ENVIRONMENTAL ASSESSMENT

(Pre-Decisional)

Integrated Wildlife Damage Management of Coyotes and Feral Dogs in Pennsylvania

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ANIMAL AND PLANT HEALTH INSPECTION SERVICE
WILDLIFE SERVICES

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List of Acronyms

ADC	Animal Damage Control
APHIS	Animals and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BMP	Best Management Practices
BO	Biological Opinion
CEQ	Council on Environmental Quality
DCNR	Department of Conservation of Natural Resources
EA	Environmental Assessment
EJ	Environmental Justice
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GAO	U.S. General Accounting Office
IWDM	Integrated Wildlife Damage Management
LPC	Livestock Protection Collar
MBTA	Migratory Bird Treaty Act
MIS	Management Information System
MOU	Memorandum of Understanding
NASS	National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOA	Notice of Availability
NWRC	National Wildlife Research Center
PDA	Pennsylvania Department of Agriculture
PGC	Pennsylvania Game Commission
SOP	Standard Operating Procedure
T&E	Threatened and Endangered Species
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WCO	Wildlife Conservation Officer
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION

Across the United States, natural systems are being substantially altered as human populations expand and encroach on wildlife habitats. Human uses and needs often compete with wildlife for space and resources increasing the potential for conflicting human/wildlife interactions. In addition, segments of the public strive for protection for all wildlife; this protection can create localized conflicts between humans and wildlife activities. The *Animal Damage Control* (ADC) *Programmatic Final Environmental Impact Statement* (FEIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (USDA 1997a):

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

The United States Department of Agriculture (USDA) is authorized by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the USDA, Wildlife Services (WS) program is the *Act* of March 2, 1931, as amended (46 Stat. 1468; 7 U.S.C. 426-426b and 426c) and the Rural Development, Agriculture and Related Agencies Appropriations Act of 1988, Public Law 100-102, Dec. 27, 1987. Stat. 1329-1331 (7 U.S.C. 426c), and the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act of 2001, Public Law 106-387, October 28, 2000. Stat. 1549 (Sec 767). WS activities are conducted in cooperation with other Federal, state and local agencies; and private organizations and individuals. Federal agencies, including the United States Department of Interior, Fish and Wildlife Service (USFWS), recognize the expertise of WS to address wildlife damage issues.

Wildlife damage management, or control, is defined as the alleviation of damage or other problems caused by, or related to the presence of wildlife (Leopold 1933, The Wildlife Society 1990, and Berryman 1991). The WS program uses an Integrated Wildlife Damage Management (IWDM) approach (sometimes referred to as "Integrated Pest Management" or IPM) in which a series of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1, 1-7 of the ADC FEIS (USDA 1997a). These methods include the alteration of cultural practices as well as habitat and behavioral modification to prevent damage. The control of wildlife damage may also require that the offending animal(s) be removed or that localized populations of the

offending species be reduced through lethal methods. Potential environmental impacts resulting from the application of various wildlife damage reduction techniques are evaluated in this environmental assessment (EA). According to the Animal and Plant Health Inspection Service procedures implementing the National Environmental Policy Act (NEPA), individual actions may be categorically excluded [7 C.F.R. 372.5(c), 60 Fed. Reg. 6,000, 6,003 (1995)]. However, in order to evaluate and determine if there may be any potentially significant or cumulative impacts from the described control program, the Wildlife Services Program in Pennsylvania has decided to prepare this EA.

The purpose of this EA is to analyze the potential effects of an integrated coyote and feral dog damage management program in Pennsylvania. This analysis relies predominately on existing Federal and State agency publications, information contained in scientific literature, and communications with other wildlife professionals, including the ADC FEIS (USDA 1997a).

All control activities will be in compliance with relevant laws, regulations, policies, orders, and procedures, including the Endangered Species Act (ESA). Notice of availability (NOA) of this document will be made consistent with the Agency's NEPA procedures in order to allow interested parties the opportunity to obtain and review this document and comment on the proposed management activities.

1.1 WILDLIFE SERVICES PROGRAM

Wildlife Services (WS) is a cooperatively funded and service oriented program. Before any operational wildlife damage management is conducted, *Agreements for Control* or *WS Work Plans* must be completed by WS and the land owner/administrator. WS cooperates with private property owners and managers and with appropriate land and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable Federal, state, and local laws and Memorandum of Understandings (MOU) between WS and other agencies.

