ENVIRONMENTAL ASSESSMENT

Integrated Wildlife Damage Management of Coyotes and Feral Dogs in Pennsylvania

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

In Consultation with:

Pennsylvania Game Commission
Pennsylvania Department of Agriculture

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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 the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS) involvement in the reduction of conflicts caused by coyotes and feral dogs 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 is 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 like physical exclusion, cultural practices, habitat modifications, repellants or harassment would be recommended and utilized to reduce damage. In other situations, coyotes and feral dogs would be removed as humanely as possible using shooting, trapping, snare/cable restraints 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 coyote or feral dog damage management, and an alternative in which WS is restricted to only providing technical assistance (Chapter 3). WS involvement in coyote and feral dog damage management in Pennsylvania is closely coordinated with the Pennsylvania Game Commission (PGC) and Pennsylvania Department of Agriculture (PDA), 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 coyote and feral dog populations, non-target species including state and federally-listed threatened and endangered (T&E) species, human health and safety, and humaneness of the alternatives used.

ACRONYMS

AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BMP	Best Management Practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
DEA	Drug Enforcement Administration
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FY	Fiscal Year (October 1, XXXX – September, 30, XXXX)
IWDM	Integrated Wildlife Damage Management
LCP	Livestock Protection Collar
MIS	Management Information System
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	Natural Historic Preservation Act
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
SOP	Standard Operating Procedures
T&E	Threatened and Endangered
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Department of Interior, Fish and Wildlife Service
WCO	Wildlife Conservation Officer
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 coyote (*Canis latrans*) and feral dog[1] (*Canis familiaris*) damage management in Pennsylvania.

Wildlife damage management (WDM) is the science of reducing damage or other problem 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.

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[2]) 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. 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 from which other governmental agencies or private entities may request assistance. Before any wildlife damage management is conducted on public or private land, Cooperative Service Agreements or other comparable documents are in place. WS cooperates with state, federal, and local land and wildlife management agencies to reduce wildlife damage effectively and efficiently according to applicable federal, state, and local laws and Memorandums of Understanding (MOUs) between WS and other agencies/entities.

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 coyotes and feral dogs in Pennsylvania. In addition, this EA will facilitate planning between WS, the USFWS, the Pennsylvania Game Commission (PGC), the Pennsylvania Department of Agriculture (PDA) 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

[1] The term "feral dog damage management" throughout this EA is referring to the damage management of any dog that is ownerless, homeless, not under control of its owner or a hybrid with a wild canine.
[2] The WS Policy Manual (http://www.aphis.usda.gov/wildlifedamage) provides guidance for WS personnel to conduct wildlife damage 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.

(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.

More specifically, WS is preparing this EA to: 1) facilitate planning, 2) promote interagency coordination, 3) streamline program management, 4) clearly communicate to the public the analysis of individual and cumulative impacts of proposed activities, and 5) evaluate and determine if there would be any potentially significant individual or cumulative adverse effects from the implementation of a damage management program.

Under the Proposed Action, coyote and feral dog damage management could be conducted on private, federal, state, county, and municipal lands in Pennsylvania upon request. The issues and alternatives associated with coyote and feral dog 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 coyotes and feral dogs 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 the Pennsylvania Game Commission (PGC), Pennsylvania Department of Agriculture (PDA) and other agencies and cooperators on a wide variety of wildlife species causing damage to numerous resources (USDA 2012). WS, the PDA, and the PGC receive requests for assistance with wildlife damage from the public, and state, federal and local government agencies. Comprehensive surveys of coyote and feral dog damage in Pennsylvania have not been conducted, but WS does maintain a Management Information System (MIS) database to document assistance that the program provides. MIS data are 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 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 coyotes and conducts management programs for coyotes because they are listed as furbearers and as a game species. The PGC provides technical assistance and issues damage management permits, but rarely provides any operational assistance. Table 1-1 shows the types and numbers of coyote-related complaints and mortalities received by the PGC Wildlife Conservation Officers (WCOs). WS potential involvement in the area of coyote 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 coyote 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 coyote hazard management at airports, reduction in coyote damage at landfills, protection of property and natural resources from damage by coyotes, and resolving health and safety concerns due to transmission of wildlife disease or aggressive behavior to humans, livestock and pets.

Table 1-1. Types and numbers of coyote related complaints and mortalities to WCO's.

	Survey Period				
	2010	2011	2012	2013	2014
% of WCO districts receiving coyote complaints	50	59	61	58	58
Complaint nature					
Cattle	11	13	13	17	16
Sheep	20	19	26	23	23
Goats	5	4	8	5	5
Poultry	21	24	25	20	35
Dogs	8	12	9	5	15
Cats	29	27	24	17	25
Afraid of coyotes	193	258	229	221	249
Deer	53	53	65	37	50
Turkeys	14	23	18	15	17
Other	31	48	18	33	26
Total Complaints	**385**	**481**	**435**	**393**	**461**
Coyote caused mortalities					
Cows	1	0	0	2	2
Calves	7	7	10	12	11
Sheep	25	22	49	41	44
Goats	4	5	6	5	3
Poultry	97	68	106	77	68
Dogs	1	7	3	0	4
Cats	18	53	28	25	23
Rabbits	6	7	5	7	22
Deer	6	8	6	11	18
Other	0	1	0	1	0
Total Depredation	**165**	**178**	**213**	**181**	**195**

The PDA has state management responsibility for domestic animals and conducts management programs for domestic animals including feral dogs. The PDA provides technical and operational assistance throughout the commonwealth. PA Bureau of Dog Law Enforcement provides dog wardens in each county to assist with the monitoring, investigation and capture of dangerous and damage causing feral dogs throughout the commonwealth. PDA has authority to investigate predation events and reimburse livestock producers for losses of livestock to coyotes and feral dogs (Table 1-2).

Table 1-2 Claims paid by PDA 2009-2013.

Year	Coyote	Dog
2008	59	26
2010	61	25
2011	67	16
2012	68	18
2013	72	25
Average	**66**	**25**

Damages to property and agricultural resources associated with coyotes and feral dogs that have been reported to or verified by WS have totaled $13,906 between FY 2009 and FY 2014. An additional $5,150 in damages to property and agricultural resources were documented during direct control activities conducted by WS during the same period. Table 1-3 and Table 1-4 show reported monetary damages caused by coyotes and feral dogs in Pennsylvania between 2009 and 2014. Although no monetary damages to natural resources and human safety have been reported and verified by WS, requests for assistance often address threats that coyotes and feral dogs 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 coyotes and feral dogs at airports.

Table 1-3. Reported or WS' reported and verified monetary damage by resource type caused by coyotes in Pennsylvania by year[1].

Resource Type	Fiscal Year						
	2009	**2010**	**2011**	**2012**	**2013**	**2014[2]**	**Average**
Property	$800	$0	$0	$0	$0	$0	**$133**
Agriculture	$1,861	$2,672	$378	$680	$11,340	$0	**$2,821**
TOTAL	**$2,661**	**$2,672**	**$378**	**$680**	**$11,340**	$0	**$2955**

[1]Reported or verified damage amounts are a combination of data collected by WS and PDA.
[2]Reported or verified monetary damages include only data from WS.

Table 1-4. Reported or WS' verified monetary damage by resource caused by feral dogs in Pennsylvania by year[1].

Resource Type	Fiscal Year						
	2009	**2010**	**2011**	**2012**	**2013**	**2014[2]**	**Average**
Agriculture	$300	$0	$670	$200	$4,200	$0	$895

[1]Reported or verified damage amounts are a combination of data collected by WS and PDA.
[2]Reported or verified monetary damages include only data from WS.

Aircraft striking coyotes or feral dogs can cause catastrophic failure of the aircraft, which has the potential to threaten passenger safety. The difficulties of placing a monetary value on reducing threats to human safety and natural resources are similar. The damages reported to or verified by WS are likely only a portion of the actual damages occurring since those damages reported to or verified by WS are based only on requests for assistance received by WS.

1.2.1 Need for Coyote and Feral Dog Damage Management to Protect Human Health and Safety

Human health and safety concerns and problems associated with coyotes and feral dogs include, but are not limited to, the potential for transmission of zoonotic diseases to humans, hazards at airports, and risks and actual instances of coyotes and feral dogs injuring humans.

Zoonotic Diseases

Zoonotic diseases are diseases of animals which are communicable to humans. Some of the coyotes and feral dogs in Pennsylvania may carry disease causing organisms or parasites including viruses, bacteria, fungi, protozoans and rickettsial organisms which pose a risk to humans (Table 1-5). 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, WDM 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).

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. It is impossible to predict every disease outbreak that could occur involving wildlife. WS could be called to assist in monitoring and managing any disease outbreak involving coyotes and feral dogs.

