies in Pennsylvania wildlife is included in the National EA (USDA 2009b) and is not included in the Pennsylvania mammal damage management EA. However, potential impacts on mammal species anticipated in the rabies

management EA have been included in the Pennsylvania mammal damage management EA to assess cumulative impacts of program actions.

1.6 AUTHORITY AND COMPLIANCE

1.6.1 Wildlife Services Legislative Authority

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

Additionally, MOU's among WS and other governmental agencies also define WS responsibilities in wildlife damage management. For example, a MOU between the Federal Aviation Administration (FAA) and WS recognizes WS role and expertise in providing wildlife hazard management assistance to the aviation community. It states, that the "FAA or the certificated airport may request technical and operational assistance from WS to reduce wildlife hazards."

1.6.2 Pennsylvania Game Commission Legislative Authority

The PGC, under the Pennsylvania State Code Title 34 and 58 is charged with the management of the state's wild bird and mammal resources. The process used to manage game and other wildlife populations includes: monitoring wildlife populations; establishing laws and regulations; setting seasons and bag limits; making habitat improvements; providing outright protection; informing and educating the public; and assessing public expectations and satisfaction.

1.6.3 Pennsylvania Department of Agriculture

The PDA's mission, under the Pennsylvania State Code Title 3, is to encourage, protect, and promote agriculture and related industries throughout the Commonwealth while providing consumer protection through inspection services that impact the health and financial security of Pennsylvania's citizens. This is conducted under the direction of the Governor appointed Secretary of Agriculture and guidance from 14 boards and 15 committees/commissions comprised of members of PDA, the legislature, industry, educational institutions, other state agencies, and the general public. PDA administers many laws. Many of them are found in Pennsylvania State Code Title 3 with detailed information available by contacting the PDA bureau tasked with management of the related topic.

1.6.4 Pennsylvania Fish and Boat Commission

The PAFBC is an independent Commonwealth agency comprised of 10 commissioners appointed by the Governor and approved by the Legislature. Day to day operations are overseen by an Executive Director. The Executive Director is the PAFBC's chief executive officer as well as chief waterways conservation officer, and has charge of all activities under the jurisdiction of the Commission. PAFBC administers many laws as listed in the Pennsylvania State Code Title 30.

1.6.5 Pennsylvania Department of Conservation and Natural Resources

The PADCNR is charged with maintaining and preserving the 120 state parks; managing the 2.2 million acres of state forest land; providing information on the state's ecological and geologic resources; and establishing community conservation partnerships with grants and technical assistance to benefit rivers, trails, greenways, local parks and recreation, regional heritage parks, open space and natural areas. The PADCNR administers many laws as listed in the Pennsylvania State Code Title 27 and 32.

1.6.6 Pennsylvania Department of Health

The PDH was created by the Act of April 27, 1905, P.L. 312, and modified subsequently through the Administrative Code of 1929. The PDH mission is to promote healthy lifestyles, prevent injury and disease, and to assure the safe delivery of quality health care for all Commonwealth citizens. PDH works collaboratively with public and private partners in Pennsylvania communities to facilitate the development of an effective public health system that promotes the optimal health of its citizens while reducing the need for health care.

1.6.7 Compliance with Federal Laws

Several federal laws regulate WS' wildlife damage management actions. WS complies with these laws and regulations, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act: All Federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). WS follows the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500 et seq.), USDA NEPA implementing regulations (7 CFR 1b), and the APHIS Implementing Procedures (7 CFR 372) as a part of the decision-making process. NEPA sets forth the requirement that Federal actions with the potential to significantly affect the human environment be evaluated in terms of their impacts for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. Federal activities affecting the physical and biological environment are regulated, in part, by CEQ through regulations in Title 40, Code of Federal Regulations, Parts 1500-1508. In accordance with CEQ and USDA regulations, APHIS NEPA Procedures, as published in the Federal Register (44 CFR 50381-50384) provide guidance to APHIS regarding the NEPA process.

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

Endangered Species Act (ESA): It is federal policy, under the ESA, 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. 2(c)). WS conducts Section 7 consultations with the USFWS, the agency with management authority for federally-listed threatened and endangered species, to ensure that any action authorized, funded, or carried out by WS is not likely to jeopardize the continued existence of any endangered or threatened species. WS has consulted with the USFWS regarding potential risks from the proposed MDM program and will incorporate all USFWS provisions for the protection of threatened and endangered species from that consultation in program activities.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA): FIFRA requires the registration, classification, and regulation of all pesticides used in the United States. The U.S. Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods integrated into the WS program are registered with and regulated by EPA and PDA and used by WS in compliance with labeling procedures and other requirements.

Executive Order 13112 of February 3, 1999: This order 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. To comply with Executive Order 13112, WS may cooperate with other federal, tribal, state, or local government agencies, or with industry or private individuals to reduce damage to the environment or threats to human health and safety.

Occupational Safety and Health Act of 1970: This Act and its implementing regulations (29CFR1910) 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.

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.

National Historic Preservation Act (NHPA) of 1966 as amended: The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that have the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the Advisory Council on Historic Preservation (i.e. State Historic Preservation Office, Tribal Historic Preservation Officers), as appropriate. WS actions on Tribal lands are only conducted at the tribe's request and under signed agreement; thus, the Tribes have control over any potential conflict with cultural resources on Tribal properties.

Each of the MDM methods described in this EA that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve 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 proposed action 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, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

There is potential for audible effects on the use and enjoyment of a historic property when methods such as propane exploders, pyrotechnics, firearms, or other noise-making methods are used at or in close proximity to such sites for purposes of hazing or removing animals. 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 or nuisance problem, which means such use would benefit the historic property. A built-in mitigating factor for this

issue is that virtually all of 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 Section 106 of the NHPA would be conducted as necessary in those types of situations.

Fish and Wildlife Act of 1956 (section 742j-1) Airborne Hunting: This Act, approved in 1971, was added to the Fish and Wildlife Act of 1956 and is commonly referred to as the Airborne Hunting Act or Shooting from Aircraft Act. The Act allows shooting animals from aircraft for certain reasons including protection of wildlife, livestock, and human life under conditions in the Act. The USFWS is responsible for implementation of the Airborne Hunting Act but has delegated implementation of the Act to the states. If an alternative which includes aerial hunting is selected, WS would obtain all necessary permits (Shooting from aircraft in Pennsylvania is only being considered for feral swine removal and would not involve any other species).

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 therefore 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.

Environmental Justice and Executive Order 12898 - "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations": 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. Environmental Justice is a priority within APHIS and WS. 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. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898.

WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. All chemicals used by WS are regulated by the EPA through FIFRA, the WDATCP, by the Drug Enforcement Agency (DEA), by MOUs with land managing agencies, and by WS Directives. All chemicals have been registered with the EPA and must have labels approved by the agency detailing the product’s ingredients, the type of pesticide, the formulation, classification, approved uses, potential hazards to humans, animals, and the environment. The registration process for pesticides is intended to assure minimal adverse effects to humans, animals, and the environment when chemicals are used in accordance with label directions. Under FIFRA and its implementing guidelines, using any pesticide in a manner inconsistent with the label of the pesticide is a violation of federal law. WS would follow and use all pesticides according to their label.WS operational program properly disposes of any

excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing mammal damage, such as threats to public health and safety.

Protection of Children from Environmental Health and Safety Risks (Executive Order 13045): Children may suffer disproportionately from environmental health and safety risks for many reasons, including their developmental, physical, and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that this proposal might have on children. The proposed mammal damage management program would only occur by using legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

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

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

Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA): The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs, including those used to capture and handle wildlife. 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 the proposed action. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified. WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

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, to identify uses of the area to be regulated by the state, the mechanism (criteria, standards or regulations) for controlling such uses, and 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. WS has consulted with the Pennsylvania Coastal Resources Management Program regarding consistency of the proposed program with the State Coastal Zone Management Plan in accordance with the provisions of the Act.

1.7 PREVIEW OF THE REMAINDER OF THIS EA

The remainder of this EA is composed of three more chapters and four appendices. Chapter 2 discusses the issues relevant to the analysis. Chapter 3 contains a description of each alternative, alternatives not considered in detail, and SOPs that may be used by WS. Chapter 4 analyzes environmental consequences and the environmental impacts associated with each alternative considered in detail. Appendix A contains the list of preparers and those consulted during this EA process. Appendix B is a list of the literature cited during the preparation of this EA. Appendix C is a detailed description of the methods used for MDM in Pennsylvania. Appendix D is a list of federal and state protected threatened and endangered species.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.0 INTRODUCTION

Chapter 2 contains a discussion of the issues relevant to development and comparison of MDM alternatives, including issues analyzed in detail in Chapter 4 (Environmental Consequences) and included in the development of SOPs. This chapter also includes a discussion of issues which were considered but not analyzed in detail for each alternative. Discussions of the affected environment are included in this chapter and in the evaluation of potential environmental impacts of the alternatives in Chapter 4.

2.1 AFFECTED ENVIRONMENT

Although the range and habitat used by individual species varies, at least some of the wild and feral mammals discussed in this analysis can be found in any location of the state where suitable habitat exists for foraging and shelter. Consequently, damage or threats of damage caused by the mammal species addressed in this EA can occur statewide in Pennsylvania wherever those mammals occur. However, mammal damage management would only be conducted by WS when requested by a landowner or manager and only on properties where a cooperative service agreement or other comparable document has been signed between WS and a cooperating entity.

Upon receiving a request for assistance, MDM activities could be conducted on federal, state, municipal, and private properties in Pennsylvania. Areas where damage or threats of damage could occur include, but are not limited to, agricultural fields, vineyards, orchards, farmyards, dairies, ranches, livestock operations, aquaculture facilities, railroad yards, waste handling facilities, industrial sites, natural resource areas, park lands, and historic sites; State, county, and interstate highways and roads; railroads and their right-of-ways; property in or adjacent to subdivisions, businesses, and industrial parks; timberlands, croplands, and pastures; property where burrowing mammals cause damage to structures, dikes, ditches, ponds, and levees; public and private properties in rural/urban/suburban areas where mammals cause damage to landscaping and natural resources, property, and pose risks to human safety. The area would also include airports and military airbases where mammals are a threat to human safety and to property; and public property where mammals are negatively impacting historic structures and cultural landscapes.

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 resident mammal species are managed under Pennsylvania code and statute without any federal oversight or protection. In accordance with applicable state or federal regulations, there are some species, such as most non-native invasive species, that are not protected under state or federal law. The PGC has the state authority to manage and authorize the taking of wild and feral mammals for damage management purposes. Oversight for other species such as escaped domestic species belongs to PDA. Feral cats, although often considered domestic animals, have no state agency oversight in Pennsylvania and are managed at the local level by municipalities. Free ranging feral swine are the management responsibility of the PGC, while swine associated with hunting facilities are the responsibility of the PDA.

Usually, 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 proposed federal action. Therefore, in those situations in which a non-federal entity has decided that a MDM action will occur and even the particular methods that will be used, WS' involvement in the action would not affect the environmental status quo because the requestor would have conducted the action in the absence of WS' involvement. Given that non-federal entities can receive authorization to use lethal MDM methods from the PGC (depending on the state classification of the species), 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 technical assistance only, or 3) WS can take no action, at which point the non-federal entity could take the action anyway, either without a permit, during the hunting or trapping season, or through the issuance of a permit by the PGC. 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.

2.2 ISSUES ANALYZED IN DETAIL IN CHAPTER 4

The following issues have been identified as areas of concern requiring consideration in this EA. These will be analyzed in detail in Chapter 4:

- Effects on target mammal species
- Effects on other wildlife species, including threatened and endangered species
- Effects on human health and safety
- Impacts on stakeholders, including aesthetics
- Humaneness and animal welfare concerns

2.2.1 Effects on Target Mammal Species

A common issue with MDM is whether damage management actions would adversely affect the populations of target mammal species. Methods that would be available under the alternatives to resolve damage or threats are considered either non-lethal methods or lethal methods. Non-lethal methods can disperse or otherwise make an area unattractive to target species causing damage, which reduces the presence of those species at the site and potentially the immediate area around the site where non-lethal methods are employed. Lethal methods employed to remove a mammal or mammals responsible for causing damage or posing threats to human safety would 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 or dispersed from an area using non-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 would be based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations would be based on population trends and harvest trend data, when available. Take would be monitored by comparing the number of animals killed with overall populations or trends in populations to assure the magnitude of take was maintained below the level that would cause significant adverse effects to the viability of a native species population. Under the alternatives where lethal methods could be employed or recommended, the lethal take (killing) of mammals would only occur at the request of a cooperator seeking assistance and only after the take of those species identified as targets had been permitted by the PGC or PDA, when required.

2.2.2 Effects on Other Wildlife Species, including T&E Species

There are concerns that the use of nonlethal and lethal MDM methods may have unintended adverse impacts on non-target species, including state and federally-listed threatened and endangered species. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target wildlife. To reduce the risks of adverse effects to non-target wildlife, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of capturing or otherwise adversely impacting non-target species. Before initiating management activities, WS would select locations which are extensively used by the target species. WS would also use Standard Operating Procedures (SOPs) that minimize the effects on non-target species' populations. SOPs are further discussed in Chapter 3. Methods available for use under the alternatives are described in Appendix C.

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 the proposed management actions are not likely to jeopardize the continued existence of any endangered or threatened species. Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or minimization measures. WS also consults with the PGC regarding potential risks to state-listed species from the proposed action. Applicable SOPs and other measures for the protection of state and federally-listed species are discussed in Chapter 4, Section 4.1.2, of this EA.

2.2.3 Effects of Damage Management Methods on Human Health and Safety

Review of the potential impacts on human health and safety from MDM actions has two primary components: 1) the potential risk to human health and safety from MDM methods; and 2) the potential benefits to human health and safety when MDM actions are conducted to reduce risks caused by wild and feral mammals. WS' employees use and recommend only those methods which are legally available and are effective at resolving the damage associated with wildlife. Still, some concerns exist regarding the safety of WS' methods despite their legality. In addition to the potential risks to the public associated with WS' methods, risks to employees are also an issue. Selection of methods, as part of an integrated approach, includes consideration of public and employee safety.

Safety of Proposed Chemical Methods

Safety concerns pertaining to the use of chemical MDM methods include the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed (e.g., animals used for food). Under the alternatives identified, the use of chemical methods would include immobilizing drugs, euthanasia drugs, and repellents (Appendix C). Chemicals proposed for use under the relevant alternatives are regulated by the EPA through FIFRA, by Pennsylvania laws, by the DEA, by the FDA, and by WS' Directives.

Safety of Proposed Non-Chemical Methods

Non-chemical methods employed to reduce damage and threats to safety caused by mammals could potentially be hazardous to human safety through misuse or accident. Non-chemical methods may include, but are not limited to, firearms, live-traps, exclusion, snares, cable restraints, body-gripping traps, pyrotechnics, and other scaring devices (Appendix C). Some people may be concerned that WS' use of firearms, traps, snares, cable restraints, and pyrotechnic scaring devices could cause injuries to people. There are also concerns regarding potential fire hazard to agricultural sites and private property from pyrotechnic use.

Firearm use is a very sensitive issue and a concern because of public fears regarding the risks associated with unsafe firearms use and the threat of misuse of firearms. WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within three months of their appointment and a refresher course annually afterwards (WS Directive 2.615). WS' employees who carry firearms as a condition of employment, are also required to sign a form certifying that they meet the criteria as stated in the Lautenberg Amendment which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

WS works with cooperators to develop management strategies suited to the specific needs of each site. WS communicates the potential risks from the proposed methods to the cooperator during the development of the management strategy. The methods to be used are listed in a MOU, cooperative service agreement, or a similar document approved by the cooperator, property owner or managed by the cooperator.

Impacts on human health and safety from mammals

The concern addressed here is that the absence of adequate MDM would result in adverse effects on human health and safety because mammal damage would not be curtailed or reduced to the minimum

levels possible and practical. The potential impacts of not conducting such work could lead to increased incidence of injuries, illness, or loss of human lives.

2.2.4 Impacts to Stakeholders, Including Aesthetics

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

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). In 2011, an estimated 90 million U.S. residents 16 years old or older participated in wildlife-related recreation including hunting (13.7 million people), fishing (33.1 million people), and/or wildlife watching (71.8 million people) (USDI and USDC 2011). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations, and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception, and today a large percentage of households have pets. Some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals. Others may experience anxiety or fear when wild animals come into close proximity to their homes and families. It is not surprising that the public reaction to wildlife damage management techniques is mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to reduce conflicts/problems between humans and wildlife.

Many people directly affected by problems and threats to public health or safety associated with mammals may insist upon removal of the animal(s) from the property or public location when they cause damage. Some members of the public believe that all wildlife should be captured and relocated to another area to alleviate damage or threats to public health or safety. Others, directly affected by the specific wildlife "problem", may not agree that there is a problem. They may perceive that the issue at hand is normal animal behavior and a consequence of living in proximity to nature, and therefore, should be tolerated. Similarly, individuals not directly affected by the harm or damage caused by wildlife may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Individuals totally opposed to mammal damage management want WS to teach tolerance for damage and threats to public health or safety, and that wildlife should never be killed. These people would strongly oppose removal of mammals regardless of the amount and type of damage. Some members of the public

who oppose removal of wildlife do so because of human-affectionate bonds with individual animals. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment. Advocates of the Animal Rights philosophy believe that animals are entitled to the same rights and protections as humans, and that if an action is unacceptable treatment for a human it is unacceptable treatment for an animal.

Some individuals are concerned about the presence of mammal species that may be considered by them to be overabundant, such as bear, raccoons, fox, feral cats, and introduced wild pigs, which they feel proliferate in such numbers that they cause ecosystem damage or human safety concerns. To such people those species represent pests which are nuisances, upset the natural order in ecosystems, damage crops and/or property, potentially carry diseases transmissible to humans or other wildlife, or pose other threats to human safety. Their overall enjoyment of other animals is diminished by what they view as the destructive presence of such species.

2.2.5 Humaneness and Animal Welfare Concerns of Methods Used

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 and very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns, if " . . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process." Suffering 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 . . . " (AVMA 1987). 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 . . . " (CDFG 1991), such as shooting.

Pain obviously occurs in animals, but assessing pain experienced by animals can be challenging (AVMA 2007, CDFG 1991). The AVMA defines pain as being, "that sensation (perception) that results from nerve impulses reaching the cerebral cortex via ascending neural pathways" (AVMA 2007). The key component of this definition is the perception of pain. The AVMA (2007) 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 2007).

The AVMA states " . . . euthanasia is the act of inducing humane death in an animal" and that " . . . 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 2001).

AVMA (2013) notes, "While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as appropriate for a particular species may not be available or may become less than an ideal choice due to differences in circumstances. Conversely, when settings are atypical, methods normally not considered appropriate may become the method of choice. Under such conditions, the humaneness (or perceived lack thereof) of the method used to bring about the death of an animal may be distinguished from the intent or outcome associated with an act of killing. Following this reasoning, it may still be an act of euthanasia to kill an animal in a manner that is not perfectly humane or that would not be considered appropriate in other contexts. For example, due to lack of control over free-ranging wildlife and the stress associated with close human contact, use of a firearm may be the most appropriate means of euthanasia. Also, shooting a suffering animal that is in extremis, instead of catching and transporting it to a clinic to euthanize it using a method normally considered to be appropriate (e.g., barbiturates), is consistent with one interpretation of a good death. The former method promotes the animal's overall interests by ending its misery quickly, even though the latter technique may be considered to be more acceptable under normal conditions (Yeates 2010). Neither of these examples, however, absolves the individual from her or his responsibility to ensure that recommended methods and agents of euthanasia are preferentially used."

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

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.

The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. WS and the National Wildlife Research Center are striving to bring additional non-lethal damage management alternatives into practical use and to improve the selectivity and humaneness of management devices. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in situations when non-lethal damage management methods are not practical or effective.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

2.3.1 No Wildlife Damage Management at Taxpayer Expense; Wildlife Damage Management should be Fee Based

An issue identified through the scoping process is the concern that wildlife damage management should not be provided at the expense of the taxpayer or that activities should be fee-based. In Pennsylvania, funds to implement wildlife damage management activities and programs are derived from a number of sources, including but not limited to, federal, state, county and municipal governments/agencies, private organizations, corporations and individuals, homeowner/property owner associations, and others, under Cooperative Service Agreements and/or other contract documents and processes. A minimal federal appropriation is allotted for the maintenance of a WS program. The remainder of the WS program is mostly fee-based. (Pennsylvania WS state report, http://www.aphis.usda.gov/wildlife_damage/informational_notebooks/2012/WS%20State%20Operations/39-pennsylvania_report.pdf). 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 cooperative service agreements between the requester and WS.

Federal, state, and local officials have decided that wildlife damage management should be conducted by appropriating funds. WS was established by Congress as the agency responsible for providing wildlife damage management to the people of the United States. Wildlife damage management is an appropriate sphere of activity for government programs, because aspects of wildlife damage management are a government responsibility and authorized by law.

2.3.2 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 owners could attempt to reduce their own damage problems. 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 contract with a government agency. In particular, large industrial businesses and cities and towns may prefer to use WS because of security and safety issues and reduced administrative burden. The relationship between WS and private industry is addressed in WS directive 3.101 (http://www.aphis.usda.gov/wildlife_damage/ directives/3101.pdf).

2.3.3 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 (Kleppe v Sierra Club, 427 U.S. 390, 414 (1976), CEQ 1508.25). Ordinarily, according to APHIS procedures implementing the NEPA, WS' individual wildlife damage management actions could be categorically excluded (7 CFR 372.5(c)). The intent in developing this EA is to determine if the 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). This EA addresses impacts for managing damage and threats to human safety associated with mammals in Pennsylvania 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 Commonwealth of Pennsylvania will provide a more comprehensive and less redundant analysis than multiple EAs covering smaller areas. 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.