Wildlife Services' mission, developed through its strategic planning process, is: 1) to provide leadership in wildlife damage management for the protection of American agriculture, endangered and threatened species, and natural resources, and 2) to safeguard public health and safety (USDA 1997b). The WS Policy Manual reflects this mission and provides guidance for engaging in wildlife damage management through:

- close cooperation with other Federal and state agencies;
- training of wildlife damage management professionals;
- development and improvement of strategies to reduce losses and threats to publics from wildlife;
- collection, evaluation, and distribution of wildlife damage management information;
- cooperative wildlife damage management programs;
- informing and educating the public on how to reduce wildlife damage and;
- providing data and a source for limited-use management materials and equipment, including Federal and state registered pesticides.

1.2 SUMMARY OF THE PREFERRED ALTERNATIVE

Wildlife Services proposes is to implement an integrated coyote and feral dog damage management program in Pennsylvania to assist livestock producers in reducing losses to sheep, cattle, goats, pigs, poultry, and other livestock; entities with reducing pet losses and injury; and any other entities with human health or safety concerns. An IWDM approach would be implemented on all private and public lands of Pennsylvania where a need exists, assistance is requested from landowners or public officials, and funding is available. An IWDM strategy would be recommended and used, encompassing 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 would provide technical assistance and operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al.1992). Cooperators requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques. Most non-lethal methods are best implemented by the cooperator and the following methods may be recommended by WS: guard dogs, llamas, and donkeys; Electronic Predator Guard (Linhart et al. 1992); fencing; moving livestock to other pastures; birthing in buildings; night penning; habitat alteration; herders and scare devices. Additional methods used by WS, or recommended to producers may include shooting, calling and shooting, trapping, snares, dogs, Livestock Protection Collars, and gas cartridges. 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. All management actions comply with appropriate Federal, state, and local laws.

1.3 PURPOSE

The purpose of this EA is to analyze the effects of WS activities in Pennsylvania to reduce coyote (*Canis latrans*) and feral dog (*Canis familiaris*) predation to livestock (e.g., sheep, goats, cattle, pigs, horses) and poultry (e.g., chickens, turkeys, fowl) [referred herein collectively as livestock]; predation and injury to pets; and threats to human health or safety.

Biological carrying capacity is the land or habitat's limit for supporting healthy populations of wildlife without degradation to the animals' health or their environment over an extended period of time (Decker and Purdy 1988). Wildlife acceptance capacity, or cultural carrying capacity, is the limit of human tolerance for wildlife or the maximum number of a given species that can coexist compatibly with local human populations (Decker and Purdy 1988). These terms are especially important in urban areas because they define the sensitivity of a local community to a specific wildlife species. For any given damage situation, there will be varying thresholds by those directly and indirectly affected by the damage. This threshold of damage is a primary limiting factor in determining the cultural carrying capacity. While the Commonwealth of Pennsylvania has a biological carrying capacity that may support more than the current number of predators, the cultural carrying capacity is often much lower. In many cases when the cultural carrying capacity is reached or exceeded, improper and sometimes illegal

implementation of population control methods (e.g., illegal toxicants or unregulated trapping, shooting and snaring) may be used to alleviate predation to livestock and pets and human health or safety threats (Loker et al. 1999).

1.4 NEED FOR ACTION

1.4.1 History of Coyotes in Pennsylvania

Historically, the coyote was mainly restricted to the prairie regions west of the Mississippi River. It is thought that the coyote moved into northern and eastern Pennsylvania from New York's Catskill Mountains in the 1960s; from there, coyotes spread south and west across the state, perhaps augmented by individuals migrating east from Ohio (Fergus 2000). Today the coyote is found in nearly all of the continental United States and all Canadian provinces and territories (Boer 1992).

DNA studies show that the coyote interbred with the gray wolf in Canada during its eastward expansion. This hybridization accounts for the larger size of the eastern coyote, compared to its western counterpart. In Pennsylvania, adult coyotes are 48 to 60 inches long, including a 12- to 16-inch tail. Weights range from 35 to more than 60 pounds, with males larger and heavier than females (Fergus 2000). Coyotes look like slim German shepherds, with pointed, erect ears and a long, slender nose. The fur is coarse, dense, and long; the basically tan coat is sprinkled with rusty brown, black, and gray. Some coyotes are pale in color; others are dark. In most, a dark stripe runs down the back, and dark fur marks the front of each foreleg. The tip of the tail is black (Fergus 2000).