Table 1-5. 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)
Sarcoptic mange	mite (*Sarcoptes scabiei*)	red foxes, coyotes, domestic dogs

Trichinosis	nematode (*Trichinella spiralis*)	coyotes, bears, raccoons, foxes, rats
Rabies	virus (Rhabidovirus)	all mammals (high risk wildlife)
Leptospirosis	bacteria (*Leptospira interrogans*)	all mammals
Echinococcus infection	tapeworm (*Echinococcus multilocularis*)	foxes, coyotes
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
Giardiasis	protozoan parasite (*Giardia lambia*, *G. duodenalis*, and other *Giardia* sp.-taxonomy controversial)	coyotes, dogs, cats
Tularemia	Bacterium	rodents, rabbits, hares, coyotes
Rocky Mountain Spotted Fever	bacterium *(Rickettsii rickettsia)*	dogs and rodents

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 dogs are considered by most professional wildlife groups to be a non-native species that has detrimental impacts to the native ecosystems and agriculture. 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 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 or free-ranging dogs 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 dogs.

Most of the zoonoses known to infect dogs 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 animals 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).

Coyote and Feral Dog 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. 2014). 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 including coyotes and feral dogs 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. 2014). Animals such as coyotes and feral dogs often venture onto airfields in search of prey or by accident and become a direct threat to planes both landing and taking off.

WS assists airports with the management of wildlife problems including the removal of coyotes and feral dogs 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 and Dolbeer 2005). Pennsylvania WS has assisted over 16 airports in between 2003 -2014 in the management of non-cervid mammal threats to aviation. This has included the removal of coyotes that have crossed runways and taxiways while foraging for rodents and feral dogs that have accessed the airfield or escaped from shipping crates during transport. Airports throughout Pennsylvania have reported a total of eight coyote strikes from 2008-2014 (FAA Wildlife Strike Database 2015). It is estimated that only 20 to 25 percent of all bird strikes are reported (Conover et al. 1995, Dolbeer et al. 2014, Linnell et al. 1996, Linnell et al. 1999), and it's likely that coyote strikes are also underreported. Consequently, the number of coyote strikes is most likely higher than FAA records indicate. Although no feral dogs are recorded as being struck by aircraft in Pennsylvania, there is a possibility that feral dogs could access aircraft movement areas striking aircraft and causing damage to the aircraft or injury to passengers.

Other Coyote and Feral Dog 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 (Timm et al. 2004). 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 (Timm et al. 2004). 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, distemper is 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. 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 animals on their property. Symptoms of distemper often lead to abnormal behavior. Coyotes 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.

1.2.2 Need for Coyote and Feral Dog Damage Management to Protect Agricultural Resources

Pennsylvania is an agricultural state with 58,800 farms and over 7.6 million acres in farm production (NASS 2015). 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 2016, an estimated 51,000 goats were on Pennsylvania farms (NASS 2016). Pennsylvania is ranked 4th in the U.S. in total sheep operations per state with 3,800 operations (NASS 2009). The Commonwealth ranks 14th in the U.S. in total number of sheep and lambs with 94,000 (NASS 2016). The many sheep operations throughout the state experience damage from coyotes and feral dogs including the loss of lambs and ewes.

The PGC and WS receive requests for assistance from citizens experiencing agricultural damage caused by coyotes and feral dogs, including, but not limited to the following: 1) predation on livestock (including lambs, poultry); 2) threat of injury to livestock; and 3) risk of disease transmission. WS could conduct and assist in management efforts with coyotes and feral dogs, coordinated by or with the PGC, PDA, USDA/APHIS/Veterinary Services 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.

Predation and Livestock

Predation by coyotes, and occasionally feral dogs, is common at smaller farms, especially related to lambs and poultry which may be penned or free-ranging and raised for meat or egg production. According to USDA's Animal and Plant Health Inspection Service's National Animal Health Monitoring System, 142

sheep and 805 lambs, valued at a combined $143,000, were lost to predation in Pennsylvania during 2014 (USDA 2015). In 2014, coyotes accounted for 59 percent of sheep and 89 percent of lambs lost to predation in Pennsylvania. Nationwide, the major causes of predator loss in adult sheep have not changed since 1994: coyotes and dogs remain the largest causes of predator losses. In Pennsylvania during 2014, 128 sheep and 11 lambs, valued at $44,000, were injured by predators but not killed (USDA 2015). Predation by coyotes and feral dogs to other livestock including alpacas, calves, goats and domestic rabbits has also been reported in Pennsylvania.

1.2.3 Need for Coyote and Feral Dog Damage Management to Protect Property

WS has provided information on coyotes and feral dogs to interested parties through over 165 technical assistance contacts during FY 2009-2014. 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 coyotes are causing property damage. The PDA receives the majority of requests from the public in situations where feral dogs are causing property damage.

In addition to the risks to human health and safety discussed in Section 1.2.1, coyotes and to some extent feral dogs can also cause considerable damage to property at airports. Coyotes and feral dogs venture onto airfields and become a direct threat to planes both landing and taking off. Twelve coyote strikes with aircraft in Pennsylvania have been reported in the FAA strike database since 1990. None of the twelve strikes have damage associated with the strike incident. This omission could be that there was no damage or because the cost of the damage was not known at the time and was never entered after the initial strike report. Not all documented strikes have corresponding damage costs associated (FAA Wildlife Strike Database 2015). Though no feral dogs have been reportedly struck by aircraft at Pennsylvania airports, the potential for an aircraft strike with a feral dog exists.

1.2.4 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. Coyotes 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 (Koenen et al. 1996, Mabee 1997). Mammalian species like the Northern flying squirrel (*Glaucomys sabrinus macrotis*, state endangered) and Allegheny woodrat (*Neotoma magister*, state threatened) may be prey for coyotes.

1.3 DECISION TO BE MADE

This EA evaluates the environmental impacts of alternatives for WS involvement in coyote and feral dog 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 and PDA 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 coyote and feral dog damage in Pennsylvania?

- Would the proposed action have significant impacts on the quality of the human environment requiring preparation of an Environmental Impact Statement (EIS)?

1.4 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

1.4.1 Actions Analyzed

This EA evaluates coyote and feral dog damage management by WS to protect property, agricultural resources, natural resources, and public health and safety in Pennsylvania wherever such management is requested.

1.4.2 Site Specificity

This EA analyzes the potential impacts of coyote and feral dog 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. Coyotes and feral dogs addressed in this EA can be found statewide and are active throughout the year; therefore, damage or threats of damage can occur wherever they occur. Planning for the management of coyote and feral dog 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 coyote and feral dog damage and the resulting management actions occurs and are treated as such.

Chapter 2 of this EA identifies and discusses issues relating to coyote and feral dog 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 and Standard Operating Procedures (SOPs) described in this EA, as well as relevant laws and regulations.

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

1.4.3 Public Involvement

Issues related to coyote and feral dog damage management as conducted by WS 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 Patriot News, through the APHIS stakeholder registry to parties that have been identified to have an interest in the reduction of threats and damage associated with predators in the state, and by posting the EA on the APHIS website at http://www.aphis.usda.gov/wildlifedamage/nepa.

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: 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. Since activities conducted under the previous EA will be re-evaluated under this EA to address the new need for action and the associated affected environment, the previous EA will be superseded by this analysis and the outcome of the Decision issued.

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 and is not included in the Pennsylvania coyote and feral dog damage management EA. However, potential impacts on coyotes and feral dogs anticipated in the rabies management EA have been included in the Pennsylvania coyote and feral dog damage management EA to assess cumulative impacts of program actions.

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

1.6 AUTHORITY AND COMPLIANCE

1.6.1 Wildlife Services Legislative Authority

The primary statutory authority for the WS program is 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). The WS program is the lead federal authority in managing damage to agricultural resources, natural resources, property, and threats to human safety associated with wildlife. WS' directives define program objectives and guide WS' activities in managing wildlife damage.

1.6.2 Pennsylvania Game Commission Legislative Authority

The PGC is an independent Commonwealth agency comprised of eight commissioners appointed by the Governor and approved by the Legislature. 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. By law, it is the duty of the commission to protect, propagate, manage and preserve the game or wildlife of Pennsylvania. 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. PDA's Bureau of Dog Law Enforcement handles issues including dog licensing, dangerous dogs, stray/feral dogs, and reimbursements for loss or damage.

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. 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): Under the ESA, all federal agencies will seek to conserve T&E species and will utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the United States Fish and Wildlife Service (USFWS) to use the expertise of the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency will use the best scientific and commercial data available*" (Sec.7 (a)(2)).

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.

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 WDM 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.