2.3.4 Cost Effectiveness of Management Methods

The CEQ does not require a formal, monetized cost benefit analysis to comply with NEPA. Consideration of this issue may not be the driving factor when developing a site-specific management strategy. The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns. Additionally, management operations may be constrained by cooperator funding and/or objectives and needs. However, the cost effectiveness of methods and the effectiveness of methods are linked. 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 generally receive the greatest application.

2.3.5 A Loss Threshold Should Be Established Before Allowing Lethal Methods

WS has received comments indicating 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 damage which may be tolerated before employing lethal methods would differ among cooperators and damage situations. In addition, establishing a threshold would be difficult or inappropriate to apply to human health and safety situations.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied plaintiffs' motion for a preliminary injunction. In part, the court found that a forest supervisor needs only show that damage from wildlife is threatened, to establish a need for wildlife damage management (Civil No. 92-C-0052A January 20, 1993). Thus, there is judicial precedence indicating that it is not necessary to establish a criterion, such as a percentage of loss of a particular resource, to justify the need for wildlife damage management actions.

2.3.6 Effects from the Use of Lead Ammunition in Firearms

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

The take of mammals by WS in Pennsylvania using firearms occurs primarily from the use of rifles. However, the use of shotguns could be employed to lethally take some species. Mammals that are removed using rifles would occur within areas where retrieval of all mammal carcasses for proper

disposal is highly likely (e.g., at an airport). With risks of lead exposure occurring primarily from ingestion of bullet fragments, the retrieval and proper disposal of mammal carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

However, deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through a mammal, if misses occur, or if the mammal carcass is not retrieved. Laidlaw et al. (2005) reported that, because of the low mobility of lead in soil, all of the lead that accumulates on the surface layer of the soil is generally retained within the top 20 cm (about 8 inches). In addition, concerns occur that lead from bullets deposited in soil from shooting activities could lead to contamination of water, either ground water or surface water, from runoff. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. Lead did not appear to "transport" readily in surface water when soils were neutral or slightly alkaline in pH (i.e., not acidic), but lead did transport more readily under slightly acidic conditions. Although Stansley et al. (1992) detected elevated lead levels in water in a stream and a marsh that were in the shot "fall zones" at a shooting range, the study did not find higher lead levels in a lake into which the stream drained, except for one sample collected near a parking lot where it was believed the lead contamination was due to runoff from the parking lot, and not from the shooting range areas. The study also indicated that even when lead shot is highly accumulated in areas with permanent water bodies present, the lead does not necessarily cause elevated lead contamination of water further downstream. Muscle samples from two species of fish collected in water bodies with high lead shot accumulations had lead levels that were well below the accepted threshold standard of safety for human consumption (Stansley et al. 1992).

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

Take of mammals can occur during regulated hunting seasons, through the issuance of depredation permits by the PGC, without the need to obtain a permit for species that are classified as an "unprotected species", and through other authorizations granted to landowners/managers for some species by regulations outlined by the PGC, *"Landowners have a right to protect their property from damages caused by wildlife. With the exception of deer, bear, elk, beaver, bobcat, fisher, wild turkey, migratory birds, threatened species and endangered species, landowners may take action when personal property – other than an agricultural crop – is being destroyed, or when a sick or diseased animal poses a threat to humans, farm animals or pets. Only the property owner or person in charge of the property may take steps to capture or kill"* (PGC 2010). Consequently, WS' assistance with removing mammals would not be additive to the environmental status quo because animals removed by WS using firearms could be lethally removed by the entities experiencing damage using the same method in the absence of WS' involvement. 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.

2.3.7 WS Impact on Biodiversity

Pennsylvania WS MDM program is not conducted to eradicate native wildlife populations. W S operates according to international, federal, and appropriate state laws and regulations enacted to ensure species viability. In addition, any reduction of a local group of mammals is frequently temporary because immigration from adjacent areas or reproduction replaces removed animals. WS operates on a relatively small percentage of the land area of the state, and WS' take of any wildlife species analyzed in this EA is a small proportion of the total population and insignificant to the viability and health of the population (see Section 4.2.3). Reductions in non-native species like feral hogs and nutria are likely to be beneficial because non-native species disrupt ecosystems and compete for resources with native wildlife.

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

Some individuals are concerned that damage management activities conducted by WS would affect the ability of persons to harvest those species during the regulated hunting and trapping seasons either by reducing local populations through the lethal removal of mammals or by reducing the number of mammals present in an area through dispersal techniques. Those species that are addressed in this EA that also can be hunted or trapped during regulated seasons in Pennsylvania include: beaver, black bear, bobcat, Eastern cottontail, fisher, fox squirrel, gray fox, gray squirrel, weasels, mink, muskrat, porcupines, raccoons, red fox, red squirrel, river otter, spotted skunk, striped skunk, and Virginia opossums.

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. Where harvest information is available, WS assesses the impact of its MDM actions in context of licensed harvest (Chapter 4). Analysis in Chapter 4 indicates that WS take is very low relative to licensed harvest (Table 4-1). Additionally, WS' MDM activities would primarily be conducted in areas where hunting access is restricted (e.g., airports, urban areas) or has been ineffective. The use of non-lethal (such as black bear relocation) 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. 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.

2.3.9 Global Climate Change/Greenhouse Gas Emissions

The WS program activities that may result from the alternatives would have a negligible effect on atmospheric conditions including the global climate. Meaningful direct or indirect emissions of greenhouse gases would not occur as a result of the proposed action. The proposed action would meet requirements of applicable federal laws, regulations, and Executive Orders including the Clean Air Act and Executive Order 13514.

CHAPTER 3: ALTERNATIVES

3.0 INTRODUCTION

Chapter 3 contains a discussion of the alternatives which were developed to meet the need for action discussed in Chapter 1 and to address the identified issues discussed in Chapter 2. Alternatives were developed for consideration based on the need for action and issues using the WS Decision model (Slate et al. 1992). The alternatives which receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences) are described, as are alternatives considered but not analyzed in detail. This chapter also includes SOPs for mammal damage management in Pennsylvania.

The No Action alternative is a procedural NEPA requirement (40 CFR 1502), and is a viable and reasonable alternative that could be selected. This alternative serves as a baseline for comparison with the other alternatives. The No Action alternative, as defined here, is consistent with the CEQ definition (CEQ 1981).

3.1 DESCRIPTION OF THE ALTERNATIVES

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

The Proposed Action/No Action alternative would continue the current implementation of an adaptive integrated approach utilizing non-lethal and lethal techniques (Appendix C), identified through use of the WS Decision Model, to reduce damage and threats caused by mammals in Pennsylvania. Under this alternative, WS, in consultation with the PGC, would continue to respond to requests for assistance by: 1) taking no action if warranted, 2) providing only technical assistance to property owners or managers on actions they could take to reduce damages caused by mammals, or 3) providing technical assistance and direct operational assistance to a property owner or manager experiencing damage. WS would also continue to work with the PGC, Penn State University Extension Service, and other entities to produce and distribute materials and provide educational programs on methods for preventing damage. Funding could occur through federal appropriations or from cooperative funding.

When a request for direct operational assistance is received to resolve or prevent damage caused by mammals, WS conducts site visits to assess damage or threats and identifies the cause of the damage. WS applies the decision model described by Slate et al. (1992) to develop an effective site specific management strategy which minimizes risk of adverse environmental impacts and risks to human health and safety from MDM methods and is consistent with landowner/manager management objectives. The use of the Decision model by WS' employees under the proposed action is further discussed below in Section 3.2.3. Property owners or managers requesting assistance would be provided with information regarding the use of effective and practical non-lethal and lethal techniques. Preference would be given to practical and effective 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. Property owners or managers may choose to implement WS' recommendations on their own (i.e., use WS technical assistance), use contractual services of private businesses, use volunteer services of private organizations, or use the services of WS (i.e., direct operational assistance). Property owners may also take management action themselves without consulting another private or governmental agency, or take no action.

3.1.2 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 in Pennsylvania (Appendix C). 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 PGC, local animal control agencies, or private businesses or organizations. Property owners or managers may 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.

3.1.3 Alternative 3: Technical Assistance Only

Under this alternative, WS would only provide technical assistance to cooperators requesting assistance. WS would not provide any operational damage management. Technical assistance could include providing information, demonstrations, and recommendations on available and appropriate methods available. In some instances, wildlife-related information provided to the requestor by WS results in tolerance/acceptance of the situation. In other instances, damage management options are discussed and recommended. Only those methods legally available for use by the appropriate individual would be recommend or loaned by WS. The implementation of methods and techniques to resolve or prevent damage would be the responsibility of the requester with no direct involvement by WS. In some cases, WS may provide supplies or materials that are of limited availability for use by private entities (e.g., loaning of propane cannons). Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Under a technical assistance only alternative, WS would recommend an integrated approach. Generally, several management strategies are described to the requester for short and long-term solutions to managing damage; these strategies are based on the level of risk, need, and the practicality of their application. Wildlife Services would use the Decision Model to recommend those methods and techniques available to the requestor to manage damage and threats of damage.

The WS program in Pennsylvania regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing mammal damage. Between FY 2009 and FY 2013, Pennsylvania WS conducted more than 1,900 technical assistance projects that involved mammal species identified in this EA causing damage to agricultural resources, property, natural resources, and threats to human safety.

This alternative would place the immediate burden of operational damage management work on the resource owner, other governmental agencies, and/or private businesses. Cooperators receiving technical assistance from WS could implement those methods recommended by WS, could employ other methods not recommended by WS, could seek assistance from other entities, or take no further action. Property owners/managers frustrated by lack of operational WS' assistance with the full range of mammal damage management techniques, may try methods not recommended by WS or use illegal methods (e.g., poisons). In some cases, property owners or managers may misuse some methods or use some methods in excess of what is necessary.

3.1.4 Alternative 4: No Mammal Damage Management Conducted by WS

Under this alternative, WS would not be involved with any aspect of mammal damage management in Pennsylvania. Information on MDM methods would still be available to producers and property owners through other sources such as PGC, Penn State University Extension Service offices, or pest control

organizations. Currently, PGC only provides direct MDM assistance in limited situations, but does provide technical assistance and issues permits for MDM activities as appropriate and allows landowners to conduct management without permits as outlined in their nuisance management guidelines (PGC 2010). Requests for information would be referred to these entities.

In Pennsylvania, persons experiencing damage caused by mammals could continue to resolve damage by employing those methods legally available. All methods described in Appendix C would be available for use by persons experiencing damage or threats from mammal species. Some take may require additional permitting from the PGC or certification by the PDA to use restricted chemicals. Other restrictions may include the use of immobilizing drugs or euthanasia chemicals. Immobilizing drugs and euthanasia chemicals can only be used by WS, licensed veterinarians, or those that are trained and working under the supervision of an appropriate DEA license holder.

3.2 MAMMAL DAMAGE MANAGEMENT STRATEGIES USED BY WS

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 2, and 3 described above. Alternative 4 would terminate both technical assistance and operational MDM by WS. Appendix C is a more thorough description of the methods that could be used or recommended by WS.

3.2.1 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 hogs), or any combination of these depending on the circumstances of the specific damage problem.

3.2.2 The IWDM Strategies Employed by WS

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 2009 through FY 2013, WS has logged over 1,900 technical assistance entries related to species covered in this EA.

Direct Damage Management Assistance

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

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. Pennsylvania 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. Wildlife Services 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.

Examples of WS Technical Assistance and Direct MDM in Pennsylvania

Susquehanna Area Regional Airport Authority (SARAA) has entered into a Cooperative Service Agreement with Pennsylvania WS for the purpose of assessing, managing, and monitoring wildlife-related public safety and aviation hazards at Harrisburg International Airport (HIA, and to a lesser extent Capital City Airport, Franklin County Regional Airport and Gettysburg Regional Airport). Mammals create direct safety hazards at the airports through strike risks and indirect hazards by attracting species that are strike risks (rabbits as prey for raptors). Woodchucks, fox, and skunks also dig holes in the airfield, under structures, and damage equipment causing safety concerns and monetary damage. WS has

implemented an IWDM approach consisting of technical assistance and direct damage management components including: WS review of airport development and landscaping plans, habitat management recommendations, providing training to HIA personnel on hazardous mammal species population management, reporting, and exclusion. WS involvement with SARAA has considerably reduced or prevented strikes with hazardous mammal species and avian predators at the airport.

WS has entered into Cooperative Service Agreements at numerous landfills to conduct wildlife damage management on site and at adjacent properties that may be experiencing wildlife damage by animals attracted to the landfill. This has included trapping skunks and raccoons that cause damage to property or are a disease concern both on and off site, removal of groundhogs that are borrowing into landfill liners, and trapping beaver that may be blocking drainages or causing structural issues by burrowing into levees or damaging trees. WS also provides recommendations to these facilities on habitat management that may reduce the attractiveness of the site or the ability of mammals to damage equipment or sensitive structures.

WS has provided technical assistance to a neighborhood experiencing disease concerns (rabies) from groundhogs, raccoons, and feral cats. Numerous residents were being approached by groundhogs that were acting aggressively. The neighborhood was located near a river and wetland area, and numerous raccoons had been observed on homeowner properties. Additionally, there was an abandoned house where feral cats were being fed. Both feral cats and raccoons had been observed fighting with groundhogs in the neighborhood. WS provided recommendations on reducing potential disease threats through education and management. WS loaned residents traps to capture raccoons and groundhogs to be euthanized and submitted for disease sampling. Also, information on alleviating the feral cat issue was provided. WS suggested eliminating feeding of the feral cats (which was being conducted by a local resident), and suggested the neighborhood find the owners of the abandoned property and work with an animal shelter to reduce the feral cat issue. WS also provided educational information on disease issues and proper response in case there was an exposure.

3.2.3 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 3-1). 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 start by assessing the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a 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 assessing the problem and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but

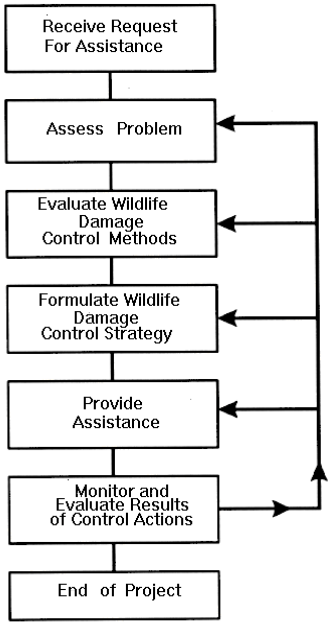

Figure 3-1. WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflicts.

a mental problem-solving process common to most, if not all, professions.

Community-based Decision Making

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

Requests for assistance to manage damage caused by mammals often originate from the decision-maker(s) based on community feedback or from concerns about damage or threats to human safety. As representatives of the community, the decision-maker(s) are able to provide the information to local interests either through technical assistance provided by WS or through demonstrations and presentation by WS on mammal damage management activities. This process allows decisions on mammal damage management activities to be made based on local input. They may implement management recommendations provided by WS or others on their own, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

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:

3.3.1 Lethal Mammal Damage Management Only By WS

Under this alternative, WS would not use or recommend any non-lethal MDM methods, but would only conduct lethal MDM. This alternative was eliminated from further analysis because some mammal damage problems can be resolved effectively through non-lethal means. Additionally, lethal methods may not always be available for use due to safety concerns, such as the discharge of firearms. Also, this is in direct conflict with WS Directive 2.101, which directs that WS must consider the use of non-lethal methods before lethal methods. Therefore, this alternative was not considered in detail.

3.3.2 Exhaust All Feasible Non-lethal Methods Before Using Lethal Methods

This alternative would require that all non-lethal methods or techniques described in Appendix C be applied to all requests for assistance to reduce damage and threats to safety from mammals in Pennsylvania. 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.

People 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 and given preference where practical and effective (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.

3.3.3 Compensation Only for Mammal Damage Losses

Reimbursement provides producers monetary compensation for losses, however it does not remove the problem nor does it assist with reducing future losses. The compensation only alternative would require the establishment of a system to reimburse persons impacted by mammal damage. This alternative was eliminated from further analysis because it is not financially feasible or practical to provide compensation for all mammal damage. There is not any federal or state law that authorizes compensation to address mammal damage in Pennsylvania.

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

This topic has undergone considerable debate in animal welfare and scientific communities for a number of years. The debate focuses on whether controlling feral, free-ranging, or invasive animal populations through Trap-Neuter-Release (TNR) programs are effective and alleviate problems (*i.e.*, diseases, predation, agricultural damage, and human safety). TNR programs have been going on for decades in Britain and Europe. Today, feral and free-ranging cats are causing the same problems they were causing ten years ago. Cat colonies have not died out or reduced in size, and many continue to increase. Common consensus is that some cat colonies stabilize, but never come close to extinction. Many of these colonies would not survive if it were not for the supplemental feeding by humans in some areas (Smith and Shane 1986). So the problems with wildlife and human health issues have not been resolved by the TNR philosophy.

Many veterinarians and public health officials oppose TNR programs based on health concerns and disease threats. 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 is a concern. The National Association of State Public Health Veterinarians and the American Veterinarians Medical Association oppose TNR programs based on health concerns and threats (AVMA 1996). First, diseases and parasites transmitted by cats to humans including ringworm, bartonellosis, larval migrans, cat scratch fever, toxoplasmosis, and vector-borne zoonotic diseases are not controlled in colony situations. Second, rabies is a major concern because cats are the number one domesticated species testing positive for rabies in the U.S. and other species commonly infected by the disease are also attracted to feeding stations in cat colonies.

The Wildlife Society (TWS), founded in 1937, is the wildlife manager's professional equivalent of the AVMA. Their special expertise is the health of the environment and maintenance of our nation's wildlife resources. TWS has spent more than two years developing its policy No. 25 on feral and free-ranging cats, and this policy clearly identifies the problems associated with these non-native predators. The society's policy includes support for "passage and enforcement of local and state ordinances prohibiting the public feeding of feral cats, especially on public lands, and release of unwanted pet or feral cats into the wild." It also indicates opposition to "passage of any local or state ordinances that legalize the

maintenance of the 'managed' (i.e., TNR) free-ranging cat colonies" (AVMA 2004).

Many other organizations have developed similar policies, including the following: the International Association of Fish and Wildlife Agencies, the Association of Avian Veterinarians, the American Association of Wildlife Veterinarians, the Council of State and Territorial Epidemiologists/National Association of State Public Health Veterinarians, the ABC, The Humane Society of the United States, the American Ornithologists' Union, People for the Ethical Treatment of Animals (PETA), the National Audubon Society, and various state wildlife federations and commissions. The perspective of PETA is, "because of the huge number of feral cats and the severe shortage of good homes, the difficulty of socialization, and the dangers lurking where most feral cats live, it may be necessary and the most compassionate choice to euthanize feral cats. A painless injection is far kinder than the fate that feral cats will meet if left to survive on their own" (AVMA 2004). As a result of the continued threat to human safety created by TNR programs and the continued threat to T&E wildlife and native wildlife in general, this alternative will not be considered further.

3.3.5 Bounties

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

3.5 STANDARD OPERATING PROCEDURES (SOPs) FOR MAMMAL DAMAGE MANAGEMENT

The current WS program, nationwide and in Pennsylvania, has developed SOPs for its activities that reduce the potential impacts of these actions on the environment. Some key SOPs pertinent to the proposed action and alternatives of this EA include:

- The WS Decision Model thought process is used to identify effective wildlife damage management strategies and their effects.

<u>Target, Non-target, and Threatened and Endangered Species</u>

- 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 PGC 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 PGC 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.

- Research is being conducted to improve MDM methods and strategies so as to increase selectivity for target species, to develop effective non-lethal control methods, and to evaluate and minimize non-target hazards and environmental effects of MDM techniques.

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

- WS uses chemical methods for MDM that have undergone rigorous research to prove their safety and lack of serious effects on non-target animals and the environment.

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

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

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

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

- Captured non-target animals will be released unless it is determined by WS personnel that the animal would not survive.

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

- Management actions would be directed toward localized populations or groups and/or individual offending animals, dependent on the magnitude of the problem.

<u>Health and Safety</u>

- All WS personnel in Pennsylvania using restricted chemicals and controlled substances (immobilization and euthanizing drugs) are trained and certified by, or operate under the direct supervision of, program personnel or others who are trained in the safe and effective use of chemical MDM materials.

- WS uses MDM devices and conducts activities for which the risk of hazards to public safety and hazard to the environment have been determined to be low. Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazards to the public is even further reduced.

- Appropriate warning signs are posted on main entrances or commonly used access points to areas where foothold traps, cable restraints, snares, or rotating jaw (conibear-type) traps are in use.

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

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

- Research is being conducted to improve MDM methods and strategies so as to increase selectivity for target species, to develop effective non-lethal control methods, and to evaluate non-target hazards and environmental effects.

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

- All WS actions are conducted in accordance with applicable state, federal and local laws, including permit conditions and regulations as dictated by the PGC in WS Special Use Permit.

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

<u>Humaneness and Animal Welfare Concerns of Methods Used</u>

- All WS actions are conducted in accordance with applicable state, federal and local laws, including regulations mandating that land traps set for mammals be checked as dictated by the PGC in WS Special Use Permit.

- Research on selectivity and humaneness of management practices would be monitored and adopted as appropriate.

- Management controls are in place within WS and its Immobilization and Euthanasia Committee to maintain personnel training and certification.

- Where practical, euthanasia procedures approved by the AVMA that cause minimal pain would be used.

- Use of newly-developed, proven, non-lethal methods would be encouraged when appropriate.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Chapter 4 provides information needed for making informed decisions when selecting an appropriate alternative for meeting the purpose of the proposed action. This chapter analyzes the environmental consequences of each alternative in relation to the issues identified for detailed analysis in Chapter 2. The environmental consequences of each alternative are analyzed in comparison with the no action alternative (Alternative 1) to determine if the real or potential effects would be greater, lesser, or the same.

The following resource values within the state are not expected to be significantly impacted by any of the alternatives analyzed as none of the alternatives cause any significant ground disturbance: soils, geology, minerals, water quality/quantity, flood plains, visual resources, air quality, prime and unique farmlands, timber, and range. Therefore, these resources will not be analyzed.