In the Northeast, coyotes live singly, in pairs, or in packs of three to eight. The usual grouping consists of two adults, some of their offspring, and subadults six to eighteen months of age who have not yet dispersed to find territories of their own. Adult males and females pair in a monogamous union for one to several years (Fergus 2000). An individual's home range may encompass 1 to 10 square miles. Coyotes in packs defend home territories; lone coyotes and pairs probably do not defend a home range.

Over 90% of a coyote's diet is flesh, animals caught and killed or found as carrion: small rodents, rabbits, snowshoe hares, muskrats, woodchucks, deer, domestic dogs and cats, livestock, birds, snakes, frogs, turtles, fish, crayfish, and insects (Fergus 2000).

Female coyotes have one heat, or estrus, per year. In Pennsylvania, this usually occurs in February. The gestation period is fifty-eight to sixty-three days. In April or May, the female seeks out a natal den, often on a brushy south-facing slope; she may enlarge a woodchuck, skunk, or fox burrow. Dens are a foot in diameter and up to 20 feet long. The female has four to eight pups; the average is six. The pups' eyes are closed, and they weigh about 9 ounces and are covered with woolly gray-brown fur. The male, and sometimes other members of the pack, bring food to the nursing female. The pups' eyes open after two weeks. In another week, they begin venturing out of the den. The pups are weaned at nine weeks. Young coyotes begin to leave the family group in early fall, when they are around six months old. Juveniles disperse 30 to 50 miles, with males

traveling further than females; some go as far as 100 miles. They achieve full size and weight by around nine months. Normally females do not breed until their second winter. Maximum life span in the wild is ten to twelve years; in captivity, coyotes have lived eighteen years (Fergus 2000).

The coyote population in Pennsylvania has grown rapidly, as evidenced by statewide hunter/trapper harvest statistics (Table 4.1). The estimated annual harvest of coyotes in Pennsylvania has grown from approximately five hundred in 1988 to over six thousand in 1994 and to approximately 11,444 in 2003 (USDA, unpublished). Coyotes are found throughout the commonwealth, with the largest concentrations in the northern and northeastern counties (Fergus 2000).

As coyote numbers increase, so have the concerns of hunters, trappers, farmers, and a variety of wildlife enthusiasts whose attitudes have ranged from complete protection to extermination. Wildlife managers are thus confronted with the challenge of developing appropriate management strategies and programs (Boer 1992).

1.4.2 The Pennsylvania Cooperative Livestock Protection Program

In August 2003, a meeting was held with representatives from state and federal agencies, elected officials, eight separate agriculture industry representatives, and the public to discuss economic loss and disease issues associated with wildlife on the agriculture industry in Pennsylvania. The wildlife species that the meeting focused around included Canada geese, European starlings, black vultures, and coyotes. It was during this meeting that a number of livestock producers expressed their frustration with the inability, regardless of methods they employed, to control coyote predation on their sheep and cattle.

During the meeting Pennsylvania WS was requested to describe integrated wildlife damage management approaches for solving problems associated with these species including coyotes. At the conclusion of the meeting, Pennsylvania Secretary of Agriculture, Dennis Wolff, formed a Cooperative Livestock Protection Program Committee from the core agencies represented including the [redacted], Pennsylvania Game Commission, Penn State Extension, USDA APHIS Wildlife Services, and Pennsylvania Department of Agriculture. The goal of the committee was/is to develop a proposed program for Pennsylvania, to create an action plan to implement the program, and to address legal and administrative items.