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, 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 coyote and feral dog damage, such as disease concerns and 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 coyote and feral dog 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 (FDA).

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; the Western Wildlife Health Committee (WWHC) of the Western Association of Fish and Wildlife Agencies has recommended that suitable identification markers include durable ear tags, neck collars, or other external markers that provide unique identification (WWHC 1999). 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.

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

Populations of bald eagles showed periods of steep declines in the lower United States during the early 1900s attributed to the loss of nesting habitat, hunting, poisoning, and pesticide contamination. To curtail declining trends in bald eagles, Congress passed the Bald Eagle Protection Act (16 USC 668) in 1940

prohibiting the take or possession of bald eagles or their parts. The Bald Eagle Protection Act was amended in 1962 to include the golden eagle and is now referred to as the Bald and Golden Eagle Protection Act. Certain populations of bald eagles were listed as *"endangered"* under the Endangered Species Preservation Act of 1966, which was extended when the modern Endangered Species Act (ESA) was passed in 1973. The *"endangered"* status was extended to all populations of bald eagles in the lower 48 States, except populations of bald eagles in Minnesota, Wisconsin, Michigan, Washington, and Oregon, which were listed as *"threatened"* in 1978. As recovery goals for bald eagle populations began to be reached in 1995, all populations of eagles in the lower 48 States were reclassified as *"threatened"*. In 1999, the recovery goals for populations of eagles had been reached or exceeded and the eagle was proposed for removal from the ESA. The bald eagle was officially de-listed from the ESA on June 28, 2007 with the exception of the Sonora Desert bald eagle population. Although officially removed from the protection of the ESA across most of its range, the bald eagle is still afforded protection under the Bald and Golden Eagle Protection Act.

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

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.0 INTRODUCTION

Chapter 2 contains a discussion of the issues relevant to development and comparison of coyote and feral dog damage management 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, coyotes and feral dogs discussed in this analysis can be found in any location within the state where suitable habitat exists for foraging and shelter. Consequently, damage or threats of damage caused by coyotes and feral dogs can occur statewide in Pennsylvania wherever they occur. However, coyote and feral dog 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, WDM activities could be conducted on federal, state, municipal, and private properties. 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 can cause damage to structures, dikes, ditches; public and private properties in rural/urban/suburban areas where coyotes and feral dogs can cause damage to landscaping and natural resources, property, and pose risks to human safety. The area would also include airports and military airbases where coyotes and feral dogs are a threat to human safety and to property; and public property where coyotes and feral dogs 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.

Coyotes and feral dogs 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 species such as escaped domestic species such as feral dogs belongs to PDA.

Usually, when a non-federal entity (e.g., agricultural producers, municipalities, counties, private companies, or individuals) takes a WDM 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 WDM 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 WDM methods from the PGC, 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 coyote and feral dog populations
- Effects on other wildlife species, including threatened and endangered species
- Effects on human health and safety
- Humaneness and animal welfare concerns

2.2.1 Effects on Target Coyotes and Feral Dogs

A common issue with WDM is whether damage management actions would adversely affect the populations of target coyote or feral dog populations. 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 coyotes or feral dogs

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 population sizes 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 removal (killing) of coyotes and feral dogs 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

The issue of non-target species effects, including effects on T&E species arises from the use of non-lethal and lethal methods identified in the alternatives. The use of non-lethal and lethal methods has the potential to inadvertently disperse, capture, or kill non-target wildlife. Concerns have also been raised about the potential for adverse effects to occur to non-target wildlife from the use of chemical methods. 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, as required, to ensure compliance with the ESA and to ensure that *"any action authorized, funded or carried out by such an agency...is not likely to jeopardize the continued existence of any endangered or threatened species…Each agency shall use the best scientific and commercial data available"* [Sec. 7(a)(2)]. 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. Procedures for compliance with the ESA provided by the USFWS are further discussed in Chapter 4.

There may also be concerns that WS' activities could result in the disturbance of eagles that may be near or within the vicinity of WS' activities. Under 50 CFR 22.3, the term "*disturb"*, as it relates to take under the Bald and Golden Eagle Act, has been defined as "*to agitate or bother a Bald and Golden Eagles to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."* The environmental consequences evaluation conducted in Chapter 4 of this EA will discusses the potential for WS' activities to disturb eagles as defined by the Act.

2.2.3 Effects of Damage Management Methods on Human Health and Safety

An additional issue often raised is the potential risks to human safety associated with employing methods to manage damage caused by target species. Both chemical and non-chemical methods have the potential to have adverse effects on human safety. WS' employees use and recommend only those methods which are legally available, selective for target species, and are effective at resolving the damage associated with wildlife. Still, some concerns exist regarding the safety of WDM methods despite their legality. As a

result, WS will analyze the potential for proposed methods to pose a risk to members of the public or employees of WS. 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 WDM 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 coyotes and feral dogs 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.

2.2.4 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 but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate damage management for societal benefits could be compatible with animal welfare concerns, if *"…the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."*

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

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

Stress has been defined as the effect of physical, physiologic, or emotional factors (stressors) that induce an alteration in an animal's base or adaptive state. Responses to stimuli vary among animals based on the animals' experiences, age, species and current condition. Not all forms of stress result in adverse

consequences for the animal and some forms of stress serve a positive, adaptive function for the animal. Eustress describes the response of animals to harmless stimuli which initiate responses that are beneficial to the animal. Neutral stress is the term for response to stimuli which have neither harmful nor beneficial effects to the animal. Distress results when an animal's response to stimuli interferes with its well-being and comfort (AVMA 2013).

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

2.3 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. 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. 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 Coyote and Feral Dog Damage Should be Managed by Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce coyote and feral dog 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. 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. This EA addresses impacts for managing damage and threats to human safety associated with coyotes and feral dogs to analyze individual and cumulative impacts, provide a thorough analysis of other issues relevant to coyote and feral dog damage management, 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 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 coyotes and feral dogs 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.

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 coyotes and feral dogs. As described in Appendix C, the lethal removal of coyotes and feral dogs 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 coyotes and feral dogs by WS using firearms occurs primarily from the use of rifles. However, the use of shotguns could be employed to lethally take some species. Coyotes and feral dogs that are removed using rifles would occur within areas where retrieval of all coyote and feral dog 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 animal carcasses would greatly reduce the risk of scavengers ingesting or being exposed to lead that may be contained within the carcass.

Deposition of lead into soil could occur if, during the use of a rifle, the projectile passes through an animal, if misses occur, or if the animal 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 coyotes 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). Take of feral dogs that are depredating on livestock or chasing wildlife is permitted by the PDA and PGC. Consequently, WS' assistance with removing coyotes and feral dogs 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 coyote or feral dog 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

WS' coyote and feral dog damage management program is not conducted to eradicate native wildlife populations. WS 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 animals 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-wildlife species like feral dogs are likely to be beneficial because non-wildlife species disrupt ecosystems and compete for resources with native wildlife.

2.3.8 Effects of Coyote and Feral Dog Damage Management Activities on the Regulated Harvest of Coyotes

Some individuals are concerned that damage management activities conducted by WS would affect the ability of persons to harvest coyotes during the regulated hunting and trapping seasons either by reducing local populations through the lethal removal of coyotes or by reducing the number of coyotes present in an area through dispersal techniques. The only species that is addressed in this EA that can be hunted or trapped during regulated seasons in Pennsylvania is the coyote. There is no regulated hunting or trapping season for feral dogs in Pennsylvania.

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 coyote damage management 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' WDM activities would often be conducted in areas where hunting access is restricted (e.g., airports, commercial/industrial sites) or has been ineffective. The use of non-lethal (pyrotechnics) or lethal methods often disperses coyotes from areas where damage is occurring to areas outside the damage area which could serve to move coyotes 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.

2.3.10 Effects on Aesthetics

Wildlife is generally 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. Some members of the public have expressed concerns that MDM could result in the loss of aesthetic benefits to the public, resource owners, or local residents. Aesthetics is the philosophy dealing with the nature of beauty or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

WS operational activities occur on a relatively limited portion of the total area in Pennsylvania. In localized areas where WS removes some portion of coyote populations, dispersal of animals from adjacent areas typically contributes to the repopulation of the area within a few weeks to a year, depending on the level of removal and the species' local abundance. Coyotes are relatively abundant across the state. The likelihood of viewing coyotes may be temporarily reduced, but would not be noticeable in most cases. Impacts to coyote populations would be relatively low under any of the alternatives being considered in this EA, and opportunities to view, hear, or see coyotes would still be available over the vast majority of the accessible land in Pennsylvania since WS conducts operations on a small percentage of land.