Cumulative Effects: Cumulative effects are discussed in relationship to each of the alternatives analyzed, with emphasis on potential cumulative effects from methods employed, and including summary analyses of potential cumulative impacts to target and non-target species, including T&E species.

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.

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

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

This section analyzes the environmental consequences of each alternative to determine the extent of actual or potential impacts on the issues addressed in detail, including a cumulative impact analysis. The analysis also takes into consideration mandates, directives, and the procedures of WS and the PGC.

4.1.1 Effects on Target Mammal Species Populations

4.1.1.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

Generally, WS only conducts damage management on species whose population densities are high or concentrated and usually only after they have caused damage. Table 4-1 identifies average annual lethal take of animals by WS, proposed maximum annual WS take, and estimated annual harvest by hunters and trappers within Pennsylvania for calendar years (CY) 2008 to 2013.

Table 4-1. Average annual Pennsylvania WS lethal take of mammals addressed in this EA for the period for 2008 to 2013.

Species	Average Annual WS Take 2008-2013[1] 5-year Average	Maximum Proposed WS Annual Take[1]	PA Statewide Average Annual Estimated Season Harvest 2008-2012[2]	% WS Proposed Annual Take compared to Average Annual PA Harvest
Feral Swine	11	500	NA	NA
Black Bear	0	5	3,606	0.13%
Feral Cat	68	200	NA	NA
Raccoon	205	500	153,157	0.33%
Red Fox	48	300	54,501	0.55%
Striped Skunk	23	100	9,993	1.0%
Spotted Skunk	0	5	NA	NA
Gray Fox	3	30	17,425	0.17%
Mink	0	20	9,681	0.21%
Weasels	0	20 combined	533	3.75%
River Otter	0	5	NA	NA
Fisher	0	5	167[3]	2.9%
Bobcat	0	5	831	0.60%
Virginia Opossum	20	200	51,076	0.39%
Beaver	4	100	11,365	0.88%
Woodchuck (borrows treated)	459 (230)	1000	811,005	0.12%[4]
Nutria	0/0	200	NA	NA
Muskrat	4	200	75,754	0.26%
Eastern Cottontail	132	500	353,764	0.14%
Snoeshoe Hare	0	15	908	1.65%
Feral/Domestic Rabbit	0	15	NA	NA
Squirrel, Fox, Gray, & Red	1 gray 0 red 0 fox	20/each	641,548	0.009%
Porcupine	0	20	11,846[5]	0.17%
Southern Flying Squirrel	0	5	NA	NA
Eastern Chipmunk	0	100	NA	NA
Misc. mice, shrews, moles &	voles 2	1,000 combined	NA	NA

voles				
Norway Rat	3	500	NA	NA

[1] Includes only lethal take.
[2] Annual harvest reports from PGC website for five harvest seasons, July 1, 2008 to June 30, 2013.
[3] Fisher harvest data is only available for 2010-2012 trapping seasons.
[4] Woodchuck take does not include borrow take by WS.
[5] Porcupine harvest data is only available for 2010 and 2011 hunting seasons.

Eastern Cottontail Rabbits

Population densities for cottontail rabbits vary with habitat quality, but one rabbit per 0.4 hectares (one acre) is a reasonable average (Craven 1994). Rabbits live only 12-15 months, but they can raise as many as six litters per year of one to nine young (usually four to six); (National Audubon Society 2000). Cottontails are a regulated game species in Pennsylvania and the PGC has established seasons and bag limits for this species. No statewide population estimates were available for cottontail rabbits; however the PGC does estimate harvest via hunter surveys. The estimated annual average take of cottontails from 2008-2013 was 353,764 rabbits (Table 4-1).

WS estimates that no more than 500 cottontail rabbits may be taken per year for MDM. This maximum estimated take by WS is 0.14% of the estimated annual take by hunters in the state. Almost all of the rabbits would be removed from urban, airport, commercial, or industrial habitats where hunting is not likely to occur. Cottontail rabbit damage management activities would target single rabbits 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. Given the high productivity of cottontail rabbits and that WS actions will be confined to very small, scattered portions of the state that are usually not subjected to hunting, WS' limited lethal take of cottontail rabbits would have no adverse impacts on overall rabbit populations in the state. Additionally, WS limited take combined with the annual hunter harvest and other forms of mortality would not significantly contribute to cumulative adverse effects on cottontail populations.

Woodchucks

Woodchucks (also known as groundhogs) are found throughout much of the Eastern and Midwestern U.S., with distribution across Pennsylvania. 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 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). The PGC is responsible for the management of the states woodchuck population but does not conduct population census for woodchucks; however, does estimate hunter harvest. The estimated five year annual woodchuck take by hunters in Pennsylvania was 811,005 animals (table 4-1). This does not include take by agricultural producers, landowners, or private pest control operators. Woodchucks may be taken by landowners if the animals are causing damage on private property, and reporting of take is not required (PGC 2010). Additionally, permitted pest control operators conduct a considerable amount of work on this species, and although take is reported to the PGC, compiled reports are not currently available for analysis (pers comm. C. Eyler PGC 20013).

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

The number of entrances to burrow systems used by woodchucks varies. Twichell (1939) found the number of entrances to burrow systems used by woodchucks ranged from two to six entrances in Missouri, with the average number being 2.8 entrances. Other studies note the number of entrances per burrow system ranged from one to five entrances (Grizzell, Jr. 1955) to high of 11 entrances per system (Merriam 1971). Merriam (1971) found the mean number of entrances per burrow system was 2.98 entrances. Based on the mean number of entrances per burrow system of approximately three entrances (Twichell 1939, Merriam 1971) and each burrow system occupied by a male and a female (Swihart 1992, Armitage 2003), the number woodchucks that could be lethally taken using gas cartridges could be estimated at approximately 333 woodchucks if 500 entrances were treated (500 borrow entrances / 3 entrances per borrow system = number of borrow systems x 2 individuals per borrow system). The take of woodchucks would also occur using other methods, such as shooting, live traps, and body-gripping traps. The number of woodchucks lethally taken using gas cartridges and by other methods is not expected to exceed 1,000 woodchucks. WS' average five year take, excluding the use of gas cartridges, was less 500 animals annually (Table 4-1). The average number of borrows treated using gas cartridges was 230 with an estimated 153 animals euthanized per year using the above mentioned method. WS' proposed take of 1,000 represents 0.12% of the average annual hunter harvest. This extremely low percentage of take, even in combination with all other methods of mortality (e.g. hunting, pest control operators, etc.), would not contribute to cumulative adverse effects on the statewide woodchuck population. The PGC's monitoring of hunter harvest and pest control operator take further ensures that cumulative adverse effects are negligible.

Other Rodents and Insectivores

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

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

litters per year with two to five young each. Large population fluctuations are characteristic of many small rodent populations.

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

Non-native Rodent Species: Norway Rats, black (roof) rats, and house mice are not native to North America and were accidentally released into this country. In the wild, the impact of these species is seen by many as entirely detrimental (Burt and Grossenheider 1980). These species eat anything digestible and may prey on eggs or offspring of native species and compete with native species for resources. Executive Order 13112 Invasive Species directs federal agencies to use their programs and authorities to prevent the spread of or to control populations of invasive species that cause economic or environmental harm, or harm to human health. Although removal of these species up to and including extirpation could be seen as desirable, because of the productivity and distribution of these species and the limited nature of WS work, WS is unlikely to ever do more than limit populations at the specific local sites where WS works. Based on the above information and WS' limited lethal take of rodents in Pennsylvania, WS should have minimal effects on local or statewide non-native rodent populations.

Nutria

Nutria are a non-native aquatic rodent, native to South America, initially imported into North America to zoos and for fur farming operations in the 20th Century. From these locations, animals were intentionally released or escaped, and by 2002, 16 states had documented nutria populations (Bounds et al. 2003). Although only one nutria has been documented in Pennsylvania (M. Lavallo PGC 2013), the species is well established in adjacent states in the Chesapeake Bay Watershed (Nutria Management Team 2012). Nutria are well documented as causing significant damage to native wetland vegetation as well as damage to agricultural areas and property and water control structures through burrowing activity (Bounds et al. 2003). The potential economic damage that nutria could cause if they become established in an area is significant, with areas of the Chesapeake Bay Watershed indicating that nutria cause millions of dollars in damage annually (Southwick Associated 2004). If future documentation of nutria in Pennsylvania occurs, it would be the goal to assist the PGC with removal and eradication efforts before a population could be established. Any reduction in nutria populations, including eradication, could be considered a beneficial impact to the environment. Executive Order 13112 Invasive Species directs federal agencies to use their programs and authorities to prevent the spread of or to control populations of invasive species that cause economic or environmental harm, or harm to human health. If further evidence of nutria occurs in the Commonwealth, WS proposes to remove up to 200 nutria annually in an effort to assist with eradication efforts and protection of natural resources, property, and human health and safety.

Feral Swine

Feral swine are not native to North America, but now inhabit much of the United States (West et al 2009). In Pennsylvania, feral swine have been documented in 23 counties, with breeding populations identified in four counties. Feral swine have colonized portions of Pennsylvania through the escape or intentional release of both domestic varieties and those imported or bread for use at captive hunting facilities. In 2013, almost 40 captive facilities were identified as housing feral swine or had housed feral swine within the past five years. At least 30 of these facilities offered some kind of feral swine hunting opportunity, while the rest were breeding or transitional facilities (Dr. D. Zellner pers. comm. Nov 2013). Advertising for swine hunts offered at these facilities ranged from "Russian boars" to "Southern hogs." This variation consisted of animals that were bread from European stock (with heavier coats, darker colors, and long tusks), typical domestic varieties that were intended for butchering purposes, and hybrid animals with a range of characteristics, creating a wide variety of swine types available. These animals mimic those that are found in the wild in Pennsylvania, with great variation in individuals and populations depending on their lineage.

In the wild, feral swine utilize a variety of habitats such as forests, thick shrubby areas, mountains, valleys, grasslands, and agricultural lands. Pigs 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). Pigs can breed throughout the year, typically producing one litter of three to eight piglets per year, but are capable of producing two litters per year in the wild (West et al. 2009).

In Pennsylvania, feral swine are a non-native species primarily found in the southcentral and northeastern portion of the state. The PGC is tasked with management of feral swine and considers them as an invasive species and does not track population densities. The executive order published by the PGC currently declares them to be unprotected wildlife with no season or bag limit restrictions. Animals can only be harvested by licensed hunters and taken using methods available during legal hunting seasons while actively hunting other legal game in Pennsylvania, essentially establishing an incidental take program. Additional take may also occur by agricultural landowners experiencing damage from feral swine. The PGC required that all take is reported to the regional office in the game region where the animal was killed.

Feral swine are also found on captive hunting facilities within Pennsylvania, with a total of 23 sites having been documented. Additional facilities may release swine for hunting purposes for occasional harvest as requested by clientele. Captive facilities are monitored by PDA, with facilities required to follow the restrictions outlined in the Interstate/International and General Quarantine Order; Importation and Intrastate Movement of Swine (PDA 2009). This quarantine order identifies how facilities that house feral swine for hunting purposes must follow guidelines of permitting, identification, fencing, disease surveillance, reproductive control, and reporting. Additionally, breeding facilities may house feral swine or historically non-domestic varieties of swine for sale to hunting facilities or for butchering and sale as exotic meats to stores and restaurants.

Currently, WS assists the PGC, Pennsylvania Department of Agriculture and USDA APHIS Veterinary Services with feral swine disease surveillance through the USDA APHIS Comprehensive Feral Swine Disease Surveillance Program. Samples are collected opportunistically from animals killed by hunters or limited agency trapping efforts. Management of conflicts associated with feral swine are being addressed in this EA so that WS may provide more comprehensive assistance to land managers and/or state or federal agencies in minimizing the impacts of this non-native species on people, livestock, and ecosystems in the state. Based upon current and anticipated increases in future work, it is anticipated that not more than 500 feral swine would be killed annually by WS in Pennsylvania. This would include feral

swine in the wild and at captive facilities. These animals are considered by many wildlife biologists to be an undesirable component of North American wild and native ecosystems. Any reduction in feral swine populations, including eradication, could be considered a beneficial impact to the environment. Executive Order 13112 Invasive Species directs federal agencies to use their programs and authorities to prevent the spread of or to control populations of invasive species that cause economic or environmental harm, or harm to human health. Additionally, feral swine in captivity may pose a threat to domestic livestock, wildlife, and human health through the transmission of diseases. Although a reduction in the number of feral swine may be desirable, the proposed level of feral swine control is unlikely to result in more than a temporary reduction of feral swine numbers at specific sites.

Feral Cats

Feral cats produce two to 10 kittens during any month of the year. An adult female may produce three litters per year where food and habitat are sufficient. Cats are opportunistic predators and scavengers that feed on rodents, rabbits, shrews, moles, birds, insects, reptiles, amphibians, fish, carrion, garbage, vegetation, and leftover pet food (Fitzwater 1994).

When conducting feral cat management projects, WS will give preference to live capture methods. Live-captured cats will be given to local animal shelters and/or animal control offices when practical. Lethal control will not be used on cats bearing obvious identification (e.g., collars). Although preference will be given to live-capture methods, based on current and anticipated requests for assistance with feral cat management, WS estimates that up to 200 feral cats may be lethally removed by WS per year. WS will only use AVMA approved euthanasia measures for lethal removal of cats. Most non-lethal or lethal removal of cats would be conducted for projects protecting human health and safety, valuable wildlife, or captive birds and other animals. The proposed lethal take of cats is insignificant to the total population of this species in the state. In metropolitan areas of Pennsylvania, animal control officers capture and remove dozens of feral cats each year. Nationwide, the Humane Society of the United States estimates that between three and four million cats are euthanized in shelters each year. Any MDM involving lethal control actions by WS would be restricted to isolated individual sites. Some local populations may be temporarily reduced as a result of MDM projects aimed at reducing damage at a specific site. In those cases this would be considered a beneficial impact on the environment because these species are not considered part of the native ecosystem. However, given the reproductive capacity of feral cats and the limited and localized nature of WS' proposed actions, WS' limited lethal removal of feral cats is unlikely to reduce overall populations of this species in Pennsylvania.

Raccoons

The raccoon is found throughout most of the United States, with the exception of the higher elevations of mountainous regions and some areas of the arid southwest (Boggess 1994, National Audubon Society 2000). Raccoons are more common in the wooded portions of the eastern United States than in the more arid western plains (Boggess 1994), and are frequently found in cities or suburbs, as well as rural areas (National Audubon Society 2000).

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). Due to their adaptability, raccoon densities reach higher levels in urban areas than that of rural areas. Relative raccoon population densities have been variously inferred by take of animals per unit area. For instance, Twichell and Dill (1949) reported removing 100 raccoons from tree dens in a 41 ha (101 acres) waterfowl refuge

area, while Yeager and Rennels (1943) studied raccoons on 881 ha (2,177 acres) in Illinois and reported trapping 35-40 raccoons in 1939, 170 in 1940, and 60 in 1941. Slate (1980) estimated 1 raccoon per 7.8 ha (19.3 acres) in New Jersey in predominantly agricultural land on the inner coastal plain. Raccoon densities of 100 per square mile (1 raccoon per 6.4 acres) can be attained around abundant food sources (Kern 2002). Kennedy et al. (1991) estimated 13 raccoons per 100 ha (1 raccoon per 19 acres) of lowland forest in Tennessee.

There are no true population estimates available for raccoons in Pennsylvania. Raccoons are managed by the PGC as a furbearer game species and may be harvested from late-October to late-February with no daily or season bag limit. In damage situations, property owners, dwelling occupants, farmers, and their agents, may take raccoons, with no permit required, via lawful procedures to alleviate damage to property, agricultural resources (including livestock, crops, or poultry), and other resources. However, property owners should first contact a PGC Conservation Officer prior to taking action. The average annual hunter harvest of raccoons was 153,157 from 2008-2012. WS has removed an average of 205 raccoon per year during this same time frame to resolve damage issues.

In future programs, WS may be requested to address damage being caused by raccoons anywhere in Pennsylvania to protect resources or human health and safety. Activities would 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 500 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.

Using the average annual hunter harvest data to assess WS' impacts to the raccoon population, WS' take of 500 raccoons would represent 0.33% of the harvest (Table 4-1). This level of take is considered to be of very low magnitude. Given that the actual statewide population is much higher than the annual harvest, WS' take is of even lower magnitude than analyzed.

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

Red Fox

Red fox mate from January to March and produce litters of one to ten kits after a gestation period of 51 to 53 days. The kits are raised in a den, such as an enlarged woodchuck den, usually in sparse ground cover on a slight rise with a good view of all approaches (National Audubon Society 2000). Juvenile fox are able to breed before reaching a year old, but in areas of high red fox densities, most yearlings do not produce pups (Voigt 1987). Red fox are generally solitary animals as adults, except when mating (Phillips and Schmidt 1994). Rabies and distemper are associated with this species.

The density of red fox populations is difficult to determine because of the animals secretive and elusive

nature. Estimates are prone to error even in open areas with good visibility. Methods used to estimate numbers have included aerial surveys, questionnaires to rural residents and mail carriers, scent post surveys, intensive ground searches, and indices derived from hunting and trapping harvest (Voigt 1987). In Great Britain, where food is abundant in many urban areas, densities as high as 30 foxes per km^2 (78 / mi^2) have been reported (Harris 1977, MacDonald and Newdick 1982, Harris and Rayner 1986), while in southern Ontario, densities of about one fox per square kilometer (2.6 / mi^2) occur during spring. In small areas of the best habitat, three times as many foxes have been observed (Voigt 1987). However, these densities rarely occur extensively because of the dispersion of unsuitable habitat, high mortality, or the presence of competition such as coyotes (Voigt and Earle 1983). Cyclical changes in fox numbers occur routinely and complicate density estimates as well as management. These cycles can occur because of changes in prey availability, or disease outbreaks among red foxes. Home ranges for red foxes in the eastern U. S. are usually from 500 to 2,000 ha. (5 -20 km^2; 1.9 - 7.7mi^2) in rural settings such as farmland (Voigt and Tinline 1980), but such sizes may not apply among fox populations in urban settings. Harrison et al (1989) determined fox home range to average 14.7 km^2 in eastern Maine.

Dispersal serves to equalize fox densities over large areas. Annual harvests in localized areas in one or more years will likely have little impact on the overall population in subsequent years, but may reduce localized predation (Allen and Sargeant 1993). Phillips (1970) stated that fox populations are resilient and for fox control (by trapping) to be successful, pressure on the population must be almost continuous. Phillips (1970) and Voigt (1987) also concluded that habitat destruction affects fox populations to a greater extent than short-term over-harvest.

Red fox are classified as furbearers in Pennsylvania, with a regulated hunting and trapping season with unlimited take. Also, a landowner or their agent may kill or have killed foxes that have damaged property, gardens, or homes after receiving permission from a PGC Conservation Officer. Sportsmen have harvested an average of 54,501 red fox annually from 2008-2012.

This species is considered widespread and very common throughout most of the state. WS has removed an average of 48 red fox per year to respond to damage complaints. Based on previous requests for assistance received by WS, the cumulative take of red fox by WS, including red fox that could be taken as part of the ORV program, would not exceed 300 red fox annually. Using the average annual hunter harvest data to assess WS' impacts to the red fox population, WS' take of 300 red fox would represent 0.55% of the harvest (Table 4-1). This level of take is considered to be a very low magnitude. Given that the actual population is much higher than the annual harvest, WS' take is an even lower magnitude of the statewide population.

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

Striped Skunk

Adult skunks begin breeding in late February. Yearling females (born in the preceding year) mate in late March. Gestation usually lasts about seven to 10 weeks, and there is usually only one litter annually.

Litters commonly consist of four to six young (Rosatte 1987). Skunk densities vary widely according to season, food sources, and geographic area. Densities have been reported to range from one skunk per 77 acres to one per 10 acres (Rosatte 1987).

No population estimates are available for striped skunks in Pennsylvania. Striped skunks can be found in a variety of habitats across the state. Therefore, a population estimate will be derived based on the best available information for skunks to provide an indication of the magnitude of take proposed by WS to alleviate damage and threats of damage. There are more than seven million acres of farmland in Pennsylvania (Stuff About States 2004). If only 50% of the farmland throughout the state has sufficient habitat to support striped skunks, skunks are only found on farmland, and skunk densities average one skunk per 77 acres, a statewide striped skunk population could be estimated at nearly 45,000 skunks. Skunks can be found in a variety of habitats, including urban areas, throughout the state; therefore, skunks likely occupy more than 50% of the farmland area in the state. However, to determine the magnitude of the proposed take by WS to alleviate or prevent damage, skunks occupying only 50% of the farmland area was used to provide a minimum population estimate.

The striped skunk is managed by the PGC as a furbearer species with a trapping season that occurs from October 27 through February 23. Skunks may be hunted throughout the year. There is no daily or season take limit for either trapping or hunting of striped skunks. In damage situations, property owners, dwelling occupants, farmers, and their agents, may take skunks via lawful procedures to alleviate damage to property, agricultural resources (including livestock, crops, or poultry), and other resources after contacting a Conservation Officer. Sportsmen have harvested an average of 9,993 skunks annually from 2008-2012 (Table 4-1).

WS has removed an average of 23 striped skunks per year to respond to damage complaints and disease issues, including work at landfills, airports, and rabies related projects. WS continues to receive an increasing number of requests for assistance with skunks. Therefore, the number of skunks taken annually by WS to address the increasing number of requests for assistance is also likely to increase. Based on recent requests for assistance and in anticipation of receiving additional requests for assistance, WS could annually take up to 100 skunks to alleviate damage or threats of damage associated with those requests.

With a statewide population estimated at 45,000 skunks, an annual take of up to 100 skunks by WS would represent 0.2% of the population, if the population remains at least stable. The unlimited harvest allowed by the PGC during the annual hunting and trapping seasons provides some indication the population of skunks is not subject to overharvest during the annual harvest seasons and from damage management activities. WS' take combined with hunter harvest and all other forms of mortality would not result in negative cumulative impacts to the statewide skunk population.