The Cooperative Livestock Protection Committee convened a meeting in October 2003, in response to the PA Department of Agriculture Secretary's request for information, tools, and options to address the problems of predation and other wildlife damage issues in Pennsylvania. The Committee adopted a plan that incorporates the principles of integrated wildlife damage management. The components of this plan include:

- Identify and utilize existing and new methods for control
- Pursue registration of the Livestock Protection collar in Pennsylvania
- Provide technical assistance and training to producers

- Increase producer and USDA APHIS WS involvement
- Increase communication between all parties
- Increase formal training to cooperating agencies
- Implement a full integrated livestock protection program
- Seek a variety of funding avenues to support the program
- Review laws that are relevant to the program
- Complete an Environmental Assessment according to NEPA guidelines

1.4.3 Need to Protect Livestock and Domestic Pets

In Pennsylvania, coyotes are non-indigenous, originally ranging in the short prairie regions of North America, but by the end of the 1900's they expanded their range eastward into Pennsylvania taking advantage of a niche left vacant when other large predators that were extirpated (Boer 1992). Today, coyotes are the primary predator of livestock in Pennsylvania, followed by dogs; however, historically, feral and free-roaming dogs had been the primary predator of livestock. Dog predators on livestock includes pet dogs and feral dogs. Some dogs kill or injure livestock, but will usually not feed upon livestock carcass. It is not uncommon for dogs to kill or injure many livestock in a relatively short period of time.

United States:

In 2000, National Agricultural Statistics Service (NASS) (2001) reported livestock inventories and values in the U.S. of 98,048,000 and $67 billion for cattle and calves, 7,026,000 and $668 million for sheep and lambs, 436,000 and $17 million for angora goats, and 59,407,000 and $4.3 billion for hogs and pigs, respectively.

Sheep and lamb losses from predators in the U.S. totaled 273,000 and $16.5 million during 1999 (NASS 2000). Coyotes accounted for 60.7% of these predator losses and dogs accounted for 15.1% of predator losses (NASS 2000). Similarly, cattle and calf losses from predators in the U.S. totaled 147,000 head and $51.6 million during 2000 (NASS 2001). Coyotes and dogs accounted for 64.6% and 17.7% of these predator losses, respectively. Coyotes were also the largest predator of goats, accounting for 35.6% of predator losses (NASS 2000). The value of goats lost from all predators was $3.4 million.

Farmers and ranchers throughout the United States spent $8.8 million on non-lethal methods to prevent predator loss of sheep and lambs. Another $1.0 million was spent on non-lethal predator controls for goats and kids (NASS 2000). Farmers and ranchers spent $184.9 million on non-lethal methods to prevent predator loss of cattle and calves (NASS 2001).

Eastern United States:

The majority of sheep production east of the Mississippi River is concentrated in New York, Pennsylvania, Virginia, West Virginia, and Ohio. Between 1990 and 1999, the percent inventory loss to coyote depredations of sheep/lambs in New York, Pennsylvania, Virginia, West Virginia, and Ohio nearly doubled, increasing from 0.53% of the inventory in 1990 to 0.97% of the inventory in 1999. In 1999, these losses were valued at

$404,948 (Houben 2004). Coyote depredations on lambs in New York and Pennsylvania have increased 88% between 1990 and 1999. This is a four fold increase compared to the 21% increase in lamb losses in Virginia, West Virginia, and Ohio during the same period (Houben 2004).

During the 1990's there was an overall rise in both the number of cattle/calves killed by coyotes and the percent of the inventory those depredations represent in the eastern United States. Between 1991 and 2000, the percent inventory loss of cattle/calves in the southern/eastern United States increased from 0.05% in 1991 to 0.11% in 2000. In 2000, these losses were valued at $10.1 million (Houben 2004). In the mid-Atlantic region (New York, Pennsylvania, West Virginia, Virginia, New Jersey, Maryland, Delaware, North Carolina, and South Carolina), cattle/calf depredation increased from almost immeasurable numbers to equal the national average between 1991 and 2000, reflecting the increase of coyote populations in this sub-region during the 1990's (Houben 2004).

Ohio, Virginia, and West Virginia have each had coyote depredation management programs since the 1990's. During 2000, WS Eastern Region programs received 874 requests from the public for technical assistance over coyote damage. The number of coyotes removed by WS Eastern Region programs increased from 72 in 1991 to 585 in 2000. This increased take of coyotes is reflective of both increased program field efforts and increases in coyote populations in the east. These two parameters further illustrate the increasing concern by the public over coyote depredations and need for assistance (Houben 2004).