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 coyote and feral dog 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 Coyote and Feral Dog 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 coyotes and feral dogs in Pennsylvania. Under this alternative, WS, in consultation with the PGC and PDA, 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 coyotes and feral dogs, 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, PDA, 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 coyotes and feral dogs, 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 coyote and feral dog damage management methods and is consistent with landowner/manager management objectives. 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.

Technical Assistance Recommendations

Under the proposed action, WS would provide technical assistance to those persons requesting wildlife damage management assistance as part of an integrated approach to managing damage. Technical assistance would occur as described in Alternative 2 of this EA.

Operational Damage Management Assistance

Operational damage management assistance includes damage management activities that are directly conducted by or supervised by personnel of WS. Operational damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone and there is a written MOU, cooperative service agreement, or other comparable document between WS and the entity requesting assistance. 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 chemicals are necessary or if the problems are complex.

Educational Efforts

Education is an important element of 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. In addition to the routine dissemination of recommendations and information to individuals or organizations, WS provides lectures, courses, and demonstrations to producers, homeowners, state and municipal agents, colleges and universities, and other interested groups. Cooperating agencies frequently cooperate with other entities in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that 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 unit of WS by providing scientific information and the development of methods that are effective and environmentally responsible. Research biologists with the NWRC work closely with wildlife managers, researchers, and others to develop and evaluate wildlife damage management techniques. NWRC biologists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

WS' Decision Making Procedures

WS' personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model (Figure 3.1) and described by Slate et al. (1992). WS' personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for effectively reducing damage. WS' personnel assess the problem and then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a damage 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, most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions, including WS.

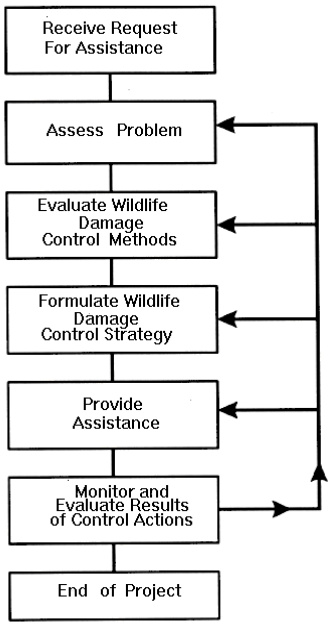

Figure 3.1 WS Decision Model as presented by Slate et al. (1992) for developing a strategy to respond to a request for assistance with human-wildlife conflicts.

3.1.2 Alternative 2: 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 large cage traps). 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. WS 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 regularly provides technical assistance to individuals, organizations, and other federal, state, and local government agencies for managing coyote and feral dog damage. Between FY 2009 and FY 2014, Pennsylvania WS conducted 165 technical assistance projects that involved coyotes or feral dogs 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 coyote or feral dog 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.

3.1.3 Alternative 3: No Coyote and Feral Dog Damage Management Conducted by WS

Under this alternative, WS would not be involved with any aspect of coyote or feral dog damage management. Information on coyote and feral dog damage management methods would still be available to producers and property owners through other sources such as the PGC, Penn State University Extension Service offices, or pest control organizations. Currently, the PGC only provides direct coyote and feral dog damage management assistance in limited situations, but does provide technical assistance. They also issue permits for coyote damage management 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.

Persons experiencing damage caused by coyotes and feral dogs could continue to resolve damage by employing those methods legally available. All methods described in Appendix C except for Compound 1080 would be available for use by persons experiencing damage or threats from those 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 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:

3.2.1 Lethal Coyote and Feral Dog Damage Management Only By WS

Under this alternative, WS would not use or recommend any non-lethal coyote and feral dog damage management methods, but would only conduct lethal coyote and feral dog damage management. This alternative was eliminated from further analysis because some coyote and feral dog 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.

3.2.2 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 coyotes and feral dogs. 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 coyote and feral dog 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.

3.2.3 Compensation Only for Coyote and Feral Dog Damage Losses

WS does not have a program to reimburse Pennsylvania residents for losses by coyotes or feral dogs. The PGC does not have a reimbursement program to compensate Pennsylvania residents for losses due to coyote predation. The PDA does have a reimbursement program to compensate Pennsylvania residents for losses due to feral dogs and coyotes. A person may submit a claim to the Bureau of Dog Law Enforcement for reimbursement for damage to a domestic animal by a dog or coyote, if the damage occurs when the domestic animal is confined in a field or other enclosure, the damage was not caused by a dog owned or housed by the owner of the damaged domestic animal, and the owner of the offending dog is unknown. A person must file a written, signed complaint within five business days of the discovery of the damage with the State Dog Warden. The PDA Bureau of Dog Law enforcement investigates the claim and either issues a dismissal of the complaint or a damage award. The reimbursement amount is limited to no greater than $10,000 for each domestic animal. Claims will not exceed $20,000 annually for damage caused by a coyote (PDA 2015).

Reimbursement provides producers monetary compensation for losses, however it does not remove the problem nor does it assist with reducing future losses. This alternative was eliminated from further analysis because it is not financially feasible or practical for WS to provide compensation for all coyote or feral dog damage. There is not any federal law that authorizes compensation to address coyote or feral dog damage in Pennsylvania.

3.2.4 Bounties

Payment of funds (bounties) for killing some predators 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, D'Angelo 2014). WS concurs with those agencies and wildlife professionals because of several inherent drawbacks and inadequacies in the payment of bounties. Although a few states such as Utah currently have a bounty program on coyotes, bounties are often ineffective at controlling damage over a wide area, such as the entire commonwealth 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.

3.2.5 Fertility Control of Coyote Populations

Fertility control of coyote populations may include surgical sterilization (vasectomies or tubal ligations), endocrine regulation (steroids, GnRH [gonadotropine-releasing hormone], antiprogestins), and immunocontraception. Endocrine regulation agents are designed to control hormone levels and regulate fertility in vertebrate species. Immunocontraception uses an individual's own immune system to disrupt reproduction. Although these fertility control methods have shown promise, they can be costly and with the exception of sterilization, need to be administered (boosted) regularly to maintain effectiveness.

Many hurdles must be overcome before fertility control becomes a viable wildlife management control alternative. These include, but are not limited to, the development of contraceptive agents that are orally deliverable, species specific, reversible, have few side-effects, and are cost effective (Sanborn et al. 1994).

Fertility control is still in the developmental stages and the full effects on wildlife populations and cost effectiveness is being evaluated. The NWRC is evaluating the effects of fertility control on coyote populations. Preliminary findings indicate that surgically sterilized coyotes maintain pair bonds, defend territories, and kill significantly fewer sheep than unsterilized coyotes. Furthermore, coyotes given multiple porcine zona pellucida (PZP, an immunosterilant) injections are immunologically sterilized and continue to maintain pair-bonds and successfully defend territories in pen tests. These results are promising; however, immunosterilization was not permanent and could break down, allowing previously sterile females to produce offspring. In addition, the effectiveness of surgical sterilization was only cost efficient when it involved 1-3 packs of coyotes (Bromley and Geese 2001).

Fertility control could not be attempted without a permit (research or otherwise) from the PGC. A representative for the PGC stated that fertility control and sterilization are not practical or effective methods to control coyotes (Matt Lavallo, PGC Furbearer Biologist, Personal Communication 5/19/15). Fertility control also may affect the genetics of a population over a large area.

Because these management techniques are still in the preliminary stages and researchers do not fully understand the effects on wildlife populations, considering fertility control to reduce coyote damage in Pennsylvania would be precipitous and premature. The Pennsylvania WS program will keep updated on new findings with regards to fertility control use on coyote populations and will consider use of these methods if they become feasible for controlling coyote damage in Pennsylvania.

3.3 STANDARD OPERATING PROCEDURES (SOPs) FOR COYOTE AND FERAL DOG 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.

Target, Non-target, and Threatened and Endangered Species

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

- WS has determined that implementations of methods listed in Appendix C would have no effect on any federally or state listed T&E species.

- Research is being conducted to improve WDM 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 WDM 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 WDM that have undergone rigorous research to prove their safety and lack of serious effects on non-target animals and the environment.

- 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.

- Traps, cable restraints 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 feral dogs that can be identified as a pet will be released to its owner or as otherwise directed by PDA.

- Captured feral dogs that are not identified as a pet will be transferred to PDA or as otherwise directed by PDA.

- Wolf-hybrid dogs captured by WS will be transferred to a licensed wolf sanctuary or as directed by an authorized agency.

- Feral dogs that are predating on livestock or big game or threatening human health and safety will be euthanized by WS using an approved AVMA method.

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

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

Health and Safety

- 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 the materials.

- WS uses WDM 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 livestock protection collars (LPC's), foothold traps, cable restraints, snares, or rotating jaw (conibear-type) traps are in use.