Virginia Opossum

The reproductive season of the Virginia opossum typically occurs from December to February, depending on latitude (Gardner 1982). Gestation is short (average of 12.8 days) with 1 to 17 young (Gardner 1982, National Audubon Society 2000). Opossums live for only one to two years, with as few as 8% of a population of those animals surviving into the second year in a study in Virginia conducted by Seidensticker et al. (1987). In that five-year study, it was also observed that there was a wide variation in opossum numbers, in what was considered excellent habitat for the species. Those variations were observed seasonally and in different years. However, the mean density during the study was 10.1 opossum per square mile with a range of 1.3 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.

The opossum is managed by the PGC as a furbearer species with a trapping season that occurs from October 27 through February 23. Opossums may be hunted throughout the year. There is no daily or season take limit for either trapping or hunting of opossum. In damage situations, property owners, dwelling occupants, farmers, and their agents, may take opossums via lawful procedures to alleviate damage to property, agricultural resources (including livestock, crops, or poultry), and other resources after contacting a Conservation Officer. Sportsmen have harvested an average of 51,076 opossums annually from 2008-2012 (Table 4-1).

This species is considered widespread and very common throughout most of the state. WS has removed an average of 20 opossums per year to respond to damage complaints. Based on previous requests for assistance received by WS, the take of opossum by WS would not exceed 200 opossum annually. Using the average annual hunter harvest data to assess WS' impacts to the opossum population, WS' take of 200 opossum would represent 0.39% of the harvest (Table 4-1). This level of take is considered to be a very low magnitude. Given that the actual population is much higher than the annual harvest, WS' take is an even lower magnitude of the statewide population.

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

Beaver

Beaver occur across most of North America, and can be found throughout Pennsylvania, occurring in 42 counties (Hardisky 2010), primarily utilizing freshwater wetlands, rivers, streams, and lakes (Baker and Hill 2003). Beaver are the largest rodent found in North America, and reach sexual maturity from 1.5-3 years of age. Age of sexual maturity may be habitat dependent, and fecundity is believed to be density dependent, so reproduction in a population may be variable, with an average of 5.5 kits per breeding female in Pennsylvania (Hardinsky 2010). Beaver populations and occurrence is often directly related to habitat and harvest, with isolated populations being more susceptible to population reduction programs or changes in habitat quality (Hardinsky 2010).

Beaver are managed as a furbearing species by the PGC, with a regulated trapping season that occurs from December 26 to March 31 with bag limits ranging from 5 to 40 per season depending on the Wildlife Management Unit being trapped. Current estimates of beaver indicate that the statewide population is between 25,000 and 30,000 animals with an estimated annual take through trapping at 11,365 annually from 2008-2012 (Table 4-1). Additional take may occur through damage management activities by landowners or their agents authorized by the PGC, receiving 400 – 1,100 complaints per year over a 13 year period (Hardinsky 2010).

Based on previous requests for assistance received by WS, the take of beaver by WS would not exceed 100 beaver annually. Using the average annual harvest data to assess WS' impacts on the population, WS' take of 100 beaver would represent 0.88% of the harvest (Table 4-1) and 0.4% of the minimum population estimate. This level of take is considered to be a very low magnitude. Given that the actual population is much higher than the annual harvest, WS' take is an even lower magnitude of the statewide population.

Muskrat

Muskrats occur over most of North America, can be found throughout Pennsylvania, and utilize both fresh and marine wetlands and streams. Muskrats are prolific breeders, producing two litters of young each year. Litter size varies from one to 14, with six to seven being the average number of young. However, their short life span and numerous mortality factors cause severe short-term population fluctuations (Godin 1977).

Muskrats are managed by the PGC as a furbearer species with a trapping season that occurs from November 23 to January 5 with no daily or season take limit. In damage situations, property owners, dwelling occupants, farmers, and their agents, may take muskrats via lawful procedures to alleviate damage to property and other resources after contacting a Conservation Officer. Sportsmen have harvested an average of 75,754 muskrats annually from 2008-2012 (Table 4-1).

This species is considered widespread and very common throughout most of the state. WS has removed an average of four muskrats per year to respond to damage complaints. Based on previous requests for assistance received by WS, the take of muskrats by WS would not exceed 200 muskrats annually. Using the average annual hunter harvest data to assess WS' impacts to the muskrat population, WS' take of 200 muskrats would represent 0.26% of the harvest (Table 4-1). This level of take is considered to be a very low magnitude. Given that the actual population is much higher than the annual harvest, WS' take is an even lower magnitude of the statewide population.

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

Other Target Species Impact Analysis

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 (5), spotted skunk (5), gray fox (30), mink (20), weasels (all species, 20 total), river otter (5), fisher (5), bobcat (5), snowshoe hare (15), feral/domestic rabbit (15), squirrels, (fox, gray, red, 20 each), porcupine (20), Southern flying squirrel (5), and Eastern chipmunk (100). 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 take would be of low magnitude when compared to the number of those game species harvested each year, and would be of extremely low magnitude when compared to the statewide population of those species. Those species are not considered to be of low densities in the state.

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

Under this alternative, WS would not intentionally take 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 the 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 take is likely to be limited to a few individuals and would not adversely impact populations of any species.

Although WS lethal take 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 taken than with a professional MDM program (Alternatives 1). Ready access to WS assistance with non-lethal MDM may decrease private efforts to use lethal techniques. Therefore, take of target species may be less than anticipated with Alternatives 3. Overall impacts on target species populations would be similar to or slightly higher 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 4.1.1 it is unlikely that target mammal populations would be adversely impacted by implementation of this alternative.

4.1.1.3 Alternative 3: Technical Assistance Only

Under this alternative, WS would have no direct impact on target mammal populations because WS would not conduct any operational MDM activities. The program would be limited to providing advice only. It is likely that most landowners/resource managers would continue to attempt to do something about their mammal damage as permitted under Pennsylvania state law. 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 with continued damage. In these instances, more animals from the target species may be taken than with a professional WDM program (Alternative 1). Use of WS technical assistance may decrease the risks associated with uninformed use of lethal management techniques and may increase the use of non-lethal alternatives over that expected in the absence of any WS involvement (Alternative 4). Overall impacts on target species populations would be similar to or slightly higher than Alternative 1 depending upon the extent to which resource managers use the technical assistance provided by WS. However, for the reasons presented in the population effects analysis in section 4.1.1, it is unlikely that target native mammal populations would be adversely impacted by implementation of this alternative.

4.1.1.4 Alternative 4: No Federal WS Mammal Damage Management

Under this alternative, WS would have no impact on target mammal populations in the state. Private efforts to reduce or prevent depredations would likely increase. As with Alternative 2, 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. Impacts on target species are likely to be similar to or slightly higher than Alternative 1. Because resource owners/managers would not have access to WS direct MDM assistance or technical assistance, impacts may be greater than Alternatives 2. For the same reasons shown in the population effects analysis in section 4.1.1, it is unlikely that target mammal populations would be adversely impacted by implementation of this alternative.

4.1.2 Effects on Other Wildlife Species, including T&E Species

4.1.2.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

Effects on Non-target (non-T&E) Species: WS activities proposed under this alternative would not involve the large-scale destruction or alteration of wildlife habitat and will not impact critical habitat for any species. In the event that WS recommends habitat modification (e.g., modifying a wetland, removing trees attracting birds to an airport) as a damage management practice for the landowner/manager, WS will advise the landowner/manager that they are responsible for checking with state and federal authorities regarding regulations and endangered species protections that may be applicable to the proposed project.

Direct impacts on non-target species could occur if WS program personnel were to inadvertently kill, injure, or harass animals that are not target species. In general, these impacts result from the use of methods that are not completely selective for target species. Non-target species are usually not affected by WS's non-lethal management methods, except for the occasional scaring from harassment devices. In these cases, affected non-target wildlife may temporarily leave the immediate vicinity of scaring, but would most likely return after conclusion of the action.

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. Shooting is virtually 100% selective for the target species; therefore no adverse impacts are anticipated from use of this method. WS personnel use animal lures and set traps and snares in locations that are conducive to capturing target animals while minimizing potential impacts to non-target species. Any non-target species captured would be subsequently released on site unless it is determined by the WS Specialist that the animal will not survive.
WS' SOPs would require compliance with pesticide label directions and use restrictions, and establish training requirements for all employees applying pesticides as built-in measures to assure that use of registered chemical products does not result in significant adverse effects on non-target species populations. The only pesticides proposed for use or recommended under this alternative are non-lethal repellents. These products have undergone considerable environmental review through EPA and State registration processes, which means they have been found to present no unreasonable risk to the environment or human health and safety when used according to label directions. Standard operating procedures designed and implemented to avoid adverse effects on non-target species are described in Chapter 3.

A small number of non-target animals have been captured and killed by Pennsylvania WS annually (Table 4.2). This level of take is unlikely to adversely impact populations of these species. As stated above in the section on target species take, muskrat, mink, beaver, raccoon, fox, weasels, skunks, Virginia opossum, coyote, fisher and bobcat can be taken by licensed hunters and trappers (Table 4-1), and WS' take is low relative to the estimated licensed harvest of these species. WS does not expect the rate of non-target species take to substantially increase above current or past program levels under the proposed action. WS has concluded that the level of non-target animals killed by the WS program would have no adverse effects on any native wildlife species population.

Under this alternative, WS would use helicopters to identify where feral swine exist and remove feral swine. There have been concerns that the use of aircraft might disturb other wildlife species populations to the point that their survival and reproduction might be adversely affected. White-tailed deer, wild turkey, and other wildlife may be seen during aerial surveillance. When used for surveillance, helicopters are likely to make a single pass through an area on a given day. In areas with swine, aircraft would be in the area longer to remove feral swine than for surveillance but the time spent on any given property will be minimal and limited to several hours per year. Overall duration and frequency of flights in an area is not expected to be sufficient to constitute a "chronic" disturbance as discussed below. WS would not conduct aerial sharpshooting in the vicinity of active bald eagle nests or eagle roosting and feeding congregations. WS Specialists must have a clear view of the animal before shooting, so the risk of shooting a non-target animal is negligible.

A number of studies have looked at responses of various wildlife species to aircraft overflights. The National Park Service (1995) reviewed studies on the effects of aircraft overflights on wildlife. The report summarized a number of studies have documented responses by certain wildlife species that suggest adverse impacts might occur. Few, if any studies, have proven that aircraft overflights cause significant adverse impacts on populations, although the report stated it is possible to draw the conclusion that impacts to wildlife populations are occurring. It appears that some species will frequently or at least occasionally show adverse responses to even minor overflight occurrences. In general, it appears that the more serious potential impacts occur when overflights are frequent such as hourly and over long periods of time which represents "chronic exposure." Chronic exposure situations generally involve areas near commercial airports and military flight training facilities.

Grubb et al. (2010) evaluated golden eagle response to civilian and military (Apache AH-64) helicopter flights in northern Utah. Study results indicated that golden eagles were not adversely affected when exposed to flights ranging from 100 to 800 meters along, towards and from behind occupied cliff nests. Eagle courtship, nesting and fledging were not adversely affected, indicating that no special management restrictions were required in the study location.

It was reported that low level overflights of 2-3 minutes in duration by a fixed-wing airplane and a helicopter produced no "drastic" disturbance of tree-nesting colonial waterbirds, and, in 90% of the observations, the individual birds either showed no reaction or merely looked up (Kushlan 1979). Conomy et al. (1998) quantified behavioral responses of wintering American black ducks (*Anas rubripes*), American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level flying military aircraft in North Carolina and found that only a small percentage (2%) of the birds reacted to the disturbance. They concluded that such disturbance was not adversely affecting the time-activity budgets of the species.

Andersen et al. (1989) conducted low-level helicopter overflights directly at 35 red-tailed hawk (*Buteo jamaicensis*) nests and concluded their observations supported the hypothesis that red-tailed hawks

habituate to low level flights during the nesting period. Their results also showed similar nesting success between hawks subjected to such overflights and those that were not. White and Thurow (1985) did not evaluate the effects of aircraft overflights, but showed that ferruginous hawks (*B. regalis*) are sensitive to certain types of ground-based human disturbance to the point that reproductive success may be adversely affected. However, military jets that flew low over the study area during training exercises did not appear to bother the hawks, and neither were they alarmed when the researchers flew within 100 feet in a small fixed-wing aircraft (White and Thurow 1985). White and Sherrod (1973) suggested that disturbance of raptors by aerial surveys with helicopters may be less than that caused by approaching nests on foot. Ellis (1981) reported that five species of hawks, two falcons, and golden eagles were "incredibly tolerant" of overflights by military fighter jets, and observed that, although birds frequently exhibited alarm, negative responses were brief and never limiting to productivity. Further reassuring, the considerable analyses of the Air National Guard (1997) show that, despite considerable research on numerous wildlife species, no scientific evidence exists that indicates any substantive adverse effects on wildlife populations will occur as a result of any of the types of low-level or other overflights that do or may occur.

Table 4-2. Pennsylvania WS average non-target capture and take for FY2009-2013.

Species	Average Killed Annually	Average Annual Freed, Relocated, Transferred Custody
Feral Cats	**0.4**	**20**
Gray Fox	**0**	**0.4**
Red Fox	**0**	**1**
Fisher	**0**	**0.4**
Raccoon	**0.4**	**3.4**
Stripped Skunk	**0.6**	**1.4**
River Otter	**0.6**	**0**
Mink	**0**	**0.2**
Virginia Opossum	**0.6**	**128.6**
Groundhogs	**0.8**	**25.8**
Gray Squirrel	**0**	**2.4**
Fox Squirrel	**0**	**0.4**
Red Squirrel	**0.2**	**0.8**
Black (roof) Rat	**0**	**0.2**

Norway Rat	**0**	**3**
Muskrat	**0**	**0.2**
Eastern Cottontail	**0.8**	**4.4**
Northern Mockingbird	**0**	**0.8**
Song Sparrow	**0**	**0.4**
Sharp-shinned Hawk	**0**	**0.6**
House Wren	**0**	**0.2**
Gray Catbird	**0**	**0.4**
Ring-necked Pheasant	**0.2**	**0**
American Kestrel	**0**	**1**
Tree Swallow	**0**	**0.4**
Tufted Titmouse	**0.2**	**0.2**
Cooper's Hawk	**0**	**0.4**
Red-tailed Hawk	**0**	**0.2**
Northern Cardinal	**0**	**0.2**
Snapping Turtle	**0**	**0.4**
Painted Turtle	**0**	**0.2**

Effects on T&E species:

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation 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 Pennsylvania as determined by the USFWS and the National Marine Fisheries Services was obtained and reviewed during the development of this EA. Appendix D contains the list of species currently listed in the Commonwealth along with common and scientific names.

Based on a review of those T&E species listed in the Commonwealth during the development of the EA, WS determined that activities conducted pursuant to the proposed action would not likely adversely affect those species listed in the Commonwealth by the USFWS and the National Marine Fisheries Services nor their critical habitats. As part of the development of the EA, WS consulted with the USFWS under Section 7 of the ESA. The USFWS concurred with WS' determination that activities conducted pursuant to the proposed action would not likely adversely affect those species currently listed in the Commonwealth or their critical habitats (USFWS, 2014).

Commonwealth Listed Species – The current list of Commonwealth listed species designated as endangered or threatened by the PGC, PAFBC, and PADCNR was reviewed during the development of the EA (see Appendix E). Based on the review of species listed in the Commonwealth, WS has determined that the proposed activities would not likely adversely affect those species currently listed by the Commonwealth. The PGC has concurred with WS' determination for Commonwealth listed species and WS will follow those recommendations provided during the consultation regarding listed species (PGC, 2014). In Pennsylvania the PAFBC is tasked with management of sensitive fish, reptiles, and amphibians. The PAFBC has agreed that the likelihood of adverse impacts to state T & E species under their jurisdiction as the result of methods outlined by WS are very low or not likely to adversly impact those listed (PAFBC, 2014). The PADCNR is trusted with management of sensitive plant species, and has agreed that the methods proposed by WS are not likely to cause adverse effects on listed plant species (PADCNR, 2014).

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

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. Under this alternative, WS take of non-target animals would be less than that of the proposed action because no lethal control actions would be taken by WS. Non-target species are usually not affected by WS's non-lethal management methods, except for the occasional scaring from harassment devices. In these cases, affected non-target wildlife may temporarily leave the immediate vicinity of scaring, but would most likely return after conclusion of the action. Capture and release (e.g., for disease monitoring) and capture and relocate would be allowed under this alternative. There is the extremely remote chance that the capture devices could result in the death of a non-target animal. 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 and peregrine falcons, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

Effects on T&E species: WS will not have any direct negative 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, such as poisons, which may increase risks to species like the bald eagle and peregrine falcon. Risks to T&E species may be lower with this alternative than with Alternative 4 because people would have ready access to assistance with non-lethal MDM techniques. WS could advise individuals as to the potential presence of state and federally-listed species in their area.

4.1.2.3 Alternative 3: Technical Assistance Only

Effects on Non-target (non-T&E) Species: Under this alternative, WS would not conduct direct MDM activities, and would not take any non-target species. Only technical assistance and self-help information would be provided. The PGC or other natural resource management entities may have to re-allocate staff time and resources for any projects to protect threatened, endangered and rare birds that would otherwise be conducted by WS. Although technical support might lead to more selective use of control methods by private parties than that which might occur under Alternative 4, private efforts to reduce or prevent depredations could still result in less experienced persons implementing control methods. This may result in greater risks to non-target wildlife than under the proposed action. It is hypothetically possible that frustration caused by difficulties in addressing wildlife damage problems could lead to use of illegal methods like chemical toxicants which could result in unknown primary (i.e., direct consumption) risks to non-target species populations and increased risks of secondary toxicity (e.g., feeding on animals that had eaten toxicants) to scavengers and predators.

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 other listed species. Risks to T&E species may be lower with this alternative than with Alternative 4 because WS could advise individuals as to the potential presence of state and federally - listed species in their area and could facilitate consultation with the appropriate agency.

4.1.2.4 Alternative 4: No Federal WS Mammal Damage Management

Alternative 3 would not allow any WS MDM in the state; therefore, WS would not take any non-target species under this alternative. The PGC or other natural resource management entities may have to allocate staff time and resources for projects to protect threatened, endangered, and rare species because

WS could no longer assist with these programs. Private efforts to reduce or prevent depredations could increase, which could result in less experienced persons implementing control methods and possibly lead to greater take of non-target wildlife than under the proposed action. 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 impact local non-target species populations, including some 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.

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, such as poisons, which may increase risks to species like the state-listed peregrine falcon. 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.

4.1.3 Effects on Human Health and Safety

4.1.3.1 Impacts on Human Safety from Chemical MDM Methods

4.1.3.1.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

The only pesticides that might be used or recommended by WS would be non-lethal repellents such as Hinder, Deer Away, and others that are registered with the PDA. Such chemicals must undergo rigorous testing and research to prove safety and low environmental risks before they would be registered by the EPA or FDA. Any operational use of chemical repellents would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations, which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in SOP that would assure that use of registered chemical products would avoid significant adverse effects on human health.

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

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

alert hunters and trappers that they should contact state officials before consuming the animal.

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

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

By following these procedures, the proposed action would avoid any significant impacts on human health with regard to this issue.

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

Alternative 2 would not allow for any lethal mammal damage management by WS in Pennsylvania. WS could only implement non-lethal methods such as harassment and exclusion devices and materials. Non-lethal methods could, however, include use and recommendation of repellents and could use capture and handling drugs for capture and release projects. Impacts from WS use of these chemicals would be similar to those described under the proposed action.

Excessive cost or ineffectiveness of non-lethal techniques could result in some entities rejecting WS's assistance and resorting to other means of MDM. Risks associated with non-WS use of toxicants will vary depending upon the training and experience of the individuals conducting the MDM. Such means could include illegal pesticide uses. Hazards to humans could be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the proposed alternative. Overall risks to human health and safety from this alternative are likely to be equal to or greater than Alternative 1.

4.1.3.1.3 Alternative 3: Technical Assistance Only

Alternative 3 would not allow any direct operational MDM assistance by WS. Concerns about human health risks from WS's use of MDM methods would be alleviated because no such use would occur. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and leading to a greater risk than Alternative 1. However, because some of these private parties would be receiving advice and instruction from WS, concerns about human health risks from chemical MDM methods use should be less than under Alternative 4.

Hazards to humans and pets could be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used. It is hypothetically possible that frustration caused by the inability to alleviate mammal damage could lead to illegal use of certain toxicants that could pose

secondary poisoning hazards to pets. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the Proposed Action Alternative.

4.1.3.1.4 Alternative 4: No Federal WS Mammal Damage Management

Alternative 3 would not allow any WS MDM in Pennsylvania. Concerns about human health risks from WS's use of chemical MDM methods would be alleviated because no such use would occur. Private efforts to reduce or prevent damage would be expected to increase. Risks to human health and safety from chemical MDM methods will be variable depending upon the training and experience of the individual conducting the MDM. Hazards to humans and pets could be greater under this alternative if other chemicals that are less selective or that cause secondary poisoning are used or if chemicals are used improperly by inexperienced personnel. It is hypothetically possible that frustration caused by the inability to alleviate mammal damage could lead to illegal use of certain toxicants that could pose secondary poisoning hazards to pets. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the current program alternative.

4.1.3.2 Impacts on Human Safety from Non-chemical MDM Methods

4.1.3.2.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

Non-chemical MDM methods that might raise safety concerns include shooting with firearms, use of traps and snares, and harassment with pyrotechnics. No adverse effects on human safety from WS' use of these methods are expected. Firearms, traps, snares and pyrotechnics are only used by WS' personnel who are experienced in handling and using them. WS' personnel use firearms to shoot mammals and euthanize animals caught in traps. WS' personnel are trained and given refresher courses to maintain awareness of firearm and pyrotechnic safety and handling as prescribed by WS' policy. Snares and traps are strategically placed to minimize non-target take and minimize exposure to the public. Signs are used to post properties where traps are set to alert the public of their presence.