WS annual reports and NASS surveys were used to determine the effectiveness of IWDM programs in managing livestock depredations in the East (Houben 2004). The Virginia and West Virginia WS expenditure for predator damage management to protect sheep in FY 1999 was $532,000. The total benefit ($1,413,905) of these programs would indicate a 2.66:1 benefit cost ratio (Table 1.1). This benefit is conservative, since the cost savings does not include projected losses to cattle and goats (Houben 2004). The marketing of the animals saved as a result of predation management, benefits many segments of the rural economy, and not just individuals involved in direct production. Jahnke et al. (1987) reported a three-fold economic multiplier effect for the benefits of predation management in Wyoming. If this multiplier is applied to the total value of sheep saved in Virginia and West Virginia, then the value of predation management to businesses not involved in direct agricultural production would be $4,241,715. The gross total benefit to all segments of the Virginia and West Virginia economy would be $5,655,620 (Houben 2004). The available evidence suggests that these programs are efficient and economical for the producers served. In New York, Pennsylvania, North Carolina, and South Carolina both sheep and cattle losses to coyotes appear to be reaching levels that will justify the creation on IWDM programs (Houben 2004).

Table 1.1. Savings attributed to USDA-APHIS-WS predation management programs in Virginia and West Virginia, calculated from statistics compiled by NASS (1999).

Sheep/Lambs	NASS Inventory	NASS Actual losses w/WS program (%)	NASS Projected losses w/out WS program (%)	Difference	Average 1999 $ value/head	Total Saved ($)
VA Sheep	65,000	400 (0.6)	3,705 (5.7)	3,305	$83	274,315
VA Lambs	50,000	1,500 (3.0)	8,750 (17.5)	7,250		601,750
WV Sheep	40,000	300 (0.7)	2,280 (5.7)	1,980		164,340
WV Lambs	36,000	1,800 (5.0)	6,300 (17.5)	4,500		373,500
TOTAL	191,000	4,000	21,035	17,035		1,413,905

Pennsylvania:

In 2002, Pennsylvania ranked 5th in sheep and lamb operations (2,600) and ranked 11th in cattle and calve operations (28,000) in the U.S. (NASS 2003). In 2002, the value of sales for livestock, poultry and their products was $2,715,039,000 (NASS 2002).

Reports of coyote-caused damage to livestock and domestic pets have been relatively stable since 1993. Sheep and poultry operations continue to report the greatest losses annually (Table 1.2) (Lovallo 2003). Reports of coyotes killing domestic dogs and cats are stable to increasing, particularly in the southwest and southeast regions of Pennsylvania. The majority of coyote complaints received by Wildlife Conservation Officers (WCO) are people expressing concern for pets, livestock, wildlife, or human safety issues (Lovallo 2003).

Table 1.2. Types and numbers of coyote-related complaints reported to Pennsylvania Wildlife Conservation Officers during 1993-2002(Lovallo 2003).

Survey Results	1993-94	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	Total
No. districts w/complaints	**42**	**44**	**60**	**47**	**63**	**61**	**58**	**58**	**433**
Nature of Complaints									
Concern for Cattle	8	19	27	8	12	11	11	11	107
Concern for Sheep	37	24	43	22	23	26	17	15	207
Concern for Goats	3	5	8	3	4	1	1	1	26
Concern for Poultry	16	5	13	12	17	14	15	15	107
Concern for Dogs	7	9	17	12	11	22	12	12	102
Concern for Cats	13	7	15	19	13	29	23	22	141
Afraid of Coyotes	71	86	114	69	114	126	114	115	809
Concern for Deer	89	52	41	49	47	57	29	28	392
Concern for Turkeys	23	13	10	14	10	18	6	5	99
Other	4	1	15	31	0	0	7	8	66
Total	271	221	303	239	251	304	235	232	2056
Coyote-caused Mortalities									

Cows	NA	3	1	0	0	1	0	0	5
Calves	2	8	9	3	7	8	5	5	47
Sheep	82	100	251	60	81	91	21	21	707
Goats	3	0	9	6	3	0	1	1	23
Poultry	112	27	51	43	52	44	49	48	426
Dogs	0	6	6	3	6	17	5	6	49
Cats	24	11	14	14	5	30	21	21	140
Rabbits	12	9	4	2	2	3	2	2	36
Deer	NA	10	3	5	5	9	10	10	52
Other	17	1	0	0	3	3	0	0	24
Total	252	175	348	136	164	206	114	114	1509

A second agency, in Pennsylvania, that receives complaints from the public about coyote and dog caused livestock damage is the Bureau of Dog Law Enforcement. The Bureau administers the Pennsylvania Dog Law of 1982, revised by Act 151 of 1996, to ensure the humane treatment of dogs and to reimburse owners of livestock, poultry and game birds damaged by dogs, as provided by law (the Bureau now reimburses for coyote caused damage as well). The number of damage claims and the amounts paid for those claims by The Bureau for coyote damage are likely underestimated because paid claims shall not exceed $20,000 per annum for coyote damages (Zerphey 1995). Also, the Bureau only tracks statistics for the indemnity payments, and does not have data on pets killed, nor livestock killed which was not reported for damage claims (Mary Bender, Director of The Bureau of Dog Law Enforcement, Personal Communication 5/4/04).