- WS' employees would follow WS Directive 2.430 and approved procedures outlined in WS' Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs.

- 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 WDM 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 PDA and the PGC in WS Special Use Permit.

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

Humaneness and Animal Welfare Concerns of Methods Used

- All WS actions are conducted in accordance with applicable state, federal and local laws, including regulations mandating that land traps set for coyotes and feral dogs 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.

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

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

Cumulative Effects: 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.

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, PDA and the PGC.

4.1.1 Effects on Target Species Populations

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

A common issue is whether damage management actions would adversely affect the populations of target species, especially when lethal methods are employed. Alternative 1 addresses requests for assistance received by WS through technical and operational assistance where an integrated approach to methods would be employed and/or recommended.

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

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

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

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

Generally, WS only conducts damage management on species whose population densities are high or concentrated and usually only after they have caused damage. Table 4-1 identifies average annual lethal take of animals by WS by federal FY, proposed maximum annual WS take by calendar year, and estimated annual harvest by hunters and trappers within Pennsylvania FY2008 to FY2013. No significant indirect effects were identified for this issue.

Table 4-1. Average annual Pennsylvania WS lethal take of coyotes and feral dogs addressed in this EA for the period for FY09 to FY14.

Species	Average Annual WS Take FY09-FY14[1]	Maximum Proposed WS Annual Take[1]	PA Statewide Average Annual Estimated Season Harvest 2008-2013[2]	% WS Proposed Annual Take compared to Average Annual PA Harvest
Coyote	14.7	100	32,335	0.31%
Feral Dog	0	5	NA	NA

[1] Includes only lethal take.

[2] Annual harvest reports from PGC website for six harvest seasons, July 1, 2008 to June 30, 2014.

Coyote

Coyotes inhabit all counties throughout Pennsylvania and continue to expand their range into suburban and urban areas of the commonwealth. Coyotes are a regulated game species in Pennsylvania and the PGC has established liberal seasons for the legal harvest of this species. Although there are no population estimates for coyotes in Pennsylvania, the PGC allows for an unlimited harvest of coyotes throughout the entire year. This is indicative of the significant coyote population. The estimated annual average harvest of coyotes from 2008-2013 was 32,335 (Table 4-1). In 2014, 52,822 hunters and trappers harvested 31,675 coyotes in Pennsylvania (Johnson 2015).

WS estimates that no more than 100 coyotes may be removed per year for coyote damage management. This maximum estimated removal by WS is 0.31% of the estimated annual harvest by hunters. Almost all of the coyotes would be removed from airport, commercial/industrial or agricultural habitats where hunting is not likely to occur. Coyote damage management activities would target single coyotes or local

populations at sites where their presence was causing unacceptable damage to agriculture, human health or safety, natural resources, or property. Given the increasing populations of coyotes 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 coyotes would have no significant impacts on overall coyote populations. Additionally, WS limited take combined with the annual hunter harvest and other forms of mortality would not significantly contribute to cumulative adverse effects on coyote populations.

Feral Dog

WS Directive 2.340 defines feral dogs as an ownerless or homeless dog and a free-ranging dog as a dog that is not under its owner's control. Hybrid dogs are defined as a canid that is a progeny of a domestic dog and a wild canid (e.g., wolf, coyote). The PDA is responsible for the management of feral or free-ranging domestic animals including dogs. Dogs are required by the PDA to be licensed by their owner annually and be under control of their owner and not allowed to run at-large. The PDA Bureau of Dog Law Enforcement consists of one dog warden for each of the 67 counties. It is unknown how many feral dogs may be running at-large. Since it is illegal for a dog to run at-large, it is accepted that all feral dogs running at-large should be managed. WS limited take of five feral dogs statewide annually would not significantly contribute to direct or cumulative adverse effects on feral dog populations.

Summary

Evaluation of WS' activities relative to wildlife populations indicate that program activities will likely have no significant cumulative 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.

4.1.1.2 Alternative 2: Technical Assistance Only

Under this alternative, WS would have no significant indirect, direct, or cumulative impact on coyote and feral dog populations because WS would not conduct any operational coyote and feral dog damage management 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 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 coyote and feral dog damage management. However, cumulative impacts would still be insignificant. 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 coyote and feral dog damage management 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 3). Overall impacts on target species populations would be similar to 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 coyote and feral dog populations would be adversely impacted by implementation of this alternative.

4.1.1.3 Alternative 3: No Federal WS Coyote and Feral Dog Damage Management

Under this alternative, WS would have no significant indirect, direct, or cumulative impact on coyote and feral dog populations in the state. Private efforts to reduce or prevent depredations would likely 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 coyote and feral dog damage management. However, cumulative impacts would still be insignificant. Impacts on target species are likely to be similar to Alternative 1. Because resource owners/managers would not have access to WS direct coyote and feral dog damage management assistance or, at least, technical assistance, the ability to reduce damage may be less than Alternatives 2. For the same reasons shown in the population effects analysis in section 4.1.1, it is unlikely that coyote and feral dog 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 Coyote and Feral Dog Damage Management Program (Proposed Action/No Action)

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

WS personnel are experienced and trained in wildlife identification and to select the most appropriate methods for taking targeted animals and excluding non-target species. To reduce the likelihood of capturing non-target wildlife, WS would employ the most selective methods for the target species, would employ the use of attractants that are as specific to target species as possible, and determine placement of methods to avoid exposure to non-targets. SOPs to prevent and reduce any potential adverse impacts on non-targets are discussed in Chapter 3 of this EA. Despite the best efforts to minimize non-target take during program activities, the potential for adverse impacts to non-targets exists when applying both non-lethal and lethal methods to manage damage or reduce threats to safety.

Direct, Indirect, and Cumulative Effects:
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., removing trees and shrubs at 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.

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. 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.

There is a risk of non-target species being taken whenever lethal control methods are employed to stop livestock predation. The PDA registered the Livestock Protection Collar (LPC) for use solely by WS personnel as a means of preventing adverse environmental effects. The use restrictions that accompany these pesticides are designed to prevent risks to the public and minimize the take of non-target animals while targeting the offending predator. Applicators must be specially trained and certified under FIFRA to use the LPC. LPC use is restricted to fenced pastures where coyote predation on sheep or goats has occurred. The LPC consists of two rubber reservoirs, each filled with about ½ oz. of a 1% solution of sodium fluoroacetate (Compound 1080), or about 152 mg of active ingredient in each reservoir. Each LPC has a collar serial number, which allows recordkeeping and inventory of individual units. The LPC, attached to the neck of a sheep or goat, dispenses the Compound 1080 solution when punctured by the bite of an attacking predator. The LPC is selective not only for the target species, but also for target individuals while they are exhibiting a particular behavior (biting the throat of a goat or sheep). Coyotes characteristically attack sheep and goats by grabbing the throat, whereas other wildlife and dogs attack the animal elsewhere on the body (e.g., dogs attack the flanks). As a result, very few dogs and non-target animals are taken to resolve depredations on pastured sheep and goats. The advantage of the LPC is its selectivity in eliminating only those individual predators that are responsible for attacking sheep and goats at the throat (Connolly 1978, Burns et al. 1988). Use of the LPC is best justified in areas with a high frequency of predation (i.e., at least one kill per week) or flocks of high value such as registered livestock.

Secondary poisoning risk is reduced because scavengers tend not to feed on the wool of the sheep's neck. In addition, the LPC is used in very limited situations, as specified on the label. WS' LPC records indicate only two incidents of exposure to domestic dogs of sodium fluoroacetate from an LPC, nationwide. There has been no non-target species taken by WS field use of the LPC since FY2002.

In most LPC projects, typically one of the LPC reservoirs is punctured, thus releasing only 152 mg of active ingredient into the environment. This is especially true for punctures not associated with predator attacks such as from barbed wire fence. Thus, in determining the potential environmental release potential from LPCs, WS considers the maximum potential amount of sodium fluoroacetate lost, but it is likely closer to half because most collars only have one reservoir damaged and not all contents from those damaged may be lost. The data summarizing the annual average number of LPCs damaged or lost, (132 or about 6% of the number placed) can be used to estimate the amount of sodium fluoroacetate exposed

to the environment. Each LPC contains about 300 mg of active ingredient equally divided between two bladders, the maximum possible average release nationwide by WS from these LPCs is 39.6 g or 0.0396 kg of active ingredient per year. During inspections, damaged collars are taken off the sheep and the collar and any contaminated wool are disposed according to label procedures.

Under this alternative, WS may use helicopters to remove coyotes. 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. When used for surveillance, helicopters are likely to make a single pass through an area on a given day. 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 contained in this report, 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.