Aerial wildlife operations, like any other flying, could result in an accident. WS' pilots and crewmembers are trained and experienced to recognize the circumstances that lead to accidents and have thousands of hours of flight time. The National Wildlife Services Aviation Program has increased its emphasis on safety, including funding for additional training, the establishment of a Wildlife Services Flight Training Center, and annual recurring training for all pilots.

In 2007 and 2008, WS conducted a programmatic safety review to assess and improve employee safety (USDA 2008). The review covered nine WS program areas, including the aviation program. The review of the aviation program was conducted by the Interagency Committee on Aviation Safety. The review team concluded that the WS aviation program is being operated in a safe, efficient, and effective manner and that the program met the Interagency Committee on Aviation Safety requirements for the Gold Standard Certificate for Excellence. At the time of the report, the WS program was the only USDA aviation program to be awarded this certification. WS' pilots and contractors are highly skilled, with commercial pilot ratings, and have passed proficiency tests in the flight environment encountered by WS. WS' pilots are trained in hazard recognition and surveillance flights would only be conducted in safe environments. Federal aviation regulations require pilots to fly a minimum distance of 500 feet from structures and people, and all employees involved in these operations are mindful of this. Although the goal of the aviation program is to have no accidents, accidents may still occur. However, the protective

measures implemented by WS keep the risk of aircraft accidents and injuries to the public and aircraft crew low.

The National Transportation Safety Board (NTSB) has stated that aviation fuel is extremely volatile and will evaporate within a few hours or less to the point that even its odor cannot be detected (USDA 2005). Helicopters used for aerial wildlife operations carry less fuel than fixed-wing aircraft with 30 gallons the maximum for most helicopters. In some cases, little or none of the fuel would be spilled if an accident occurs. Thus, there should be little environmental hazard from un-ignited fuel spills.

For these reasons, the risk of ground fires or fuel/oil pollution from aviation accidents could be considered low. In addition, based on the history and experience of the program in aircraft accidents, it appears the risk of significant environmental damage from such accidents is exceedingly low.

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

Under this alternative, non-chemical MDM methods that might raise safety concerns include shooting with firearms when used as a harassment technique, cage traps, harassment with pyrotechnics, and surveillance from aircraft. Risks to human health and safety from use of firearms as a harassment technique under this alternative are similar to risks discussed for firearms use (harassment and lethal removal of target animals) under Alternative 1, as are risks associated with aircraft use. As with Alternative 1, WS personnel would receive safety training on a periodic basis to keep them aware of safety concerns. Therefore, no adverse effects on human safety from WS's use of these methods are expected.

Some resource owners/managers may not feel that non-lethal techniques are adequate to resolve their wildlife conflict and may use lethal MDM methods without WS assistance. Risks to human safety from these actions will depend on the method selected and the experience and training of the individual using the technique.

4.1.3.2.3 Alternative 3: Technical Assitance Only

Under this alternative, WS would not engage in direct damage in Pennsylvania. Risks to human safety from WS's use of firearms, traps, snares and pyrotechnics would not exist because WS would not be conducting direct damage management activities. However, WS would provide technical advice to those persons requesting assistance. Landowners/resource managers could use information provided by WS or implement damage reduction methods without WS technical assistance. Hazards to humans and property could be greater under this alternative if personnel conducting MDM activities using non-chemical methods are poorly or improperly trained. Negative impacts to public safety resulting from the improper use of control methods should be less than Alternative 4 when WS technical advice is followed.

4.1.3.2.4 Alternative 4: No Federal WS Mammal Damage Management

Alternative 4 would not allow any WS MDM in the state. Concerns about human health risks from WS's use of non-chemical MDM methods would be alleviated because no such use would occur. However, private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially leading to greater risk to human health and safety than the Proposed Action Alternative. Non-WS personnel would be able to use pyrotechnics, traps, snares, or firearms in MDM programs and these activities would likely occur to a

greater extent in the absence of WS assistance. Hazards to humans and property could be greater under this alternative if personnel conducting MDM activities using non-chemical methods are poorly or improperly trained.

4.1.3.3 Impacts on Human Health and Safety from Mammals

4.1.3.3.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

An Integrated MDM strategy has the greatest potential of successfully reducing human health and safety risks associated with the mammals addressed in this EA. Efficacy of any given MDM method will vary depending on site specific conditions. Access to the full range of MDM methods results in the greatest possibility of alleviating risks to human health and safety by allowing WS personnel to pick the methods best suited to the particular situation.

In most cases, it is difficult to conclusively prove that mammals were responsible for transmission of individual human cases or outbreaks of mammal-borne diseases. However, the limited records of disease occurrence in Pennsylvania does not necessarily mean absence of risk but may only mean lack of reliable research in this area. There are limited studies available on the occurrence and transmission of zoonotic diseases in wild mammals. Study of this issue is complicated by the fact that some disease-causing agents associated with wildlife may also be contracted from other sources. WS works with cooperators on a case-by-case basis to assess the nature and magnitude of the wildlife conflict, including providing information on the limitations about what we know regarding health risks associated with wild mammals. In most cases, the risk of contracting a disease from wild mammals is relatively low. It is the choice of the individual cooperator to tolerate the potential health risks or to seek to reduce those risks. Certain requesters of MDM service may consider even a low level of risk to be unacceptable. Many property owners/managers wish to eliminate risks prior to someone actually getting sick due to conditions at their site. In such cases, MDM, either by lethal or non-lethal means, would, if successful, reduce the risk of mammal-borne disease transmission at the site for which MDM is requested.

In some situations the implementation of non-lethal controls such as netting, electric fences, and harassment, could actually increase the risk of human health problems at other sites by causing the mammals to move to other sites not previously affected. In such cases, lethal removal of the mammals may actually be the best alternative from the standpoint of overall human health concerns in the local area. If WS is providing direct damage management assistance in relocating mammals, coordination with local authorities would be conducted to assure they do not reestablish in other undesirable locations.

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

Under this alternative, WS would be restricted to implementing and recommending only non-lethal methods when providing assistance with mammal damage problems. Non-lethal methods may not be effective or suitable for all situations. The efficacy of some techniques may be limited by habituation (the ability of an animal to become accustomed to and not respond to an otherwise frightening sight or sound). Other techniques like fencing may not be suitable because of zoning restrictions, visual impacts on the site, site use, or because they may adversely impact other non-injurious species. In some situations, the implementation of non-lethal controls, such as netting barriers and harassment, could actually increase the risk of human health problems at other sites by causing the mammals to move to other sites not previously affected. When WS is providing direct damage management assistance in relocating mammals,

coordination with local authorities would be conducted to minimize the risk of problem animals relocating to other undesirable areas.

4.1.3.3.3 Alternative 3: Technical Assitance Only

With WS technical assistance but no direct damage management, entities requesting MDM assistance for human health concerns would either take no action, which means the risk of human health problems would likely continue or increase in each situation as mammal numbers are maintained or increased, or implement WS recommendations for non-lethal and lethal control methods. Potential impacts would be variable depending upon the training and experience of the individuals conducting the MDM. Individuals or entities that implement the recommendations may lack the experience necessary to efficiently and effectively conduct an effective MDM program and risks could continue or increase. Therefore, the odds of successfully reducing wildlife risks to human health and safety may be similar to or lower than Alternative 1. The likelihood that individual efforts would reduce mammal conflicts would be higher under this alternative than Alternative 4 if people request and use WS technical assistance recommendations.

4.1.3.3.4 Alternative 4: No Federal WS Mammal Damage Management

With no WS assistance, cooperators would be responsible for developing and implementing their own MDM program. Success of cooperator efforts to reduce or prevent risks to human health and safety from wildlife will depend on the training and experience of the individual conducting the MDM. If less experienced persons attempt to implement control methods, risks of not reducing mammal hazards could be greater than under the proposed action. For example, in some situations the implementation of non-lethal controls, such as electric fences and harassment, could actually increase the risk of human health problems at other sites by causing the mammals to move to other sites not previously affected.

4.1.4 Impacts on Stakeholders, including Aesthetics

4.1.4.1 Alternative 1: Integrated Mammal Damage Management Program (Proposed Action/No Action)

Those who routinely view or feed individual animals would likely be disturbed by removal of such mammals under the current program. WS is aware of such concerns and takes these concerns into consideration when developing site-specific management plans. WS may be able to mitigate such concerns by leaving certain animals that have been identified by interested individuals.

Some members of the public have expressed opposition to the killing of any mammals during MDM activities. Under this Proposed Action Alternative, some lethal control of mammals would occur and these persons would be opposed. However, many persons who voice opposition have no direct connection to or opportunity to view or enjoy the particular mammals that would be killed by WS' lethal control activities. Lethal control actions would generally be restricted to local sites and to small, unsubstantial percentages of overall populations. Therefore, the species subjected to limited lethal control actions would remain common and abundant, and would therefore continue to remain available for viewing by persons with that interest.

Damage to property would be expected to decrease under this alternative, since all available damage management methods and strategies would be available for WS use and consideration.

Relocation or dispersal of mammals by harassment can sometimes result in the mammals causing the same or similar problems at the new location. If WS is providing direct damage management assistance in relocating such mammals, coordination with local authorities would be conducted to assure they do not re-establish in other undesirable locations.

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

Under this alternative, WS would not conduct any lethal MDM, but may conduct harassment of mammals that are causing damage. Some people who oppose lethal control of wildlife by the government, but are tolerant of government involvement in non-lethal wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild mammals would not be affected by the death of individual mammals under this alternative, but might oppose dispersal or translocation of certain mammals. WS may be able to mitigate such concerns by leaving certain animals that have been identified by interested individuals. Individuals opposed to any type of management of wildlife for human purposes (i.e., animal rights philosophy) will continue to be opposed to WS actions. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, which means the cumulative effects would be similar to the Proposed Action Alternative.

4.1.4.3 Alternative 3: Technical Assitance Only

Under this alternative, WS would not conduct any direct damage management, but would still provide technical assistance or self-help advice to persons requesting assistance with mammal damage. Those who oppose assistance with wildlife damage management by the government, but favor government technical assistance, would favor this alternative. Persons who have developed affectionate bonds with individual wild mammals would not be affected by WS's activities under this alternative because animals would not be killed by WS. However, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, which means the cumulative effects would be similar to the Proposed Action Alternative.

4.1.4.4 Alternative 4: No Federal WS Mammal Damage Management

Under this alternative, WS would not conduct any lethal removal of mammals nor would the program conduct any harassment of mammals. Those in opposition of any government involvement in wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild mammals would not be affected by WS's activities under this alternative. However, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, which means the cumulative effects would then be similar to the Proposed Action Alternative.

4.1.5 Humaneness and Animal Welfare Concerns of Methods Used

4.1.5.1 Alternative 1: Implement an Integrated Mammal Damage Management Program (Proposed Action/No Action)

MDM methods viewed by some persons as inhumane would be employed by WS under this alternative. These methods would include shooting, trapping, toxicants/chemicals, and 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 take target animals, including shooting and 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 may use EPA registered and approved chemicals to manage damage caused by some mammals in Pennsylvania. Some individuals consider the use of such chemicals to be inhumane. WS personnel are experienced, professional, and humane in their use of management methods. Under this alternative, mammals would be killed by experienced WS personnel using the best and most appropriate method(s) available.

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.

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

Under this alternative, lethal methods, viewed as inhumane by some persons, would not be used by WS. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, resulting in impacts similar to the Proposed Action Alternative.

4.1.5.3 Alternative 3: Technical Assistance Only

Under this alternative, WS would provide self-help advice only. Lethal methods viewed as inhumane by some persons would not be used by WS. Resource owners could use the information provided by WS or implement their own damage reduction program without WS technical assistance. Many of the methods considered inhumane by some individuals and groups might still be used by resource owners. Overall impacts should be less than Alternative 4 when WS technical advice is requested and followed, but still similar to the proposed action.

4.1.5.4 Alternative 4: No Federal WS Mammal Damage Management

Under this alternative, lethal and non-lethal methods, viewed as inhumane by some persons, would not be used by WS. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct MDM activities similar to those that would no longer be conducted by WS, resulting in impacts similar to the Proposed Action Alternative.

4.2 Cumulative Impacts

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

Under Alternatives 1, 2, and 3, WS would, to varying extents, address damage associated with mammals in a number of situations throughout the state. The WS MDM program would be the primary federal program with MDM responsibilities; however, some state and local government agencies may conduct MDM activities in Pennsylvania as well. Through ongoing coordination with these agencies, WS is aware of such MDM activities and may provide technical assistance in such efforts. WS does not normally conduct direct damage management activities concurrently with such agencies in the same area, but may conduct MDM activities at adjacent sites within the same time frame. In addition, commercial pest control companies may conduct MDM activities in the same area. The potential cumulative impacts analyzed below could occur either as a result of WS MDM program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and individuals.

Cumulative Impacts on Wildlife Populations

Evaluation of WS' activities relative to wildlife populations indicated that program activities will likely have no cumulative adverse effects on populations in Pennsylvania. 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.

No cumulative adverse impacts on wildlife populations are expected from WS' actions based on the following considerations:

Historical outcomes of WS' programs on wildlife:
No cumulative adverse effects have been identified for wildlife as a result of program activities implemented over time based from annual monitoring reports, or from analyses contained in the EA. WS continues to implement an integrated damage management program that adapts to the damage situation and the species involved with causing the damage. WS only targets wildlife causing damage and only after a request for assistance is received. All program activities are coordinated with appropriate federal, state, and local entities to ensure WS' activities do not adversely impact the populations of any native wildlife species.

In the past several years, the number of species and the total number of mammal species addressed by WS has increased annually which provides some indication that WS' activities are not cumulatively impacting

populations. WS continues to implement an integrated program that employs primarily non-lethal dispersal and harassment methods. WS will continue to provide technical assistance to those persons requesting assistance to identify and alleviate damage.

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

As shown in Section 4.1.1, MDM methods used or recommended by the WS program in Pennsylvania will have no cumulative adverse effects on target and non-target native wildlife populations. WS limited lethal take of target mammal species is anticipated to have minimal impacts on target native mammal populations in Pennsylvania. When control actions are implemented by WS, the potential lethal take of non-target wildlife species is expected to be minimal and will not adversely affect populations of these native species. All WS take of mammals is coordinated with the PGC to ensure that cumulative impacts of WS actions will not jeopardize native wildlife populations and are consistent with state management objectives for the species.

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 in Pennsylvania, 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, 2, and 3 conduct their own MDM activities, and when no WS assistance is provided in Alternative 4. In all four 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 within Pennsylvania, 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. Table 4-3 summarizes the expected impact of each of the alternatives on each of the issues.

Table 4-3. Summary of Potential Impacts.

Issue	Alternative 1 Integrated Mammal Damage Management Program (Proposed Action/No Action)	Alternative 2 Non-lethal MDM Only by WS	Alternative 3 Technical Assistance Only	Alternative 4 No Federal WS MDM Program

1. Target Mammal Species Effects	Low effect - reductions in local target mammal numbers; would not significantly affect local or state native populations.	No effect by WS. Low effect - reductions in local target mammal numbers by non-WS personnel variable but likely would not significantly affect local or state populations.	No effect by WS. Low effect - reductions in local target mammal numbers by non-WS personnel variable but likely would not significantly affect local or state populations.	No effect by WS. Low effect - reductions in local target mammal numbers by non-WS personnel variable but likely would not significantly affect local or state populations.
2. Effects on Other Wildlife Species, Including T&E Species	Low effect - methods used by WS would be highly selective with very little risk to non-target species. WS would provide operational assistance with T&E species protection.	Low effect - methods used by WS would be highly selective with very little risk to non-target species. WS only able to provide limited operational assistance with T&E species protection.	No effect by WS. Impacts by non-WS personnel would be variable. WS would not provide operational assistance with T&E species protection.	No effect by WS. Impacts by non-WS personnel would be variable. WS would not provide operational assistance with T&E species protection.
3. Human Health and Safety Effects	The proposed action has the greatest potential of successfully reducing this risk. Low risk from methods used by WS.	Low risk of injuries from methods used by WS. WS less likely to resolve risks associated with animals than with Alt 2. Efforts by non-WS personnel to use lethal MDM techniques could result in less experienced persons implementing control methods, a greater risk of injuries and greater potential of not reducing mammal damage than under the proposed action.	Efforts by non-WS personnel to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater risk of injuries and greater potential of not reducing mammal damage than under the proposed action.	Efforts by non-WS personnel to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater risk of injuries and greater potential of not reducing mammal damage than under the proposed action.

4a. Aesthetic Values of Wild Mammal Species and Human Affectionate Bonds	Low to moderate effect at local levels; Some local populations may be reduced; WS mammal damage management activities do not adversely affect overall state target native mammal populations.	Low to moderate effect. Local mammal numbers in damage situations would remain high or possibly increase when non-lethal methods are ineffective unless non-WS personnel successfully implement lethal methods; no adverse effect on state target mammal populations.	Low to moderate effect. Local mammal numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse effect on overall state target mammal populations.	Low to moderate effect. Local mammal numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse effect on overall state target mammal populations.
4b. Aesthetic Values of Property Damaged by Mammals	Low effect - mammal damage problems most likely to be resolved without creating or moving problems elsewhere.	Mammal damage may not be reduced to acceptable levels; mammals may move to other sites which can create aesthetic damage problems at new sites.	Mammal damage may not be reduced to acceptable levels; mammal may move to other sites which can create aesthetic damage problems at new sites.	High effect - mammal problems less likely to be resolved without WS involvement. Mammals may move to other sites which can create aesthetic damage problems at new sites.
5. Humaneness and Animal Welfare Concerns of Methods Used	Impact by WS low to moderate effect - methods viewed by some people as inhumane would be used by WS.	Impact by WS Lower effect than Alt. 1 since only non-lethal methods would be used by WS. Impacts by non-WS personnel would be variable.	No effect by WS. Impacts by non-WS personnel would be variable.	No effect by WS. Impacts by non-WS personnel would be variable.

APPENDIX A

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APPENDIX B

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APPENDIX C

MAMMAL DAMAGE MANAGEMENT METHODS

Resource owners and government agencies use a variety of techniques as part of integrated mammal damage management programs. All lethal and non-lethal methods have limitations based on costs, logistics, practicality, or effectiveness. There are also regulatory constraints on the availability and use of some MDM techniques. Mammal damage management methods currently available to the Pennsylvania WS program are described here. If other methods are proven effective and legal to use in Pennsylvania, they could be incorporated into the Pennsylvania WS program, pursuant to permits, other authorizations, agreements with landowners, NEPA compliance, and applicable laws, regulations, and policies.

Wildlife Services 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 hogs may be intended to reduce or eliminate the local, regional (within state), or state populations of these species. Depending upon the alternative selected, the specific control methods and techniques that could be used are as follows:

NON-LETHAL METHODS (NON-CHEMICAL)

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 to deter animals from entering a protected area, removal of trees from around buildings to reduce access by squirrels and raccoons, or planting lure crops on fringes of protected crops. 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. Making trash, bird food, and garbage unavailable and removing all pet food from outside during nighttime hours can reduce the presence of bears, raccoons, and opossums when they become a problem. If tree squirrels are damaging property or causing a nuisance, care in preventing them from obtaining bird seed left in bird feeders can often greatly reduce their presence. This may mean hanging bird feeders by thin wire from tree limbs, or constructing mounting poles which cannot be climbed by these animals.

Other habitat management strategies may include physical manipulation of the natural environment. As an example, continual destruction of beaver dams and removal of dam construction materials on a daily basis will sometimes cause beavers to move to other locations, although this strategy can be far more expensive than removing beavers in conjunction with dam removal. Water control devices such as the 3-log drain (Roblee 1983), the T-culvert guard (Roblee 1987), wire mesh culvert (Roblee 1983), and the Clemson beaver pond leveler (Miller and Yarrow 1994) can sometimes be used to control the water in beaver ponds to desirable levels that do not cause damage. Use of these devices is very limited among private landowners. Such methods have variable results and rarely provide acceptable levels of control unless used in an integrated program with other strategies.

In general, WS involvement in cultural methods and habitat management is limited to technical assistance (advice). Implementation of the methods and associated legal requirements are the responsibility of the landowner/manager. When WS makes habitat management recommendations, WS advises landowners/managers that they are responsible for compliance with all applicable state federal and local regulations, including the ESA.

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 (e.g., flashing lights). Unfortunately many of these techniques are only effective for a short time before animals habituate (i.e., learn there is not a real threat; Conover 1982). The position of such frightening devices should be changed frequently because over a period of time, animals usually become used to scare devices (Pfiefer and Goos 1982). Using motion activated systems instead of systems which are activated on regular intervals may also extend the effective period for frightening devices. Some devices used to modify behavior in mammals may include:

- Electronic guards (siren/strobe-light devices)
- Propane exploders
- Pyrotechnics
- Laser lights
- Human effigies

Wildlife Exclusion (physical 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 of culverts, drain pipes, and other water control structures like that used with a Beaver Deceiver™ can sometimes prevent beavers from building dams which plug these devices. In those applications, however, consideration must be given for water flow so that the fence does not act to catch and hold water-borne debris. Fencing, especially if it is installed with an underground skirt, can prevent access to areas for many mammal species which dig, including coyotes, foxes, woodchucks, beaver, and muskrat. 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. Construction of concrete spillways may reduce or prevent damage to dams by burrowing aquatic rodent species. Riprap can also be used on dams or levies at times, especially to deter muskrat, woodchucks, and other burrowing rodents. Electrical water barriers have proven effective in limited situations for beaver; an electrical field through the water in a ditch or other narrow channel, or hot-wire suspended just above the water level in areas protected from public access, have been effective at keeping beaver out. The effectiveness of an electrical barrier is extended when used in conjunction with an odor or taste cue that is emitted because beaver will avoid the area even if the electrical field is discontinued (Kolz and Johnson 1997). Similarly, electric fences of various constructions have been used effectively to reduce damage to various crops by raccoons, bears and other species (Boggess 1994).