Between 1999 and 2003 there were a total of 233 dog damage claims and 306 coyote damage claims reported to the Bureau of Dog Law (Figure 1.1.). The dog damage claims totaled approximately $59,695 and the coyote damage claims totaled approximately $69,672 from 1999 to 2003. The Bureau paid more for coyote caused damage than for dog caused damage from 2000 to 2002 (Figure 1.2.) (Personal communication, Mary Bender, Director of The Bureau of Dog Law Enforcement 5/4/04).

Figure 1.1. Number of Damage Claims Received by The Bureau of Dog Law from 1999-2003 for Coyotes and Dogs in Pennsylvania

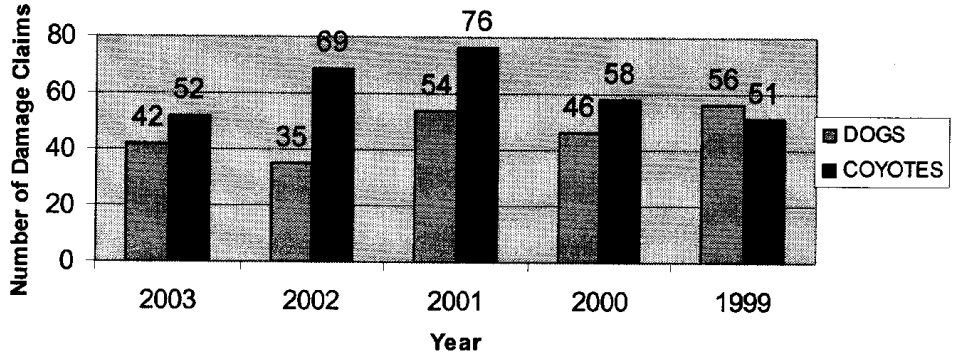
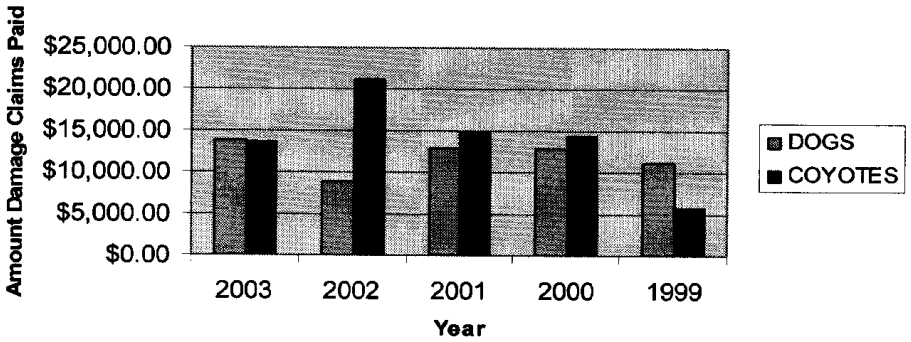
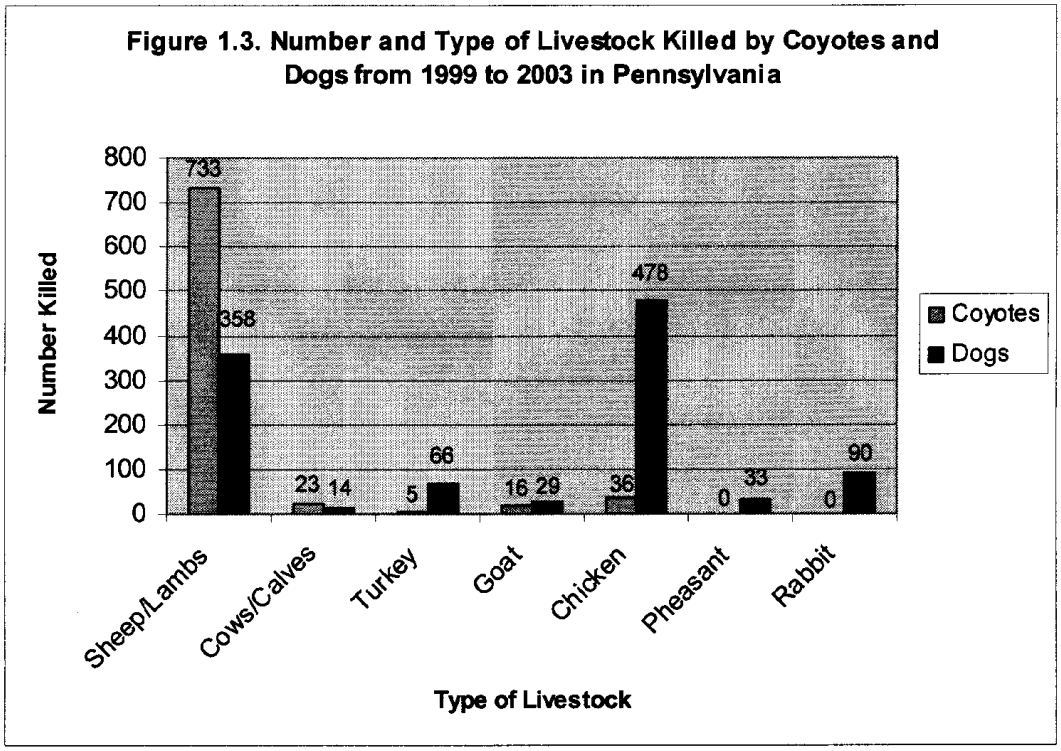