During the migration period, eagles occur throughout the United States and parts of Mexico (Buehler 2000). Under the Bald and Golden Eagle Act, activities that could result in the "take" of eagles cannot occur unless the United States Fish and Wildlife Service allow those activities to occur through the issuance of a permit. Take could occur through purposeful take (e.g., harassing an eagle from an airport using pyrotechnics to alleviate aircraft strike hazards) or non-purposeful take (e.g., unintentionally capturing an eagle in a trap). Both purposeful take and non-purposeful take require a permit from the United States Fish and Wildlife Service (see 50 CFR 22.26, 50 CFR 22.27). In those cases where purposeful take could occur or where there is a high likelihood of non-purposeful take occurring, WS would apply for a permit for those activities.

However, routine activities conducted by WS' personnel under the proposed action alternative could occur in areas where bald eagles were present, which could disrupt the current behavior of an eagle or eagles that were nearby during those activities. As discussed previously, "take" as defined by the Bald and Golden Eagle Protection Act, include those actions that "disturb" eagles. Disturb has been defined under 50 CFR 22.3 as those actions that cause or are likely to cause injury to an eagle, a decrease in productivity, or nest abandonment by substantially interfering with their normal breeding, feeding, or sheltering behavior.

WS has reviewed those methods available under the proposed action alternative and the use patterns of those methods. The routine measures that WS conducts would not meet the definition of disturb requiring a permit for the non-purposeful take of bald eagles. The USFWS states, "Eagles are unlikely to be disturbed by routine use of roads, homes, or other facilities where such use was present before an eagle pair nesting in a given area. For instance, if eagles build a nest near your existing home, cabin, or place of business you do not need a permit" (USFWS 2012). Therefore, activities that are species specific and are not of a duration and intensity that would result in disturbance as defined by the Act would not result in non-purposeful take. Activities, such as walking to a site, discharging a firearm, or riding an ATV along a trail, generally represent short-term disturbances to sites where those activities take place. WS would conduct activities that were located near eagle nests using the National Bald Eagle Management Guidelines (USFWS 2007). The categories that would encompass most of these activities are Category D (Off-road vehicle use), Category F (Non-motorized recreation and human entry), and Category H (Blasting and other loud, intermittent noises). These categories generally call for a buffer of 330 to 660 feet for category D and F, and a ½-mile buffer for category H. WS would take active measures to avoid disturbance of bald eagle nests by following the National Bald Eagle Management Guidelines. However, other routine activities conducted by WS do not meet the definition of "disturb" as defined under 50 CFR 22.3. Those methods and activities would not cause injuries to eagles and would not substantially interfere with the normal breeding, feeding, or sheltering behavior of bald eagles.

A small number of non-target animals have been captured and killed by Pennsylvania WS (Table 4-2). This level of take does not significantly impact populations of these species. Muskrats, mink, beavers, raccoons, foxes, weasels, skunks, opossums, coyotes, fishers and bobcats can be harvested by licensed hunters and trappers, 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.

Table 4-2. Pennsylvania WS average non-target capture and take for FY2009-2014.

Species	Average Killed Annually	Average Annual Freed, Relocated, Transferred Custody
Feral Cats	0.5	18.1
Gray Fox	0	0.5
Red Fox	0	1
Fisher	0	0.3
Raccoon	0.7	3
Stripped Skunk	0.5	1.5
River Otter	0.5	0
Mink	0.2	0.2
Virginia Opossum	0.7	112.2
Groundhogs	0	19
Gray Squirrel	0.2	2
Fox Squirrel	0	0.3
Red Squirrel	0.3	0.3
Black (roof) Rat	0	0.2
Norway Rat	0.2	2.5
Muskrat	0	0.2
Eastern Cottontail	0.7	4.7
Northern Mockingbird	0	0.7
Song Sparrow	0	0.3
Sharp-shinned Hawk	0	0.5
House Wren	0	0.2
Gray Catbird	0	0.3
Ring-necked Pheasant	0.2	0
American Kestrel	0	0.8
Tree Swallow	0	0.3
Tufted Titmouse	0.2	0.2
Cooper's Hawk	0	0.5
Red-tailed Hawk	0	0.2
Northern Cardinal	0	0.2
Snapping Turtle	0	0.3
Painted Turtle	0	0.2

Summary

WS does not anticipate any adverse cumulative impacts on non-target species from the implementation of the proposed canine damage management methods. Based on the methods available to resolve canine damage and/or threats, WS does not anticipate the number of non-targets removed to reach a magnitude where declines in those species' populations would occur. Therefore, removal under the proposed action of non-targets will not create adverse cumulative effects on non-target species. LPCs are currently only available for use by WS employees; therefore, no significant adverse cumulative impacts are expected from the use of these chemicals due to no additional contribution of these chemicals into the environment from non-WS entities.

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 have no effect on those species listed in the Commonwealth by the USFWS and the National Marine Fisheries Services nor their critical habitats.

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 have no effect on 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, 2015).

4.1.2.2 Alternative 2: Technical Assistance Only

Under this alternative, WS would not conduct direct coyote and feral dog damage management 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.

Direct, Indirect, and Cumulative Effects:

Although technical support might lead to more selective use of control methods by private parties than that which might occur under Alternative 3, 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. While cumulative impacts would be variable, WS does not anticipate any significant cumulative impacts from this alternative.

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 coyote and feral dog damage management. 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 3 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.

4.1.2.3 Alternative 3: No Federal WS Coyote or Feral Dog Damage Management

Under this alternative, WS would not be directly involved with damage management activities. Therefore, no direct impacts to non-targets or T&E species would occur by WS under this alternative. Coyotes would continue to be harvested as prescribed by the PGC. Risks to non-targets and T&E species would continue to occur from those persons who implement damage management activities on their own or through recommendations by the other federal, state, and private entities. Although some risks occur from those that implement damage management in the absence of any involvement by WS, those risks are likely low and are similar to those under the other alternatives.

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

Effects on T&E species: WS will not have any direct impact on T&E species. Risks to T&E species from increased private efforts to address damage management problems will vary depending upon the training and level of experience of the individual conducting the coyote and feral dog damage management. 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 coyote and feral dog damage management 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 Alternative 1: Integrated Coyote and Feral Dog Damage Management Program (Proposed Action/No Action)

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

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

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

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

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

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

The use of restraining devices (*e.g.*, foot-hold traps, cage traps) and body-gripping traps have also been identified as a potential issue. Restraining devices and body-gripping traps are typically set in situations where human activity is minimal to ensure public safety. Restraining devices and body-gripping traps rarely cause serious injury and are triggered through direct activation of the device. Therefore, human safety concerns associated with restraining devices and body-gripping traps used to capture wildlife require direct contact to cause bodily harm. Again, restraining devices are not located in high-use areas to ensure the safety of the public and pets. Signs warning of the use of those tools in the area are posted for public view at access points to increase awareness that those devices are being used and to avoid the area, especially pet owners.

The issue of using chemical methods as part of managing damage associated with wildlife relates to the potential for human exposure either through direct contact with the chemical or exposure to the chemical from wildlife that have been exposed. Under the alternatives identified, the use of chemical methods would include immobilizing drugs, euthanasia drugs, fumigants, toxicants, and repellents. All WS' personnel who handle and administer chemical methods would be properly trained in the use of those methods. Training and adherence to agency directives would ensure the safety of employees applying chemical methods. Canines euthanized by WS or taken using chemical methods would be disposed of in accordance with WS Directive 2.515. All euthanasia would occur in the absence of the public to further minimize risks, whenever possible.

All WS' personnel who apply fumigants and toxicants registered with the EPA pursuant to the FIFRA and the PDA are licensed as commercial pesticide applicators. WS personnel are trained in the safe and effective use of fumigants and toxicants. Training and adherence to agency directives and label requirements would ensure the safety of both employees applying fumigants and toxicants and members of the public. To the extent possible, toxicants and/or canines taken with fumigants or toxicants by WS will be collected and/or disposed of in accordance with label requirements to reduce risk of secondary toxicity to people who may be exposed to them or attempt to consume them. As appropriate, WS would use signage and other means of notification to ensure the public is aware of fumigant or toxicant applications or applications sites, to ensure people, including children, are not exposed.

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

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

Euthanizing drugs would be administered under similar circumstances to immobilizing drugs under the relevant proposed alternatives. Euthanizing drugs would be administered to animals live-captured using other methods. Euthanized animals would be disposed of in accordance with WS Directives; therefore, would not be available for harvest and consumption. If canines were immobilized for sampling or translocation and released, risks could occur to human safety if harvest and consumption occurred.