Electric Fencing and Maintenance

Electric fencing has proven effective in deterring a wide variety of mammal species. Bears have been dissuaded from landfills, trash dumpsters, apiaries, cabins, and other high-value properties. Electric fencing has also been effective in reducing crop damage from deer and also discouraging raccoons from gardens. Fencing, however, can be an expensive abatement measure. When developing a damage

prevention program, consideration is given to the extent, duration, and expense of damage in relation to the expense of using fencing. Numerous fence designs have been used with varying degrees of success. Electric fence chargers increase effectiveness.

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

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

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

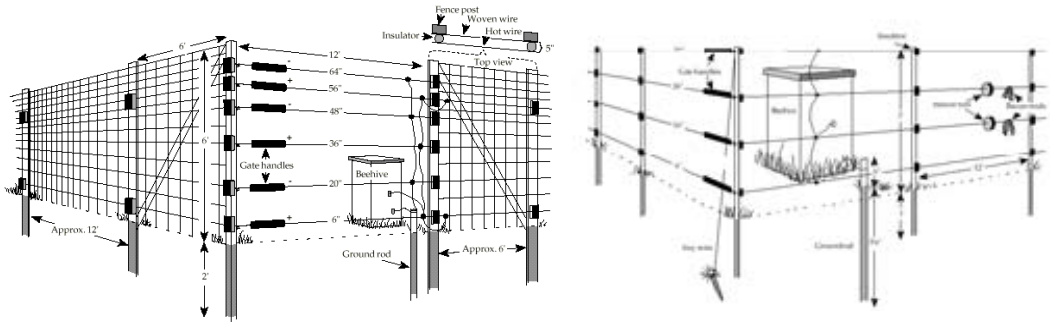

Figure C-1. Electric fence examples to help reduce wildlife conflicts.

Relocation of damaging mammals to other areas following live capture generally would not be biologically effective, or cost-effective. Relocation to other areas following live capture would not generally be effective because problem species are highly mobile and can easily return to damage sites from considerable distances, habitats in other areas are generally already occupied, and relocation would most likely result in similar damage problems at the new location. Relocated animals can have poor survival rates at the new site (Rosatte and MacInnes 1989, Wright 1978, Frampton and Webb 1974) although careful timing of relocation and selection of release site can markedly improve survival rates (Griffith et al. 1989). Relocating animals also runs the risk of spreading parasites and diseases to previously uninfected areas. For example, the spread of raccoon variant of rabies in the eastern U.S. was likely unintentionally accelerated through the translocation of infected raccoons (Krebs et al. 1999). Translocation of wildlife is discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, and difficulties in adapting to new locations or habitats.

There are exceptions for the relocation of damaging mammals that might be a viable solution, such as

when the mammals are considered to have high value such as T&E species. Under the right conditions, relocating wildlife can be a viable and effective wildlife management technique (Craven et al. 1998). Pennsylvania WS would only relocate wildlife at the direction of and only after consulting with the USFWS and/or PGC to coordinate capture, transportation, and selection of suitable relocation sites, as well as compliance with all proper guidelines.

Animal Capture Devices are used by WS specialists to capture mammals. For reasons discussed above under "Relocation", small to medium sized mammals captured are usually killed via gunshot, cervical dislocation, or one of the chemical euthanasia methods listed below. However, there are occasions where captured animals are relocated, or in the case of some disease surveillance projects, may be released on site.

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 often set over a food source and it is triggered by an observer using a pull cord or remote controlled electronic switch.

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 cable restraint, the loop becomes smaller in size, holding the animal as if it were on a leash. When used as a live capture device, cable restraints are equipped with integrated stops that permit tightening, but do not choke the animal.

Cage traps are live capture devices used to catch a variety of small to medium sized mammals. Cage traps come in a variety of sizes and are generally made of galvanized wire mesh with a treadle inside the cage that triggers the door to close behind the animal being captured. Cage traps can range from the extremely small, intended for the capture of rodents and other small mammals, to the large corral/panel traps fitted with a routing or saloon style repeating door, used to live-capture feral hogs.

Beaver live traps include the Hancock traps (suitcase/basket type cage traps) and commercially produced traps designed to live-capture beaver. The Hancock 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. Other traps are constructed of steel and placed in running water or on the edge where a beaver may swim into it. When set, the trap is opened to allow an animal to enter, and when tripped the sides close around the animal.

Catch poles consist of a long pole with a cable noose at one end. The noose end is typically encased in plastic tubing. Catch poles can be used to safely catch and restrain animals such as small bears (cubs) and raccoons.

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 et al. 1987). Colony traps are set at entrances to muskrat burrows or placed in muskrat travel lanes.

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

unharmed.

Foothold traps are devices that come in a variety of sizes which allows the traps to be species specific to some degree. Depending on the circumstances, pan-tension devices, trap placement, and lure selection can also be used to reduce risks to non-target species. These traps can be set on land or in water. They are made of steel with springs that close the jaws of the trap around the foot (and sometimes the leg) of the target species. These traps may have offset steel or padded jaws, which hold the animal. Newer modifications, commonly referred to as "dog proof" or "species specific" traps, have been designed to reduce the chance of non-target captures. There are a variety of different designs commercially available, but the general design consists of a 1-2 inch steel tubing (cylinder or square). There is a trigger at the closed end of the tubing attached to a spring. The trigger must be pushed or pulled when an animal grasps it and a leveraged bar is released by the spring holding the animals arm/paw in place. Because of the size of the opening and trigger mechanism, it is extremely difficult for a canine to trigger the trap. This type of trap is commonly used for raccoons. Non-target animals would be released unharmed.

Foot snares are spring activated snares that captures the foot or leg of the target (i.e., Aldrich-type or snare throwers) that would be used in situations that preclude the use of culvert traps (Figure C-2). Foot snares are a safe and effective capture device when properly set and inspected (Miller et al 1973, Johnson and Pelton 1980). Bears captured in this manner can be tranquilized, released, relocated, or destroyed. WS uses bait, as described previously, to attract bears to foot snare sets.

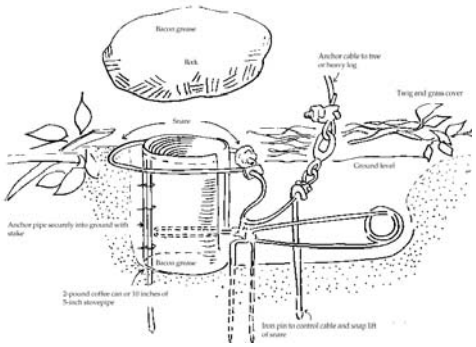

Figure C-2. Example of a foot snare design

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.

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

Cannon/Rocket netting involves setting bait in an area that would be completely contained within the dimensions of a manually propelled net. The launching of the rocket net occurs too quickly for the animals to escape. Rocket netting is normally used for birds and larger mammal species such as deer, but can be used to capture other mammal species.

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

captured.

NON-LETHAL METHODS (CHEMICAL)

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to sedate captured wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calm fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical sedation 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.

Telazol (tiletamine) is another anesthetic used to sedate captured wildlife capture. It is 2.5 to 5 times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telazol produces extensive muscle tension in dogs, but produces a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for these wild species (Fowler and Miller 1999).

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 are 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.

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. Many repellents are commercially available for mammals and are registered primarily for herbivores, such as rodents and deer. Repellents are not available for many species which may present damage problems, such as some predators or furbearing species. Repellents are variably effective and depend to a great extent on the resource to be protected, time and length of application, and sensitivity of the species causing damage. Acceptable levels of damage control are usually not realized unless repellents are used in conjunction with other techniques, as part of an integrated damage management program. In Pennsylvania, repellents must be registered with Pennsylvania Department of Agriculture.

LETHAL METHODS (NON-CHEMICAL)

For reasons discussed above under “Relocation”, animals captured using the non-lethal capture methods are usually killed via gunshot, cervical dislocation, or one of the chemical euthanasia methods listed below. Other lethal mechanical methods are:

Body gripping (Conibear) traps are steel framed devices used to capture and quickly kill mammals, especially aquatic species. These traps come in a variety of sizes and may be used on land or in the water, depending on trap size and state and local laws. The traps are made of two steel square frames that are hinged on two sides and have one or two springs.

Cervical dislocation is sometimes used to euthanize small rodents which are captured in live traps 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 a 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).

Shooting is selective for target species and may involve the use of spotlights, night vision, or thermal imagery. A handgun, shotgun, or rifle may be utilized. Shooting is an effective method to remove a target number of mammals in damage situations. Removal of specific animals in the problem area can oftentimes 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 efficiently and selectively than some other methods. Shooting may sometimes be one of the only damage management options available if other factors preclude setting of damage management equipment. Firearm use may be a public concern because of issues relating to safety and misuse of firearms. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within 3 months of their appointment and a refresher course annually thereafter (WS Directive 2.615). WS employees, who carry firearms as a condition of employment, are required to meet criteria contained in the Lautenberg Amendment which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence. WS activities where shooting is used include, but are not limited to, take of mammals in damage situations pursuant to PGC authorization.

Surveillance and sharpshooting from helicopters has been a very effective method in removing feral swine across the US. Aerial surveillance would be conducted throughout the year by low level helicopter flight to determining presence of feral hogs prior to initiating other control methods. Aerial sharpshooting would be conducted during the winter (approximately January through March) after leaves have fallen from trees. Wildlife Services would not conduct aerial sharpshooting on a property without the consent of the landowner/manager. All aerial activities would be conducted in accordance with the policies established in WS Directive 2.62 – Aviation Safety and Operations and the WS Aviation Safety and Operations manuals. Aerial sharpshooting has been identified as a viable tool for feral swine management in the U.S. (Campbell et al. 2010, West et al. 2009). Reported removal rates for aerial removal of feral swine range from 9-39 swine per hour (Campbell et al. 2010, Saunders and Bryant 1988, Hone 1983). Differences in swine density, climate, terrain and plant cover account for most of the variation in capture rates. Although aerial sharpshooting is an expensive method, WS' experience with feral swine removals indicates that the staff time, travel time, and labor required to achieve similar results using ground-based methods will likely make aerial sharpshooting a cost-effective option.

Aerial shooting or aerial hunting (shooting from an aircraft) is a commonly used method. Aerial hunting is species-specific and can be used for immediate control to reduce swine populations if weather, terrain, and cover conditions are favorable. Fixed-wing aircraft are most frequently used in flat and gently rolling terrain whereas helicopters, with better maneuverability, have greater utility and are safer over rugged terrain and timbered areas. In broken timber or deciduous cover, aerial hunting is more effective in winter when snow cover improves visibility and leaves have fallen. The WS program aircraft-use policy helps ensure that aerial hunting is conducted in a safe and environmentally sound manner, in accordance with Federal and State laws. Pilots and aircraft must be certified under established WS program procedures

and only properly trained WS employees are approved as gunners.

Snap traps are used to remove small rodents. The trap treadle is baited with peanut butter or other taste attractants and attached near the damage area. These traps pose no imminent danger to pets or the public. Snap traps are commonly used to survey small rodent populations, such as mice and voles.

Sport Hunting/Trapping is sometimes recommended by WS as a viable damage management method when the target species can be legally hunted and/or trapped, and activities can meet site security and safety objectives. A valid hunting or trapping license and other licenses or permits may be required by the PGC. This method provides sport, income and/or food for hunters/trappers, and requires no cost to the landowner. Sport hunting/trapping is occasionally recommended if it can be conducted safely for coyotes, feral hogs, bear, deer, and other damage causing mammals.

LETHAL METHODS (CHEMICAL)

All chemicals used by WS are registered as required by US Department of Justice Drug Enforcement Administration (DEA) and PDA. WS personnel that use restricted-use chemical methods are WS certified and are required to adhere to all certification requirements set forth in FIFRA and Pennsylvania pesticide control laws and regulations. Chemicals are only used on private, public, or tribal property sites with authorization from the property owner/manager.

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

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 and trained WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA and state regulations.

Zinc Phosphide is a toxicant used to kill rodents, lagomorphs, and nutria. It is two to 15 times more toxic to rodents than to carnivores (Hill and Carpenter 1982). Secondary risks appear to be minimal to predators and scavengers that scavenge carcasses of animals killed with zinc phosphide (Hill and Carpenter 1983, Tietjen 1976, Hegdal and Gatz 1977, Hegdal et al. 1980, and Johnson and Fagerstone 1994). This is because: 1) 90% of the zinc phosphide ingested by rodents is detoxified in the digestive tract (Matschke unpubl. as cited in Hegdal et al. 1980), 2) 99% of the zinc phosphide residues occur in the digestive tracts, with none occurring in the muscle, and 3) the amount of zinc phosphide required to kill target rodents is not enough to kill most other predatory animals that consume prairie dog tissue (Johnson and Fagerstone 1994).

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

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

Ramey et al. (2000) reported that five weeks after treatment, no ring-necked pheasants (*Phasianus colchicus*) had been killed as a result of zinc phosphide baiting. In addition, Hegdal and Gatz (1977) determined that zinc phosphide did not affect non-target populations, and more radio-tracked animals were killed by predators than died from zinc phosphide intoxication (Hegdal and Gatz 1977, Ramey et al. 2000). Tietjen (1976) observed horned larks (*Eremophila alpestris*) and mourning doves (*Zenaida macroura*) on zinc phosphide-treated prairie dog colonies, but observations after treatment did not locate any sick or dead birds, a finding similar to Apa et al. (1991). Uresk et al. (1988) reported that ground feeding birds showed no difference in numbers between control and treated sites. Apa et al. (1991) further states that zinc phosphide was not consumed by horned larks because: 1) poison grain remaining for their consumption was low (*i.e.*, bait was accepted by prairie dogs before larks could consume it), 2) birds have an aversion to black-colored foods, and 3) birds have a negative sensory response to zinc phosphide. Reduced impacts on birds have also been reported by Tietjen and Matschke (1982). Deisch et al. (1989) reported on the effect zinc phosphide has on invertebrates. They determined that zinc phosphide bait reduced ant densities: however, spider mites, crickets, wolf spiders, ground beetles, darkling beetles, and dung beetles were not affected. Wolf spiders and ground beetles showed increases after one year on zinc phosphide treated areas (Desich 1986). Generally, direct long-term impacts from rodenticide treatments were minimal for the insect populations sampled (Deisch et al. 1989). Long-term effects were not directly related to rodenticides, but more to habitat changes (Deisch 1986) as vegetative cover and prey diversity increased without prairie dogs grazing and clipping the vegetation (Deisch et al. 1989).

Gas Cartridges are incendiary devices composed of carbon and sodium nitrate. When ignited and placed in the target animal's burrow, the resultant carbon monoxide and other gases cause asphyxiation. WS will not use gas cartridges in areas where State and Federally listed species may be in burrows with the target animal

Anticoagulant Rodent Baits could be used in bait stations in and around airport structures. The use and proper placement of bait stations minimizes the likelihood that the bait will be consumed by non-target 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 PGC before applying rodenticides at airports in order to confirm that no state-listed threatened or endangered rodents would be harmed in the process.

APPENDIX D: SPECIES LISTED BY THE U.S. FISH AND WILDLIFE SERVICE[1]

[1]List obtained from <http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=PA&s8fid=112761032792&s8fid=112762573902> on 29 March 2013

Notes:

- This report shows the listed species associated in some way with this state.
- This list does not include experimental populations and similarity of appearance listings.
- This list includes non-nesting sea turtles and whales in State/Territory coastal waters.
- This list includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.

Summary of Animals listings:

Animal species listed in this state that occur in this state (10 species):

Status[1]	Species
E	Bat, Indiana Entire (*Myotis sodalis*)
PE	Bat, northern long-eared (*Myotis septentrionalis*)
E	Bean, rayed (*Villosa fabalis*)
E	Bulrush, northeastern (*Scirpus ancistrochaetus*)
E	Clubshell Entire Range; Except where listed as Experimental Populations (*Pleurobema clava*)
E	Mussel, sheepnose (*Plethobasus cyphyus*)
E	Mussel, snuffbox (*Epioblasma triquetra*)
E	Plover, piping Great Lakes watershed (*Charadrius melodus*)
T	Pogonia, small-whorled (*Isotria medeoloides*)
T	Rabbitsfoot (*Quadrula cylindrical cylindrical*)
C	Rattlesnake, estern massasauga (*Sistrurus catenatus catenatus*)
E	Riffleshell, northern Entire (*Epioblasma torulosa rangiana*)
E	Sturgeon, Atlantic (*Acipenser oxyrinchus oxyrinchus*)
E	Sturgeon, shortnose Entire (*Acipenser brevirostrum*)
T	Turtle, bog (=Muhlenberg) northern (*Clemmys muhlenbergii*)
E	Wedgemussel, dwarf Entire (*Alasmidonta heterodon*)

[1]E = Endangered; T = Threatened; PE = Proposed for listing as Endangered; C = Candidate

Animal species listed in this state that do not occur in this state (11 species):

Status	Species
E	Beetle, American burying Entire (*Nicrophorus americanus*)
E	Butterfly, Karner blue Entire (*Lycaeides melissa samuelis*)
E	Fanshell (*Cyprogenia stegaria*)
E	Mucket, pink (pearlymussel) Entire (*Lampsilis abrupta*)
E	Pigtoe, rough (*Pleurobema plenum*)
E	Pimpleback, orangefoot (pearlymussel) (*Plethobasus cooperianus*)
E	Puma (=cougar), eastern Entire (*Puma (=Felis) concolor couguar*)
E	Ring pink (mussel) (*Obovaria retusa*)
Status	**Species**

E	Squirrel, Delmarva Peninsula fox Entire, except Sussex Co., DE (*Sciurus niger cinereus*)
T	Tiger beetle, northeastern beach Entire (*Cicindela dorsalis dorsalis*)
E	Wolf, gray U.S.A.: All of AL, AR, CA, CO, CT, DE, FL, GA, KS, KY, LA, MA, MD, ME, MO, MS, NC, NE, NH, NJ, NV, NY, OK, PA, RI, SC, TN, VA, VT and WV; those portions of AZ, NM, and TX not included in an experimental population; and portions of IA, IN, IL, ND, OH, OR, SD, UT, and WA. Mexico. (*Canis lupus*)

APPENDIX E: SPECIES LISTED BY THE COMMONWEALTH OF PENNSLYVANIA[1]

[1]List obtained from <http://www.naturalheritage.state.pa.us/HomePage.aspx> on 29 March 2013

Scientific Name	Common Name	State Status[2]
Abies balsamea	Balsam Fir	N
Acalypha deamii	Three-seeded Mercury	N
Ageratina aromatica	Small White-snakeroot	N
Alopecurus aequalis	Short-awn Foxtail	N
Amelanchier canadensis	Serviceberry	N
Andropogon gyrans	Elliott's Beardgrass	N
Antennaria virginica	Shale Barren Pussytoes	N
Arabis patens	Spreading Rockcress	N
Arctosa littoralis	A Sand Spider	N
Aristida longespica	Three-awned grass	N
Aristida longespica var. longespica	Slender Three-awn	N
Arnoglossum reniforme	Great Indian-plantain	N
Asimina triloba	Pawpaw	N
Asplenium pinnatifidum	Lobed Spleenwort	N
Astragalus canadensis	Canadian Milkvetch	N
Baptisia australis	Blue False-indigo	N
Bartonia paniculata	Screw-stem	N
Bidens discoidea	Small Beggar-ticks	N
Bidens laevis	Beggar-ticks	N
Botrychium simplex	Least Grape-fern	N
Bromus kalmii	Brome Grass	N
Calamagrostis porteri	Porter's Reedgrass	N
Cardamine maxima	Large Toothwort	N
Carex brevior	A Sedge	N
Carex ormostachya	Spike Sedge	N
Carex planispicata	Flat-spiked sedge	N
Carex richardsonii	Richardson's Sedge	N
Carex shortiana	Sedge	N
Carex siccata	A Sedge	N
Carex sprengelii	Sedge	N
Carya laciniosa	Shellbark Hickory	N
Chionanthus virginicus	Fringe-tree	N
Conoclinium coelestinum	Mistflower	N
Corydalis aurea	Golden Corydalis	N
Crataegus dilatata	A Hawthorn	N
Crataegus pennsylvanica	Red-fruited Hawthorn	N
Cuscuta campestris	Dodder	N
Cuscuta compacta	Dodder	N
Cuscuta pentagona	Field Dodder	N
Cyperus lancastriensis	Many-flowered Umbrella Sedge	N
Cystopteris tennesseensis	Bladder Fern	N
Deschampsia cespitosa	Tufted Hairgrass	N
Desmodium laevigatum	Smooth Tick-trefoil	N
Desmodium obtusum	Stiff Tick-trefoil	N
Desmodium viridiflorum	Velvety Tick-trefoil	N
Diarrhena americana	American Beakgrain	N

Dichanthelium laxiflorum	Lax-flower Witchgrass	N
Dichanthelium oligosanthes	Heller's Witchgrass	N
Dryopteris celsa	Log Fern	N
Dryopteris clintoniana	Clinton's Wood Fern	N
Dryopteris filix-mas	Male Fern	N
Elymus trachycaulus	Slender Wheatgrass	N
Equisetum x ferrissii	Scouring-rush	N
Erythronium albidum	White Trout-lily	N
Eupatorium godfreyanum	Godfrey's Thoroughwort	N
Eurybia radula	Rough-leaved Aster	N
Fraxinus profunda	Pumpkin Ash	N
Fraxinus quadrangulata	Blue Ash	N
Galium latifolium	Purple Bedstraw	N
Galium trifidum	Marsh Bedstraw	N
Gentiana linearis	Narrow-leaved Gentian	N
Goodyera repens	Lesser Rattlesnake-plantain	N
Gymnocarpium x heterosporum	A Fern Hybrid (Sterile Triploid)	N
Helianthemum propinquum	Low Rockrose	N
Helianthus hirsutus	Sunflower	N
Helianthus microcephalus	Small Wood Sunflower	N
Helianthus occidentalis	Sunflower	N
Hieracium umbellatum	Umbellate Hawkweed	N
Hierochloe hirta ssp. arctica	Common Northern Sweet Grass	N
Houstonia serpyllifolia	Creeping Bluets	N
Hypericum stragulum	St Andrew's-cross	N
Ilex laevigata	Smooth Winterberry Holly	N
Ipomoea lacunosa	White Morning-glory	N
Iris virginica	Virginia Blue Flag	N
Isoetes valida	Quillwort	N
Isoetes x brittonii	Quillwort	N
Juglans cinerea	Butternut	N
Juncus debilis	Weak Rush	N
Juniperus communis	Common Juniper	N
Lactuca hirsuta	Downy Lettuce	N
Lasius minutus	An Ant	N
Lathyrus venosus	Veiny Pea	N
Lechea minor	Thyme-leaved Pinweed	N
Lemna perpusilla	Minute Duckweed	N
Liatris scariosa	Round-head Gayfeather	N
Linaria canadensis	Old-field Toadflax	N
Lithospermum canescens	Hoary Puccoon	N
Lycopodiella margueritae	A Clubmoss	N
Lycopodiella x copelandii	Copeland's clubmoss	N
Lysimachia hybrida	Lance-leaf Loosestrife	N
Oenothera oakesiana	Evening-primrose	N
Omalotheca sylvatica	Woodland Cudweed	N
Oxysoma cubana	A Sac-spider	N
Panicum polyanthes	Panic-grass	N
Pedicularis lanceolata	Swamp Lousewort	N