Figure 1.2. Amount of Damage Claim Payments made by The Bureau of Dog Law Enforecement from 1999-2003 for Coyote and Dog Damage in Pennsylvania.



Between 1999 and 2003, there were 9 different types of livestock, poultry or game birds (from here on referred to collectively as livestock) that were predated upon by coyotes (813 animals total) and 15 different types of livestock that were predated upon by dogs (1,102 animals total). Sheep and lambs (733) were the number one type of livestock predated upon by coyotes and chickens (478) were the number one type of livestock predated upon by dogs (Figure 1.3.) (Personal communication, Mary Bender, Director of The Bureau of Dog Law Enforcement 5/4/04).



***Type of Livestock only includes the top seven categories of animals based on number killed.**

1.4.3.1 Impacts to the Sheep Industry

Costs associated with livestock protection includes labor, loss of genetic stock, time (in months or years) to replace lost animals, implementation of wildlife management practices to reduce damage or the threat of damage, and long distance calls to government agencies to seek assistance.

In a 1982 presentation, "Economic Effect on the Family, the Community, and the County", Dr. Robert Kensing, an economist with the Texas Agricultural Extension Service, reported, "Predation is a major cause of the almost complete liquidation of sheep and goat [operations] from central Texas." Kensing (1982) also reported that most sheep and goat operations are family farms, and the effects of predation on these operations include a decline in total income, loss of benefits from diversification, and the necessity to seek off-farm income. In addition, when these operations are discontinued, the family loses the opportunity to work together, a factor benefiting family life. The following are examples of coyote predation losses to sheep operations in Pennsylvania:

- In Brave, Pennsylvania at least 80 lambs and ewes worth $10,000 were slain on two adjoining farms. Predatory teeth tore the sheep's throats or pierced their skulls, and their soft inner organs were eaten. All clues pointed to coyotes, but to convince skeptics the farmer paid a trapper $50 to prove the coyotes existed. Five females have been trapped or shot near the scene (Associated Press, undated).

- A Lycoming County farmer lost at least 20 sheep in a single attack by coyotes, one of the worst cases the state has seen in years. The farmer found 16 of his

sheep dead in his farm; four more have died since and about a dozen more were injured (Lock Haven Express 2003).

In Fiscal Year (FY) 2001, PA WS' records indicated that one Llama and 40 adult sheep where reported to have been predated by coyotes. In FY 2002, seven adult sheep were predated by coyotes and in FY 2003, eleven lambs were predated by coyotes (Unpublished MIS data). PA WS receives very few coyote related complaints and therefore the above MIS data is much underestimated. WS MIS data is limited to information that is collected from people who have requested services or information from Wildlife Services. It does not include requests received or responded to by local, State or other Federal agencies, and it is not a complete database for all wildlife damage occurrences. The number of requests for assistance does not necessarily reflect the extent of need for action, but this data does provide an indication that needs exist.