Drugs used in capturing, handling, and euthanizing wildlife for wildlife hazard management purposes include ketamine, a mixture of ketamine and xylazine, sodium pentobarbital, potassium chloride, and Beuthanasia-D. Meeting the requirements of the Animal Medicinal Drug Use Clarification Act should prevent any significant adverse impacts on human health with regard to this issue. SOPs include:

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

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

The LPC containing sodium fluoroacetate (Compound 1080) and the Large Gas Cartridge which produces carbon monoxide are the only lethal chemicals registered for use in Pennsylvania. WS has used relatively small amounts of these chemicals annually. Regarding Compound 1080, the EPA stated in a petition response on January 16, 2009 that use consistent with the 1080 LPC product label does not result in significant environmental release of, or secondary exposure to, Compound 1080 (EPA 2009). The potential for any cumulative, direct or indirect effects from these pesticides are insignificant.

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 WS Flight Training Center and annual recurring training for all pilots.

The National Transportation Safety Board 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 2002). 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.

Direct, Indirect, and Cumulative Effects:
No adverse direct or indirect effects to human safety have occurred from WS' use of methods to alleviate predator damage since the inception of the program in Pennsylvania. The risks to human safety from the use of non-lethal and lethal methods, when used appropriately and by trained personnel, is considered low. No adverse direct effects to human health and safety are expected through the use of live-capture traps and devices or other non-lethal methods. Since WS personnel are required to complete and maintain firearms safety training, no adverse direct effects to human health and safety are expected as a result of the misuse of firearms by WS personnel. Additionally, all WS personnel are properly trained on all chemicals handled and administered in the field, ensuring their safety as well as the safety of the public. Therefore, adverse direct effects to human health and safety from chemicals used by WS are anticipated to be very low. The amount of chemicals used or stored by WS and cooperating agencies would be minimal to ensure human safety. No adverse indirect effects are anticipated from the application of any of the chemicals available for WS. WS does not anticipate any additional adverse cumulative impacts to human safety from the use of firearms when recommending that coyotes be harvested during regulated hunting seasons to help alleviate damage.

4.1.3.2 Alternative 2: Technical Assistance Only

Alternative 2 would not allow any direct operational coyote or feral dog damage management assistance by WS. Concerns about human health risks from WS's use of coyote and feral dog damage management methods would be alleviated because no such use would occur.

Direct, Indirect, and Cumulative Effects:
Private efforts to reduce or prevent damage would be expected to increase, possibly resulting in less experienced persons implementing damage management methods. However, because some of these private parties would be receiving advice and instruction from WS, concerns about human health risks from chemical coyote and feral dog damage management methods use should be less than under Alternative 3.

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 coyote or feral dog 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 Alternative 1. However, those risks are still believed to be insignificant.

4.1.3.3 Alternative 3: No Federal WS Coyote and Feral Dog Damage Management

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

Direct, Indirect, and Cumulative Effects:
Similar to Alternative 2, immobilizing drugs and euthanasia chemicals would not be available under this alternative to those persons experiencing damage or threats. However, fumigants, toxicants (excluding Compound 1080), and repellents would continue to be available to those persons with the appropriate pesticide applicators license. Since most methods available to resolve or prevent predator damage or threats are available to anyone, the threats to human safety from the use of those methods are similar between the alternatives. Habitat modification and harassment methods are also generally regarded as posing minimal adverse direct and indirect effects to human safety. Although some risks to safety are likely to occur with the use of pyrotechnics, propane cannons, and exclusion devices, those risks are minimal when those methods are used appropriately and in consideration of human safety. However, methods employed by those not experienced in the use of methods or are not trained in their proper use, could increase threats to human safety. Overall, the methods available to the public, when applied correctly and appropriately, pose minimal risks to human safety.

4.1.4 Humaneness and Animal Welfare Concerns of Methods Used

4.1.4.1 Alternative 1: Implement an Integrated Coyote and Feral Dog Damage Management Program (Proposed Action/No Action)

Coyote and feral dog damage management methods viewed by some persons as inhumane would be employed by WS under this alternative. Methods available under the proposed action could include non-lethal and lethal methods integrated into direct operational assistance conducted by WS. Under this alternative, non-lethal methods would be used by WS which are generally regarded as humane.

WS may use EPA registered and approved chemicals to manage damage caused by coyotes and feral dogs 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, coyotes and feral dogs would be killed by experienced WS personnel using the best and most appropriate method(s) available.

The AVMA states "... euthanasia is the act of inducing humane death in an animal" and that "...that if an animal's life is to be taken, it is done with the highest degree of respect, and with an emphasis on making the death as painless and distress free as possible" (AVMA 2013). Additionally, euthanasia methods should minimize any stress and anxiety experienced by the animal prior to unconsciousness." Although use of euthanasia methods to end an animal's life is desirable, as noted by the AVMA, "For wild and feral animals, many of the recommended means of euthanasia for captive animals are not feasible. In field circumstances, wildlife biologists generally do not use the term euthanasia, but use terms such as killing, collecting, or harvesting, recognizing that a distress- free death may not be possible" (AVMA 2007).

AVMA (2013) notes, "While recommendations are made, it is important for those utilizing these recommendations to understand that, in some instances, agents and methods of euthanasia identified as appropriate for a particular species may not be available or may become less than an ideal choice due to

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

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

Direct, Indirect, and Cumulative Effects:
The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology. Damage management 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 methods used to remove target animals, including shooting, result in a relatively humane death because the animals die instantly or within seconds to a few minutes. These methods however, are also considered inhumane by some individuals.

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

4.1.4.2 Alternative 2: Technical Assistance Only

The issues of humaneness of methods under this alternative are likely to be perceived to be similar to humaneness issues discussed under the proposed action. This perceived similarity is derived from WS' recommendation of methods that some consider inhumane. WS would not directly be involved with damage management activities under this alternative. However, the recommendation of the use of methods would likely result in the requester employing those methods. Therefore, by recommending methods and thus a requester employing those methods, the issue of humaneness would be similar to the proposed action.

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

4.1.4.3 Alternative 3: No Federal WS Coyote and Feral Dog Damage Management

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

Direct, Indirect, and Cumulative Effects:
The humaneness of methods would be based on the skill and knowledge of the person employing those methods. A lack of understanding of the target species or methods used could lead to an increase in situations perceived as being inhumane to wildlife despite the method used. Despite the lack of involvement by WS under this alternative, those methods perceived as inhumane by certain individuals and groups would still be available to the general public to use to resolve damage and threats caused by canines.

SUMMARY

No significant cumulative environmental impacts are expected from any of the three Alternatives. Under the Proposed Action, the lethal removal of coyotes and feral dogs by WS would not have significant impacts on overall coyote or feral dog populations in Pennsylvania, but some short-term local reductions may occur.

Some efforts to reduce damage cause by non-native species could result in elimination of the species from local areas. 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 coyote and feral dog damage management activities. There is a slight increased risk to public safety when persons who reject WS assistance and recommendations in Alternatives 1 and 2 conduct their own coyote and feral dog damage management activities, and when no WS assistance is provided in Alternative 3. In all three Alternatives, however, the increase in risk would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS's participation in coyote and feral dog damage management activities on public and private lands within Pennsylvania, the analysis in this EA indicates that WS' Integrated coyote and feral dog damage management program will not result in significant cumulative adverse impacts on the quality of the human environment.

APPENDIX A

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APPENDIX B
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APPENDIX C
COYOTE AND FERAL DOG DAMAGE MANAGEMENT METHODS

Resource owners and government agencies use a variety of techniques as part of integrated wildlife 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 WDM techniques. Coyote and feral dog 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 WDM efforts are not intended to reduce overall coyote or feral dog populations in the commonwealth or region, although in some instances, reduction of local population densities may be conducted to address site specific damage problems. 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 for coyotes 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 coyotes or feral dogs might hide, manipulating the surrounding environment to deter animals from entering a protected area or removal of trees and shrubs around pastures to reduce habitat for prey species.

Cultural methods for feral dogs may include animal husbandry, neutering, restraining dog, or penning dog in house or kennel. 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 animals 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 a frightening devices. Some devices used to modify behavior in coyotes and feral dogs may include:

- Electronic guards (siren/strobe-light devices)
- Propane exploders
- Pyrotechnics
- 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 structures can sometimes prevent coyotes and feral dogs from entering livestock pastures or airfields. Fencing, especially if it is installed with an underground skirt, can prevent access to areas for many mammal species which dig, including coyotes and feral dogs. Areas such as airports, yards or livestock pastures may be fenced. 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 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. Coyotes have been effectively excluded from electrified forest enclosures which provided refuge to white-tailed deer (Conner et al. 2016). 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 coyote or feral dog 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.

Relocation of damaging feral dogs and coyotes 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) 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 animals that might be a viable solution, such as when the animals 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.