Penstemon canescens	Beard-tongue	N
Penstemon laevigatus	Beard-tongue	N
Phaseolus polystachios	Wild Kidney Bean	N
Pinus echinata	Short-leaf Pine	N
Pinus resinosa	Red Pine	N
Piptochaetium avenaceum	Blackseed Needlegrass	N
Platanthera blephariglottis	White Fringed-orchid	N
Polygala nuttallii	Nuttall's Milkwort	N
Polymnia canadensis	Leaf-cup	N
Potamogeton bicupulatus	Pondweed	N
Prenanthes serpentaria	Lion's-foot	N
Prunus alleghaniensis	Alleghany Plum	N
Prunus angustifolia	Chickasaw Plum	N
Pycnanthemum clinopodioides	Mountain-mint	N
Pyrola chlorantha	Green-Flowered Wintergreen	N
Quercus macrocarpa	Bur Oak	N
Quercus michauxii	Swamp Chestnut Oak	N
Ranunculus ambigens	Water-plantain crowfoot	N
Ranunculus flabellaris	Yellow Water-crowfoot	N
Ranunculus pusillus	Spearwort	N
Rosa blanda	Meadow Rose	N
Rosa setigera	Prairie Rose	N
Rudbeckia fulgida	Eastern Coneflower	N
Ruellia pedunculata	Stalked Wild-petunia	N
Sagittaria cuneata	Wapatum Arrowhead	N
Salix caroliniana	Carolina Willow	N
Salix myricoides	Broad-leaved Willow	N
Salix pedicellaris	Bog Willow	N
Schoenoplectus subterminalis	Water Bulrush	N
Singa eugeni	An Orb-weaver Spider	N
Smallanthus uvedalius	Leaf-cup	N
Solidago speciosa var. speciosa	Showy Goldenrod	N
Solidago uliginosa	Bog Goldenrod	N
Sparganium angustifolium	Bur-reed	N
Spiranthes lucida	Shining Ladies'-tresses	N
Stellaria borealis	Mountain Starwort	N
Stenanthium gramineum	Featherbells	N
Strophostyles umbellata	Wild Bean	N
Symphyotrichum drummondii	Hairy Heart-leaved Aster	N
Symphyotrichum praealtum	Veiny-lined Aster	N
Thalictrum dasycarpum	Purple Meadow-rue	N
Toxicodendron rydbergii	Giant Poison-ivy	N
Triadenum walteri	Walter's St. John's-wort	N
Trillium cernuum	Nodding Trillium	N
Trisetum spicatum	Narrow False Oats	N
Utricularia cornuta	Horned Bladderwort	N
Utricularia geminiscapa	Bladderwort	N
Utricularia inflata	Floating Bladderwort	N
Utricularia subulata		N

Veratrum virginicum	Virginia Bunchflower	N
Viola selkirkii	Great-spurred Violet	N
Woodwardia areolata	Netted Chainfern	N
Xyris torta	Twisted Yellow-eyed Grass	N
Zanthoxylum americanum	Northern Prickly-ash	N
Zigadenus glaucus	White Camas	N
Amia calva	Bowfin	PC
Crotalus horridus	Timber Rattlesnake	PC
Culaea inconstans	Brook Stickleback	PC
Emydoidea blandingii	Blanding's Turtle	PC
Ichthyomyzon bdellium	Ohio Lamprey	PC
Lampetra aepyptera	Least Brook Lamprey	PC
Nocomis biguttatus	Hornyhead Chub	PC
Plestiodon laticeps	Broadhead Skink	PC
Umbra limi	Central Mudminnow	PC
Umbra pygmaea	Eastern Mudminnow	PC
Umbra pygmaea	Eastern Mudminnow	PC
Acipenser brevirostrum	Shortnose Sturgeon	PE
Acipenser fulvescens	Lake Sturgeon	PE
Acipenser oxyrinchus	Atlantic Sturgeon	PE
Aconitum reclinatum	White Monkshood	PE
Acorus americanus	Sweet Flag	PE
Acris crepitans	Northern Cricket Frog	PE
Agalinis auriculata	Eared False-foxglove	PE
Agalinis paupercula	Small-flowered False-foxglove	PE
Alasmidonta heterodon	Dwarf Wedgemussel	PE
Alisma triviale	Northern Water-plantain	PE
Alnus viridis	Mountain Alder	PE
Alosa mediocris	Hickory Shad	PE
Ambystoma laterale	Blue-spotted Salamander	PE
Ameiurus melas	Black Bullhead	PE
Amelanchier bartramiana	Oblong-fruited Serviceberry	PE
Ammannia coccinea	Scarlet Ammannia	PE
Anemone cylindrica	Long-fruited Anemone	PE
Arabis missouriensis	Missouri Rock-cress	PE
Ardea alba	Great Egret	PE
Arethusa bulbosa	Swamp-pink	PE
Arnica acaulis	Leopard's-bane	PE
Artemisia campestris ssp. caudata	Beach Wormwood	PE
Asio flammeus	Short-eared Owl	PE
Asplenium resiliens	Black-stemmed Spleenwort	PE
Astragalus neglectus	Cooper's Milk-vetch	PE
Bartramia longicauda	Upland Sandpiper	PE
Boltonia asteroides	Aster-like Boltonia	PE
Botaurus lentiginosus	American Bittern	PE
Cardamine pratensis var. palustris	Cuckooflower	PE
Carex atherodes	Awned Sedge	PE
Carex aurea	Golden-fruited Sedge	PE
Carex bebbii	Bebb's Sedge	PE

Carex bicknellii	Bicknell's Sedge	PE
Carex bullata	Bull Sedge	PE
Carex careyana	Carey's Sedge	PE
Carex collinsii	Collin's Sedge	PE
Carex crinita var. brevicrinis	Short Hair Sedge	PE
Carex eburnea	Ebony Sedge	PE
Carex foenea	A Sedge	PE
Carex formosa	Handsome Sedge	PE
Carex garberi	Elk Sedge	PE
Carex geyeri	Geyer's Sedge	PE
Carex mitchelliana	Mitchell's Sedge	PE
Carex pauciflora	Few-flowered Sedge	PE
Carex polymorpha	Variable Sedge	PE
Carex pseudocyperus	Cyperus-like Sedge	PE
Carex retrorsa	Backward Sedge	PE
Carex typhina	Cattail Sedge	PE
Carex viridula	Green Sedge	PE
Catostomus catostomus	Longnose Sucker	PE
Cerastium velutinum var. villosissimum	Goat Hill Chickweed	PE
Chaenobryttus gulosus	Warmouth	PE
Chasmanthium laxum	Slender Sea-oats	PE
Chenopodium foggii	Fogg's Goosefoot	PE
Chlidonias niger	Black Tern	PE
Chrysogonum virginianum	Green-and-gold	PE
Cirsium horridulum	Horrible Thistle	PE
Cistothorus platensis	Sedge Wren	PE
Cladium mariscoides	Twig Rush	PE
Clematis viorna	Vase-vine Leather-flower	PE
Clethra acuminata	Mountain Pepper-bush	PE
Clitoria mariana	Butterfly-pea	PE
Clonophis kirtlandii	Kirtland's Snake	PE
Conioselinum chinense	Hemlock-parsley	PE
Coregonus artedi	Cisco	PE
Cryptogramma stelleri	Slender Rock-brake	PE
Cryptotis parva	Least Shrew	PE
Cymophyllus fraserianus	Fraser's Sedge	PE
Cynanchum laeve	Smooth Swallow-wort	PE
Cyperus diandrus	Umbrella Flatsedge	PE
Cyperus houghtonii	Houghton's Flatsedge	PE
Cyperus refractus	Reflexed Flatsedge	PE
Cyperus retrorsus	Retrorse Flatsedge	PE
Cypripedium calceolus var. parviflorum	Small Yellow Lady's-slipper	PE
Delphinium exaltatum	Tall Larkspur	PE
Diarrhena obovata	American Beakgrain	PE
Dicentra eximia	Wild Bleeding-hearts	PE
Dichanthelium scoparium	Velvety Panic-grass	PE
Dodecatheon meadia	Common Shooting-star	PE
Dryopteris campyloptera	Mountain Wood Fern	PE
Echinochloa walteri	Walter's Barnyard-grass	PE

Eleocharis caribaea	Capitate Spike-rush	PE
Eleocharis compressa	Flat-stemmed Spike-rush	PE
Eleocharis elliptica	Slender Spike-rush	PE
Eleocharis obtusa var. peasei	Wrights Spike Rush	PE
Eleocharis parvula	Little-spike Spike-rush	PE
Eleocharis pauciflora var. fernaldii	Few-flowered Spike-rush	PE
Eleocharis quadrangulata	Four-angled Spike-rush	PE
Eleocharis rostellata	Beaked Spike-rush	PE
Eleocharis tenuis var. verrucosa	Slender Spike-rush	PE
Elephantopus carolinianus	Elephant's Foot	PE
Empidonax flaviventris	Yellow-bellied Flycatcher	PE
Enneacanthus obesus	Banded Sunfish	PE
Epilobium strictum	Downy Willow-herb	PE
Epioblasma torulosa rangiana	Northern Riffleshell	PE
Epioblasma triquetra	Snuffbox	PE
Equisetum variegatum	Variegated Horsetail	PE
Erimystax x-punctatus	Gravel Chub	PE
Eriophorum gracile	Slender Cotton-grass	PE
Eriophorum tenellum	Rough Cotton-grass	PE
Etheostoma exile	Iowa Darter	PE
Etheostoma pellucida	Eastern Sand Darter	PE
Euphorbia ipecacuanhae	Wild Ipecac	PE
Euphorbia purpurea	Glade Spurge	PE
Eurybia spectabilis	Low Showy Aster	PE
Falco peregrinus	Peregrine Falcon	PE
Festuca paradoxa	Cluster Fescue	PE
Galium labradoricum	Labrador Marsh Bedstraw	PE
Gasterosteus aculeatus	Threespine Stickleback	PE
Gaylussacia dumosa	Dwarf Huckleberry	PE
Geranium bicknellii	Cranesbill	PE
Glaucomys sabrinus	Northern Flying Squirrel	PE
Glyceria borealis	Small-floating Manna-grass	PE
Glyceria obtusa	Blunt Manna-grass	PE
Glyptemys muhlenbergii	Bog Turtle	PE
Gymnopogon ambiguus	Broad-leaved Beardgrass	PE
Helianthemum bicknellii	Bicknell's Hoary Rockrose	PE
Heteranthera multiflora	Multiflowered Mud-plantain	PE
Hieracium traillii	Maryland Hawkweed	PE
Hierochloe odorata	Vanilla Sweet-grass	PE
Huperzia porophila	Rock Clubmoss	PE
Hydrophyllum macrophyllum	Large-leaved Waterleaf	PE
Ichthyomyzon fossor	Northern Brook Lamprey	PE
Ictiobus cyprinellus	Bigmouth Buffalo	PE
Iodanthus pinnatifidus	Purple Rocket	PE
Iris cristata	Crested Dwarf Iris	PE
Iris prismatica	Slender Blue Iris	PE
Iris verna	Dwarf Iris	PE
Isotria medeoloides	Small-whorled Pogonia	PE
Ixobrychus exilis	Least Bittern	PE

Juncus brachycarpus	Short-fruited Rush	PE
Juncus dichotomus	Forked Rush	PE
Juncus militaris	Bayonet Rush	PE
Juncus scirpoides	Scirpus-like Rush	PE
Kinosternon subrubrum subrubrum	Eastern Mud Turtle	PE
Lanius ludovicianus migrans	Migrant Loggerhead Shrike	PE
Lepisosteus oculatus	Spotted Gar	PE
Lepomis megalotis	Longear Sunfish	PE
Lespedeza angustifolia	Narrowleaf Bushclover	PE
Ligusticum canadense	Nondo Lovage	PE
Linum intercursum	Sandplain Wild Flax	PE
Linum sulcatum	Grooved Yellow Flax	PE
Lipocarpha micrantha	Common Hemicarpa	PE
Listera australis	Southern Twayblade	PE
Listera cordata	Heart-leaved Twayblade	PE
Listera smallii	Kidney-leaved Twayblade	PE
Lithobates sphenocephalus utricularius	Southern Leopard Frog	PE
Lithospermum caroliniense	Hispid Gromwell	PE
Lithospermum latifolium	American Gromwell	PE
Lobelia kalmii	Brook Lobelia	PE
Lobelia puberula	Downy Lobelia	PE
Lonicera oblongifolia	Swamp Fly Honeysuckle	PE
Lonicera villosa	Mountain Fly Honeysuckle	PE
Lota lota	Burbot	PE
Ludwigia decurrens	Upright Primrose-willow	PE
Ludwigia polycarpa	False Loosestrife Seedbox	PE
Lycopodiella alopecuroides	Foxtail Clubmoss	PE
Lycopus rubellus	Bugleweed	PE
Lyonia mariana	Stagger-bush	PE
Lythrurus umbratilis	Redfin Shiner	PE
Margaritifera margaritifera	Eastern Pearlshell	PE
Marshallia grandiflora	Large-flowered Marshallia	PE
Matelea obliqua	Oblique Milkvine	PE
Megalodonta beckii	Beck's Water-marigold	PE
Mitella nuda	Naked Bishop's-cap	PE
Monarda punctata	Spotted Bee-balm	PE
Montia chamissoi	Chamisso's Miner's-lettuce	PE
Muhlenbergia uniflora	Fall Dropseed Muhly	PE
Myotis sodalis	Indiana or Social Myotis	PE
Myriophyllum farwellii	Farwell's Water-milfoil	PE
Myriophyllum heterophyllum	Broad-leaved Water-milfoil	PE
Myriophyllum sibiricum	Northern Water-milfoil	PE
Myriophyllum verticillatum	Whorled Water-milfoil	PE
Notropis bifrenatus	Bridle Shiner	PE
Notropis blennius	River Shiner	PE
Notropis buchanani	Ghost Shiner	PE
Notropis chalybaeus	Ironcolor Shiner	PE
Notropis heterodon	Blackchin Shiner	PE
Noturus eleutherus	Mountain Madtom	PE

Noturus gyrinus	Tadpole Madtom	PE
Noturus stigmosus	Northern Madtom	PE
Nyctanassa violacea	Yellow-crowned Night-heron	PE
Nycticorax nycticorax	Black-crowned Night-heron	PE
Obovaria subrotunda	Round Hickorynut	PE
Oclemena nemoralis	Bog Aster	PE
Onosmodium molle var. hispidissimum	False Gromwell	PE
Opheodrys aestivus	Rough Green Snake	PE
Ophioglossum engelmannii	Limestone Adder's-tongue	PE
Packera antennariifolia	Cat's-paw Ragwort	PE
Panicum amarum var. amarulum	Southern Sea-beach Panic-grass	PE
Panicum xanthophysum	Slender Panic-grass	PE
Parnassia glauca	Carolina Grass-of-parnassus	PE
Passiflora lutea	Passion-flower	PE
Paxistima canbyi	Canby's Mountain-lover	PE
Phlox ovata	Mountain Phlox	PE
Phlox subulata ssp. brittonii	Moss Pink	PE
Phoxinus eos	Northern Redbelly Dace	PE
Phyllanthus caroliniensis	Carolina Leaf-flower	PE
Piptatherum pungens	Slender Mountain-ricegrass	PE
Platanthera dilatata	Leafy White Orchid	PE
Pleurobema clava	Clubshell	PE
Poa autumnalis	Autumn Bluegrass	PE
Polemonium vanbruntiae	Jacob's-ladder	PE
Polygala cruciata	Cross-leaved Milkwort	PE
Polygala curtissii	Curtis's Milkwort	PE
Polygala incarnata	Pink Milkwort	PE
Polygonum careyi	Carey's Smartweed	PE
Polystichum braunii	Braun's Holly Fern	PE
Populus balsamifera	Balsam Poplar	PE
Potamogeton friesii	Fries' Pondweed	PE
Potamogeton gramineus	Grassy Pondweed	PE
Potamogeton hillii	Hill's Pondweed	PE
Potamogeton obtusifolius	Blunt-leaved Pondweed	PE
Potamogeton pulcher	Spotted Pondweed	PE
Potamogeton strictifolius	Narrow-leaved Pondweed	PE
Potamogeton tennesseensis	Tennessee Pondweed	PE
Potamogeton vaseyi	Vasey's Pondweed	PE
Potentilla fruticosa	Shrubby Cinquefoil	PE
Potentilla paradoxa	Bushy Cinquefoil	PE
Potentilla tridentata	Three-toothed Cinquefoil	PE
Prenanthes crepidinea	Crepis Rattlesnake-root	PE
Prunus maritima	Beach Plum	PE
Pseudacris kalmi	New Jersey Chorus Frog	PE
Pseudotriton montanus montanus	Eastern Mud Salamander	PE
Ptilimnium capillaceum	Mock Bishop-weed	PE
Pycnanthemum torrei	Torrey's Mountain-mint	PE
Quadrula cylindrica	Rabbitsfoot	PE
Quadrula verrucosa	Pistolgrip Mussel	PE

Quercus falcata	Southern Red Oak	PE
Quercus phellos	Willow Oak	PE
Quercus shumardii	Shumard's Oak	PE
Rallus elegans	King Rail	PE
Ranunculus fascicularis	Tufted Buttercup	PE
Rhamnus lanceolata	Lance-leaved Buckthorn	PE
Rhexia mariana	Maryland Meadow-beauty	PE
Rhododendron atlanticum	Dwarf Azalea	PE
Rhynchospora capillacea	Capillary Beaked-rush	PE
Ribes missouriense	Missouri Gooseberry	PE
Ruellia humilis	Fringed-leaved Petunia	PE
Sagittaria calycina var. spongiosa	Long-lobed Arrow-head	PE
Scaphiopus holbrookii	Eastern Spadefoot	PE
Scheuchzeria palustris	Pod-grass	PE
Schoenoplectus acutus	Hard-stemmed Bulrush	PE
Schoenoplectus smithii	Smith's Bulrush	PE
Schoenoplectus torreyi	Torrey's Bulrush	PE
Scirpus ancistrochaetus	Northeastern Bulrush	PE
Scleria minor	Minor Nutrush	PE
Scleria muehlenbergii	Reticulated Nutrush	PE
Scleria verticillata	Whorled Nutrush	PE
Sedum rosea	Roseroot Stonecrop	PE
Sericocarpus linifolius	Narrow-leaved White-topped Aster	PE
Setophaga striata	Blackpoll Warbler	PE
Shepherdia canadensis	Canada Buffalo-berry	PE
Sida hermaphrodita	Sida	PE
Simpsonaias ambigua	Salamander Mussel	PE
Sistrurus catenatus catenatus	Eastern Massasauga	PE
Sisyrinchium atlanticum	Eastern Blue-eyed Grass	PE
Solidago arguta var. harrisii	Harris' Golden-rod	PE
Solidago curtisii	Curtis' Golden-rod	PE
Solidago erecta	Slender Golden-rod	PE
Solidago simplex ssp. randii var. racemosa	Sticky Golden-rod	PE
Sorbus decora	Showy Mountain-ash	PE
Sparganium androcladum	Branching Bur-reed	PE
Spiranthes casei	Case's Ladies'-tresses	PE
Spiranthes ovalis	October Ladies'-tresses	PE
Spiranthes romanzoffiana	Hooded Ladies'-tresses	PE
Spiranthes vernalis	Spring Ladies'-tresses	PE
Spiza americana	Dickcissel	PE
Sporobolus clandestinus	Rough Dropseed	PE
Sporobolus heterolepis	Prairie Dropseed	PE
Stachys cordata	Nuttall's Hedge-nettle	PE
Sterna hirundo	Common Tern	PE
Swertia caroliniensis	American Columbo	PE
Symphyotrichum boreale	Rush Aster	PE
Taenidia montana	Mountain Pimpernel	PE
Thalictrum coriaceum	Thick-leaved Meadow-rue	PE
Trichostema setaceum	Blue-curls	PE