WS may transfer custody of feral, free-ranging or hybrid dogs that were captured by WS to PDA dog warden, owner of feral dogs or to a licensed kennel or sanctuary.

Animal Capture Devices are used by WS specialists to capture feral dogs and coyotes. For reasons discussed above under "Relocation", small to medium sized mammals captured are usually killed via gunshot 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.

Cable restraints are traps made of light cable (e.g., 5/64, 3/32) with a locking device and are used to capture coyotes and feral dogs. The cable is placed in the path of an animal in the form of a loop that is secured to an anchoring system. 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 locks that permit tightening, but do not choke the animal. Cable restraints have a "break-away" device that will break away when a certain force is exerted on it allowing non-target animals (i.e., livestock) to escape unharmed (Phillips 1996). Cable restraints may also contain deer stops that allow the cable to close to a diameter of not less than 2 ½ inches and allow deer or other animals caught by the leg to escape.

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. Larger cage trap sizes can be used to capture feral dogs and coyotes.

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 feral dogs and coyotes.

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 of the target species. These traps may have offset steel, laminated or padded jaws, which hold the animal. Modifications will be implemented by WS to improve animal welfare and may include adding pan tension devices to exclude non-target animals, center swiveling to reduce injuries from twisting, and shock springs in the chain which anchors the trap to reduce lunging injuries. Jaws are without teeth and may have rubber pads attached. Jaws may be offset to keep them from coming together which reduce pressure on the animal's foot. WS personnel would use, as often as necessary, traps and trap anchoring methods proven to be humane according to the Best Management Practices (BMP) related to coyotes. If in the future new foothold traps or anchoring methods are designed, but not yet researched for the BMP process, WS may utilize the new foothold trap or anchoring method unless deemed inhumane by WS or a future BMP process. Non-target animals would be released unharmed.

Throw nets are used to catch small-medium sized animals when you can get in close proximity them. These nets are thrown by hand over the animal capturing the animal.

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

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 or one of the chemical euthanasia methods listed below. Other lethal mechanical methods are:

Neck Snares are traps made of light cable similar to cable restraints listed above but do not contain break-away devices or relaxing locks.

Shooting is selective for target species and may involve the use of spotlights, night vision, or thermal imagery to assist with positive identification of target species. A handgun, shotgun, or rifle may be utilized. Decoy dogs and predator calling may be used to enhance the effectiveness of shooting. Shooting is an effective method to remove a target number of coyotes and feral dogs 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 coyotes and feral dogs in damage situations pursuant to PGC & PDA authorization.

Aerial Shooting or aerial hunting (*i.e*., shooting from an aircraft) is a commonly used coyote damage management method; it can be especially effective in removing offending predators that have become "*bait-shy*" to trap sets or are not susceptible to calling and shooting. Aerial hunting consists of visually sighting target animals in the problem area and shooting them from an aircraft. Aerial hunting is mostly species-selective (there is a slight potential for misidentification) and can be used for immediate control to reduce livestock and natural resource losses 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 brush covered ground, timbered areas, steep terrain, or broken land where animals are more difficult to spot.

Cain et al. (1972) rated aerial hunting as "*very good*" in effectiveness for problem solving, safety, and lack of adverse environmental impacts. Wagner (1997) and Wagner and Conover (1999) found that aerial hunting might be an especially appropriate tool as it reduces risks to non-target animals and minimizes contact between damage management operations and recreationists. They also stated that aerial hunting was an effective method for reducing livestock predation and that aerial hunting three to six months before sheep are grazed on an area was cost-effective when compared with areas without aerial hunting. Good visibility and relatively clear and stable weather conditions are required for effective and safe aerial hunting. Summer conditions limit the effectiveness of aerial hunting as heat reduces coyote activity and visibility is greatly hampered by vegetative ground cover. Air temperature (high temperatures), which influences air density affects low-level flight safety and may restrict aerial hunting activities. In broken timber or deciduous cover, aerial hunting is more effective in winter when snow cover improves visibility and leaves have fallen or in early spring before the leaves emerges. 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. Ground crews are often used with aerial operations for safety reasons. Ground crews can also assist with locating and recovering target animals, as necessary.

Hunting dogs are sometimes trained and used for coyote damage management to alleviate livestock depredation (Rowley and Rowley 1987, Coolahan 1990). Trained dogs are used primarily to find a coyotes and dens and to pursue or decoy problem animals. Dogs could be essential to the successful location of coyote sign (tracks, hair, or droppings).

Denning is the practice of finding predator dens and eliminating the young, adults, or both to stop an ongoing predation problem or prevent future depredation on livestock. Till and Knowlton (1983) documented denning's cost effectiveness and high degree of efficacy in resolving predation problems due to coyotes killing lambs in the spring. Coyote depredations on livestock often increase in the spring and early summer due to the increased food requirements associated with feeding and rearing

litters of pups. Removal of pups will often stop depredations even if the adults are not taken (Till 1992). Pups are typically euthanized in the den using a registered gas fumigant cartridge.

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 and other damage causing mammals. See the *Pennsylvania Digest of Hunting and Trapping* regulations (2013-2014) provided by the PGC for more information on seasons and regulations.

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 PDA 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 Fluoroacetate (Compound 1080) has been a subject of wide research in the United States and elsewhere and has been widely used for pest management in many countries. Sodium fluoroacetate is a chemically stable, non-volatile compound and is relatively insoluble in most organic solvents. Fluoracetic acid and related chemicals occur naturally in plants in many parts of the world and are not readily absorbed through intact skin (Atzert 1971). Should sodium fluoroacetate spill to the soil during a predator attack, the compound is degraded by soil microorganisms and enzymes in plants. Sodium fluoroacetate is contained in two rubber bladders on a Livestock Protection Collar (LPC). LPC's come in two sizes and are fitted around a sheep or goats neck where coyotes typically attack. When a coyote bites the neck of the sheep or goat its teeth punctures the rubber bladders ingesting a lethal dose of sodium fluoroacete killing the coyote within five hours. The coyote will die a painless death from cardiac failure or central nervous system failure. The LPC's allow WS to selectively remove the coyote(s) causing predation to livestock. Only WS personnel that successfully pass an exam administered by the PDA and are certified by WS can apply LPC's containing sodium fluoroacete on livestock. Numerous restrictions apply to the use of LPC's and are specified in the EPA approved LPC technical bulletin which is part of the restricted use pesticide label. Secondary poisoning risk is reduced because scavengers tend to feed preferentially in the thoracic cavity and hind portion of the carcass, while sodium fluoroaceteate contamination would be primarily to the wool on the sheep's neck. Brown (1993) found vultures that fed on meat contaminated with sodium fluoroacetate showed no signs of having been poisoned. The use of the LPC would pose little likelihood of a dog being poisoned because they usually attack flanks and not the throat.

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.

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. Carbon monoxide euthanasia is recognized by the AVMA as an approved and humane method to euthanize animals (AVMA 2013).

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

[1]List obtained from < http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=PA&status=listed > on 3 March 2016

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 (15 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, 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

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

[1]List obtained from <http://www.naturalheritage.state.pa.us/HomePage.aspx> on 3 March 2016

Scientific Name	Common Name	Status
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
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		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 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
Dichanthelium polyanthes	Panic-grass	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
Lactuca hirsuta	Downy Lettuce	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
Morus rubra	Red Mulberry	N
Oenothera oakesiana	Evening-primrose	N
Omalotheca sylvatica	Woodland Cudweed	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

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
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	Dragon's Mouth	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	North American 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
Delphinium exaltatum	Tall Larkspur	PE
Diarrhena obovata	American Beakgrain	PE
Dicentra eximia	Wild Bleeding-hearts	PE
Dichanthelium scoparium	Velvety Panic-grass	PE
Dichanthelium xanthophysum	Slender 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 Bat	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
Parnassia glauca	Carolina Grass-of-parnassus	PE
Passiflora lutea	Passion-flower	PE
Paxistima canbyi	Canby's Mountain-lover	PE
Persicaria careyi	Carey's Smartweed	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
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 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
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

Dichanthelium commonsianum var. euchlamydeum	Cloaked Panic-grass	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
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	Tennessee Golden-rod	PR
Tipularia discolor	Cranefly Orchid	PR
Trautvetteria caroliniensis	Carolina Tassel-rue	PR
Trillium nivale	Snow Trillium	PR
Utricularia purpurea	Purple Bladderwort	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
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 Bat	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
Scaphiopus holbrookii	Eastern Spadefoot	PT
Scirpus pedicellatus	Stalked Bulrush	PT
Scleria pauciflora	Few Flowered Nutrush	PT
Sorex palustris punctulatus	West Virginia 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 parviflorum 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
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.