Trifolium virginicum	Kate's Mountain Clover	PE
Triphora trianthophora	Nodding Pogonia	PE
Triplasis purpurea	Purple Sandgrass	PE
Trollius laxus	Spreading Globeflower	PE
Utricularia radiata	Small Swollen Bladderwort	PE
Vernonia glauca	Tawny Ironweed	PE
Viburnum nudum	Possum-haw	PE
Villosa fabalis	Rayed Bean Mussel	PE
Viola brittoniana	Coast Violet	PE
Amaranthus cannabinus	Waterhemp Ragweed	PR
Andromeda polifolia	Bog-rosemary	PR
Aplectrum hyemale	Puttyroot	PR
Baccharis halimifolia	Eastern Baccharis	PR
Cakile edentula	American Sea-rocket	PR
Carex disperma	Soft-leaved Sedge	PR
Carex lasiocarpa	Slender Sedge	PR
Castanea pumila	Allegheny Chinkapin	PR
Collinsia verna	Spring Blue-eyed Mary	PR
Cyperus schweinitzii	Schweinitz's Flatsedge	PR
Eleocharis olivacea	Capitate Spike-rush	PR
Gaultheria hispidula	Creeping Snowberry	PR
Juncus filiformis	Thread Rush	PR
Juncus gymnocarpus	Coville's Rush	PR
Ledum groenlandicum	Common Labrador-tea	PR
Lupinus perennis	Lupine	PR
Lygodium palmatum	Hartford Fern	PR
Malaxis bayardii	Bayard's Malaxis	PR
Menziesia pilosa	Minniebush	PR
Opuntia humifusa	Prickly-pear Cactus	PR
Orontium aquaticum	Golden Club	PR
Packera anonyma	Plain Ragwort	PR
Panicum commonsianum var. euchlamydeum	Cloaked Panic-grass	PR
Potamogeton robbinsii	Flat-leaved Pondweed	PR
Potamogeton zosteriformis	Flat-stem Pondweed	PR
Pyrularia pubera	Buffalo-nut	PR
Rotala ramosior	Tooth-cup	PR
Sagittaria subulata	Subulate Arrowhead	PR
Schizachyrium scoparium var. littorale	Seaside Bluestem	PR
Schoenoplectus fluviatilis	River Bulrush	PR
Sedum telephioides	Allegheny Stonecrop	PR
Solidago roanensis	Tenessee Golden-rod	PR
Tipularia discolor	Cranefly Orchid	PR
Trautvetteria caroliniensis	Carolina Tassel-rue	PR
Trillium nivale	Snow Trillium	PR
Utricularia purpurea	Purple Bladderwort	PR
Wolffiella gladiata	Bog-mat	PR
Xyris montana	Northern Yellow-eyed Grass	PR
Zizania aquatica	Indian Wild Rice	PR
Aconitum uncinatum	Blue Monkshood	PT

Actaea podocarpa	Mountain Bugbane	PT
Ammophila breviligulata	American Beachgrass	PT
Aneides aeneus	Green Salamander	PT
Arceuthobium pusillum	Dwarf Mistletoe	PT
Aristida purpurascens	Arrow-feathered Three Awned	PT
Asio otus	Long-eared Owl	PT
Asplenium bradleyi	Bradley's Spleenwort	PT
Bidens bidentoides	Swamp Beggar-ticks	PT
Bouteloua curtipendula	Tall Gramma	PT
Camassia scilloides	Wild Hyacinth	PT
Carex alata	Broad-winged Sedge	PT
Carex aquatilis	Water Sedge	PT
Carex cryptolepis	Northeastern Sedge	PT
Carex diandra	Lesser Panicled Sedge	PT
Carex flava	Yellow Sedge	PT
Carex oligosperma	Few-seeded Sedge	PT
Carex paupercula	Bog Sedge	PT
Carex prairea	Prairie Sedge	PT
Carex schweinitzii	Schweinitz's Sedge	PT
Carex sterilis	Sterile Sedge	PT
Carex tetanica	A Sedge	PT
Carex wiegandii	Wiegands Sedge	PT
Chamaesyce polygonifolia	Small Sea-side Spurge	PT
Chrysopsis mariana	Maryland Golden-aster	PT
Circus cyaneus	Northern Harrier	PT
Cypripedium reginae	Showy Lady's-slipper	PT
Dodecatheon radicatum	Jeweled Shooting-star	PT
Eleocharis intermedia	Matted Spike-rush	PT
Eleocharis robbinsii	Robbins' Spike-rush	PT
Ellisia nyctelea	Ellisia	PT
Erigenia bulbosa	Harbinger-of-spring	PT
Eriophorum viridicarinatum	Thin-leaved Cotton-grass	PT
Etheostoma camurum	Bluebreast Darter	PT
Etheostoma maculatum	Spotted Darter	PT
Etheostoma tippecanoe	Tippecanoe Darter	PT
Euthamia tenuifolia	Grass-leaved Goldenrod	PT
Fimbristylis annua	Annual Fimbry	PT
Gaylussacia brachycera	Box Huckleberry	PT
Haliaeetus leucocephalus	Bald Eagle	PT
Hypericum densiflorum	Bushy St. John's-wort	PT
Hypericum majus	Larger Canadian St. John's-wort	PT
Ichthyomyzon greeleyi	Mountain Brook Lamprey	PT
Ilex opaca	American Holly	PT
Juncus alpinoarticulatus ssp. nodulosus	Richardson's Rush	PT
Juncus arcticus var. littoralis	Baltic Rush	PT
Juncus brachycephalus	Small-headed Rush	PT
Juncus torreyi	Torrey's Rush	PT
Lathyrus japonicus	Beach Peavine	PT
Lathyrus ochroleucus	Wild-pea	PT

Linnaea borealis	Twinflower	PT
Lobelia dortmanna	Water Lobelia	PT
Lycopodiella appressa	Southern Bog Clubmoss	PT
Magnolia tripetala	Umbrella Magnolia	PT
Magnolia virginiana	Sweet Bay Magnolia	PT
Melica nitens	Three-flowered Melic-grass	PT
Minuartia glabra	Appalachian Sandwort	PT
Minytrema melanops	Spotted Sucker	PT
Myotis leibii	Eastern Small-footed Myotis	PT
Myrica gale	Sweet-gale	PT
Myriophyllum tenellum	Slender Water-milfoil	PT
Najas gracillima	Bushy Naiad	PT
Neotoma magister	Allegheny Woodrat	PT
Notropis dorsalis	Bigmouth Shiner	PT
Noturus miurus	Brindled Madtom	PT
Nymphoides cordata	Floating-heart	PT
Oenothera argillicola	Shale-barren Evening-primrose	PT
Pandion haliaetus	Osprey	PT
Panicum tuckermanii	Tuckerman's Panic-grass	PT
Percina bimaculata	Chesapeake Logperch	PT
Percina evides	Gilt Darter	PT
Phemeranthus teretifolius	Round-leaved Fame-flower	PT
Phoxinus erythrogaster	Southern Redbelly Dace	PT
Plethobasus cyphyus	Sheepnose Mussel	PT
Poa paludigena	Bog Bluegrass	PT
Potamogeton confervoides	Tuckerman's Pondweed	PT
Potamogeton richardsonii	Red-head Pondweed	PT
Potentilla anserina	Silverweed	PT
Pseudemys rubriventris	Eastern Redbelly Turtle	PT
Ptelea trifoliata	Common Hop-tree	PT
Ribes triste	Red Currant	PT
Ruellia strepens	Limestone Petunia	PT
Salix candida	Hoary Willow	PT
Salix serissima	Autumn Willow	PT
Scirpus pedicellatus	Stalked Bulrush	PT
Scleria pauciflora	Few Flowered Nutrush	PT
Sorex palustris punctulatus	Southern Water Shrew	PT
Spiraea betulifolia	Dwarf Spiraea	PT
Streptopus amplexifolius	White Twisted-stalk	PT
Symphyotrichum depauperatum	Serpentine Aster	PT
Symphyotrichum novi-belgii	New York Aster	PT
Utricularia intermedia	Flat-leaved Bladderwort	PT
Viola appalachiensis	Appalachian Blue Violet	PT
Vittaria appalachiana	Appalachian Gametophyte Fern	PT
Cypripedium calceolus var. pubescens	Large Yellow Lady's-slipper	PV
Hydrastis canadensis	Golden-seal	PV
Panax quinquefolius	Wild Ginseng	PV
Aeschynomene virginica	Sensitive Joint-vetch	PX
Agalinis decemloba	Blue-ridge False-foxglove	PX

Agrostis altissima	Tall Bentgrass	PX
Arctostaphylos uva-ursi	Bearberry Manzanita	PX
Asclepias rubra	Red Milkweed	PX
Berberis canadensis	American Barberry	PX
Buchnera americana	Bluehearts	PX
Carex adusta	Crowded Sedge	PX
Carex backii	Rocky Mountain Sedge	PX
Carex barrattii	Barratt's Sedge	PX
Carex chordorrhiza	Creeping Sedge	PX
Carex hyalinolepis	Shore-line Sedge	PX
Carex sartwellii	Sartwell's Sedge	PX
Chamaecyparis thyoides	Atlantic White Cedar	PX
Commelina erecta	Slender Day-flower	PX
Commelina virginica	Virginia Day-flower	PX
Coreopsis rosea	Pink Tickseed	PX
Crassula aquatica	Water Pigmy-weed	PX
Critesion pusillum	Little Barley	PX
Crotonopsis elliptica	Elliptical Rushfoil	PX
Cynoglossum boreale	Northern Hound's-tongue	PX
Cypripedium candidum	Small White Lady's-slipper	PX
Desmodium sessilifolium	Sessile-leaved Tick-trefoil	PX
Dichanthelium leibergii	Leiberg's Panic-grass	PX
Dichanthelium spretum	Eaton's Witchgrass	PX
Diphasiastrum sabinifolium	Fir Clubmoss	PX
Draba reptans	Carolina Whitlow-grass	PX
Echinacea laevigata	Smooth Coneflower	PX
Elatine americana	Long-stemmed Water-wort	PX
Eleocharis tricostata	Three-ribbed Spike-rush	PX
Eleocharis tuberculosa	Long-tubercled Spike-rush	PX
Elodea schweinitzii	Schweinitz's Waterweed	PX
Erianthus giganteus	Sugar Cane Plumegrass	PX
Eriocaulon decangulare	Ten-angle Pipewort	PX
Eriocaulon parkeri	Parker's Pipewort	PX
Eryngium aquaticum	Marsh Eryngo	PX
Eupatorium leucolepis	White-bracted Thoroughwort	PX
Euphorbia obtusata	Blunt-leaved Spurge	PX
Fimbristylis puberula	Hairy Fimbry	PX
Galactia regularis	Eastern Milk-pea	PX
Galactia volubilis	Downy Milk-pea	PX
Gentiana catesbaei	Elliott's Gentian	PX
Gentianopsis virgata	Lesser Fringed Gentian	PX
Helianthus angustifolius	Swamp Sunflower	PX
Hottonia inflata	American Featherfoil	PX
Hydrocotyle umbellata	Many-flowered Pennywort	PX
Hypericum adpressum	Creeping St. John's-wort	PX
Hypericum crux-andreae	St Peter's-wort	PX
Hypericum denticulatum	Coppery St. John's-wort	PX
Hypericum gymnanthum	Clasping-leaved St. John's-wort	PX
Ilex glabra	Ink-berry	PX

Itea virginica	Virginia Willow	PX
Juncus greenei	Greene's Rush	PX
Koeleria macrantha	Junegrass	PX
Leiophyllum buxifolium	Sand-myrtle	PX
Lemna obscura	Little Water Duckweed	PX
Lemna valdiviana	Pale Duckweed	PX
Lespedeza stuevei	Tall Bush Clover	PX
Limosella australis	Awl-shaped Mudwort	PX
Lobelia nuttallii	Nuttall's Lobelia	PX
Ludwigia sphaerocarpa	Spherical-fruited Seedbox	PX
Micranthemum micranthemoides	Nuttall's Mud-flower	PX
Muhlenbergia capillaris	Short Muhly	PX
Onosmodium virginianum	Virginia False-gromwell	PX
Ophioglossum vulgatum	Adder's Tongue	PX
Phoradendron leucarpum	Christmas Mistletoe	PX
Platanthera cristata	Crested Yellow Orchid	PX
Platanthera leucophaea	Prairie White-fringed Orchid	PX
Polygala lutea	Yellow Milkwort	PX
Populus heterophylla	Swamp Cottonwood	PX
Potamogeton praelongus	White-stemmed Pondweed	PX
Prenanthes racemosa	Glaucous Rattlesnake-root	PX
Proserpinaca pectinata	Comb-leaved Mermaid-weed	PX
Ranunculus hederaceus	Long-stalked Crowfoot	PX
Rhododendron calendulaceum	Flame Azalea	PX
Rhynchospora fusca	Brown Beaked-rush	PX
Rhynchospora gracilenta	Beaked-rush	PX
Ruellia caroliniensis	Carolina Petunia	PX
Sabatia campanulata	Slender Marsh Pink	PX
Sagittaria filiformis	An Arrow-head	PX
Schoenoplectus heterochaetus	Slender Bulrush	PX
Scutellaria serrata	Showy Skullcap	PX
Sisyrinchium fuscatum	Sand Blue-eyed Grass	PX
Smilax pseudochina	Long-stalked Greenbrier	PX
Sparganium natans	Small Bur-reed	PX
Spiraea virginiana	Virginia Spiraea	PX
Spiranthes magnicamporum	Ladies'-tresses	PX
Trifolium reflexum	Buffalo Clover	PX
Triglochin palustris	Marsh Arrowgrass	PX
Utricularia resupinata	Northeastern Bladderwort	PX
Vitis rupestris	Sand Grape	PX
Adiantum aleuticum	Aleutian Maidenhair Fern	TU
Aletris farinosa	Colic-root	TU
Amelanchier humilis	Serviceberry	TU
Amelanchier obovalis	Coastal Juneberry	TU
Amelanchier sanguinea	Roundleaf Serviceberry	TU
Andropogon glomeratus	Bushy Bluestem	TU
Antennaria solitaria	Single-headed Pussy-toes	TU
Arabis hirsuta	Western Hairy Rock-cress	TU
Aristida dichotoma var. curtissii	Three-awned Grass	TU

Aristida longespica var. geniculata	Spiked Needlegrass	TU
Asclepias variegata	White Milkweed	TU
Carex buxbaumii	Brown Sedge	TU
Carex crawfordii	Crawford's Sedge	TU
Carex haydenii	Cloud Sedge	TU
Carex limosa	Mud Sedge	TU
Carex longii	Long's Sedge	TU
Carex lupuliformis	False Hop Sedge	TU
Carex meadii	Mead's Sedge	TU
Castilleja coccinea	Scarlet Indian-paintbrush	TU
Chasmanthium latifolium	Wild Oat	TU
Chenopodium capitatum	Strawberry Goosefoot	TU
Coeloglossum viride	Long-bracted Green Orchid	TU
Corallorhiza wisteriana	Spring Coral-root	TU
Crataegus brainerdii	Brainerd's Hawthorne	TU
Crataegus mollis	Downy Hawthorne	TU
Cuscuta cephalanthi	Button-bush Dodder	TU
Cuscuta coryli	Hazel Dodder	TU
Cuscuta polygonorum	Smartweed Dodder	TU
Cystopteris laurentiana	Laurentian Bladder-fern	TU
Desmodium glabellum	Tall Tick-trefoil	TU
Desmodium nuttallii	Nuttalls' Tick-trefoil	TU
Dichanthelium annulum	Serpentine Panic-grass	TU
Dichanthelium boreale	Panic-grass	TU
Dichanthelium commonsianum var. commonsianum	Cloaked Panic Grass	TU
Dichanthelium lucidum	Shining Panic-grass	TU
Dichanthelium villosissimum var. villosissimum	Long-haired Panic-grass	TU
Dichanthelium yadkinense	Yadkin River Panic-grass	TU
Elatine minima	Small Waterwort	TU
Epilobium palustre	Marsh Willow-herb	TU
Eupatorium rotundifolium	A Eupatorium	TU
Filipendula rubra	Queen-of-the-prairie	TU
Gentiana alba	Yellow Gentian	TU
Gentiana saponaria	Soapwort Gentian	TU
Gentiana villosa	Striped Gentian	TU
Goodyera tesselata	Checkered Rattlesnake-plantain	TU
Gratiola aurea	Golden Hedge-hyssop	TU
Gymnocarpium appalachianum	Appalachian Oak Fern	TU
Houstonia purpurea var. purpurea	Purple Bluets	TU
Hypericum drummondii	Nits-and-lice	TU
Juncus biflorus	Grass-leaved Rush	TU
Lathyrus palustris	Vetchling	TU
Lemna turionifera	A Duckweed	TU
Leucothoe racemosa	Swamp Dog-hobble	TU
Lonicera hirsuta	Hairy Honeysuckle	TU
Luzula bulbosa	Southern Wood-rush	TU
Lythrum alatum	Winged-loosestrife	TU
Malaxis monophyllos var. brachypoda	White Adder's-mouth	TU
Meehania cordata	Heartleaf Meehania	TU

Muhlenbergia cuspidata	Plains Muhlenbergia	TU
Nuphar microphylla	Yellow Cowlily	TU
Oxydendrum arboreum	Sourwood	TU
Oxypolis rigidior	Stiff Cowbane	TU
Packera plattensis	Prairie Ragwort	TU
Panicum flexile	Wiry Witchgrass	TU
Panicum longifolium	Long-leaf Panic-grass	TU
Paronychia fastigiata var. nuttallii	Forked-chickweed	TU
Parthenium integrifolium	American Fever-few	TU
Phlox pilosa	Downy Phlox	TU
Phyla lanceolata	Lance Fog-fruit	TU
Physalis virginiana	Virginia Ground-cherry	TU
Platanthera ciliaris	Yellow-fringed Orchid	TU
Platanthera hookeri	Hooker's Orchid	TU
Platanthera peramoena	Purple-fringeless Orchid	TU
Pluchea odorata	Shrubby Camphor-weed	TU
Poa languida	Drooping Bluegrass	TU
Podostemum ceratophyllum	Riverweed	TU
Polygala polygama	Racemed Milkwort	TU
Polygonella articulata	Eastern Jointweed	TU
Polygonum amphibium var. stipulaceum	A Water Smartweed	TU
Polygonum ramosissimum	Bushy Knotweed	TU
Potamogeton filiformis	Slender Pondweed	TU
Potamogeton illinoensis	Illinois Pondweed	TU
Potamogeton oakesianus	Oakes' Pondweed	TU
Pycnanthemum verticillatum var. pilosum	Hairy Mountain-mint	TU
Ranunculus flammula	Lesser Spearwort	TU
Ratibida pinnata	Gray-headed Prairie Coneflower	TU
Rhamnus alnifolia	Alder-leaved Buckthorn	TU
Rhynchospora recognita	Small Globe Beaked-rush	TU
Ribes lacustre	Swamp Currant	TU
Rosa virginiana	Virginia Rose	TU
Rubus cuneifolius	Sand Blackberry	TU
Rubus setosus	Small Bristleberry	TU
Rumex hastatulus	Heart-winged Sorrell	TU
Salix petiolaris	Meadow Willow	TU
Samolus parviflorus	Pineland Pimpernel	TU
Saxifraga micranthidifolia	Lettuce Saxifrage	TU
Scleria triglomerata	Whip Nutrush	TU
Scutellaria saxatilis	Rock Skullcap	TU
Senna marilandica	Wild Senna	TU
Sisyrinchium albidum	Blue-eyed Grass	TU
Solidago rigida	Hard-leaved Goldenrod	TU
Spiranthes tuberosa	Little Ladies'-tresses	TU
Stachys hyssopifolia	Hyssop Hedge-nettle	TU
Stylosanthes biflora	Pencilflower	TU
Symphyotrichum dumosum	Bushy Aster	TU
Symphyotrichum ericoides	White Heath Aster	TU
Symphyotrichum firmum	Firm Aster	TU

Taxus canadensis	American Yew	TU
Tradescantia ohiensis	Ohio Spiderwort	TU
Trillium flexipes	Declined Trillium	TU
Triosteum angustifolium	Horse-gentian	TU
Tripsacum dactyloides	Eastern Gamma-grass	TU
Uvularia pudica	Mountain Bellwort	TU
Viburnum trilobum	Highbush-cranberry	TU
Viola renifolia	Kidney-leaved White Violet	TU
Viola tripartita	Three-parted Violet	TU
Vitis cinerea var. baileyana	A Pigeon Grape	TU
Wolffia borealis	Dotted Water-meal	TU

[2] In the Commonwealth of Pennsylvania, plants, wild birds and mammals, and fish, amphibians, reptiles, and aquatic organisms fall under the jurisdiction of three different authorities. Each authority, as outlined below, has different definitions for listing status.

Plant Status Codes and Definitions:
Native Plant Species Legislative Authority: Title 17 Chapter 45, Conservation of Native Wild Plants, January 1, 1988; Pennsylvania Department of Conservation and Natural Resources.

PE (Pennsylvania Endangered): Plant species which are in danger of extinction throughout most of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth.

PT (Pennsylvania Threatened): Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man.

PR *(Pennsylvania Rare)*: Plant species which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification. Disjunct: significantly separated from their main area of distribution, Endemic: confined to a specialized habitat, Limit of Range: at or near the periphery of their natural distribution, Restricted: found in specialized habitats or habitats infrequent in Pennsylvania.
PX *(Pennsylvania Extirpated)*: Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.

PV *(Pennsylvania Vulnerable)*: Plant species which are in danger of population decline within Commonwealth because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.

TU *(Tentatively Undetermined)*: A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxanomic uncertainties, limited evidence within historical records, or insufficient data.

N: No current legal status exists, but is under review for future listing.

Wild Birds and Mammals Status Codes and Definitions:
Wild Birds and Mammals Legislative Authority: Title 34 Chapter 133, Game and Wildlife Code, revised Dec. 1, 1990, Pennsylvania Game Commission.

PE *(Pennsylvania Endangered)*: Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity

or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93 205 (87 Stat. 884), as amended.

PT *(Pennsylvania Threatened)*: Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

Fish, Amphibians, Reptiles, and Aquatic Organisms Status Codes and Definitions:
Fish, Amphibians, Reptiles, and Aquatic Organisms Legislative Authority: Title 30, Chapter 75, Fish and Boat Code, revised February 9, 1991; Pennsylvania Fish Commission.

PE *(Pennsylvania Endangered)*: All species declared by: 1) the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission, Executive Director to be threatened with extinction and appear on the Pennsylvania Endangered Species List published by the Pennsylvania Bulletin.

PT *(Pennsylvania Threatened)*: All species declared by: 1) the Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens, and appear on a Threatened Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission Executive Director to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin.

PC: Animals that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution or are at risk because of certain aspects of their biology.

N: No current legal status, but is under review for future listing.