Sheep and lambs remain vulnerable to predation throughout the year, particularly from coyotes and dogs (Henne 1977, NASS 1977, 1980, Tigner and Larson 1977, O'Gara et al. 1983). Without actions to control predation losses, studies reveal that losses of adult sheep and lambs to predators can be as high as 8.4% and 29.3%, respectively (Henne 1975, Munoz 1977, O'Gara et al. 1983). The National Agricultural Statistics Service and the [redacted] report that predation increases the annual maintenance cost per breeding ewe by 12%. Conversely, other studies indicate that sheep and lamb losses are much lower where wildlife damage management is applied (NASS 1977, Tigner and Larson 1977, Howard and Shaw 1978, Howard and Booth 1981). NASS (2001) reported sheep and lamb losses from predators in the U.S. totaled 273,000 during 1999. This represented 36.7% of the total losses from all causes and resulted in a loss of $16.5 million to farmers and ranchers. Coyotes and dogs accounted for 60.7% and 15.1% of the total sheep and lamb losses to predators, respectively.

NASS (2000) reported 100 sheep and 400 lambs lost to coyotes and 300 sheep and 200 lambs lost to dogs in Pennsylvania. The lost value of the sheep and lambs totaled $46,000 and $44,000, respectively. Between 1999 and 2003, The Bureau of Dog Law received claims that coyotes killed 733 sheep/lambs and dogs killed 358 sheep/lambs in Pennsylvania (Figure 1.3.) (Mary Bender, Director of The Bureau of Dog Law Enforcement, Personal Communication 5/4/04).

1.4.3.2 Impacts to the Cattle Industry

In 2000, NASS (2001) reported 147,000 head of cattle were lost to animal predators in the U. S., totaling $51.6 million dollars. Coyotes accounted for 64.6% (95,000 head) of the total cattle and calves lost to predators. Dogs were the second leading cause for cattle and calves lost to predators, accounting for 17.7% (26,000 head). Between 1999 and 2003, The Bureau of Dog Law received claims that coyotes killed 23 cows/calves and dogs killed 14 cows/calves in Pennsylvania (Figure 1.3.) (Mary Bender, Director of The Bureau of Dog Law Enforcement, Personal Communication 5/4/04).

Non-lethal methods are used by Pennsylvania livestock producers to prevent losses of cattle and calves to predators. For the year 2000, the following are estimates of the types

of non-lethal methods used by livestock producers: 23.5% (guard animals), 41.2% (exclusion fencing), 5.9% (herding), 29.4% (night penning) (NASS 2001). Cattle and calves are most vulnerable to predation at calving time and less vulnerable as they get older and larger (Shaw 1977, 1981, Horstman and Gunson 1982). Many Pennsylvania farmers begin calving during January when coyote food requirements are at their highest level.

Neosporosis is a disease caused by the protozoan parasite *Neospora caninum*. This disease is a frequent cause of bovine abortion worldwide. Dogs are a definitive host of the parasite. Besides dogs, other canids have been considered to be potential definitive hosts of *N. caninum*. Anitbodies to *N. caninum* have been found in North American coyotes, British red foxes, and Australian dingoes. Based upon the finding that coyotes are a definitive host of *N. caninum,* it is important that reasonable steps be taken to reduce the risk of transmission of this organism between coyotes and ruminant livestock (Gondim et al. 2004). The expanding range and population of coyotes increases the probability of contact with domestic animals, and this increases the risk of *N. caninum* transmission between coyotes and livestock (Gondim et al. 2004).

In Texas, Wildlife Services staff responded to a request from a large dairy in [redacted] that had concerns about coyotes introducing the disease Neosporosis to the cattle. The disease causes stillbirths, or sick calves that usually die within the first few weeks of birth. The dairy reported a three year loss of over $144,000 to the disease. The disease can be transmitted through a protozoan parasite in coyote feces which contaminates feed where the animals wander. Cattle ingest the feed and become infected. Additionally, actual calf losses by predation from coyotes have also occurred at this site. These problems and concerns have prompted the dairy to limit coyote/cattle interactions as much as possible. Coyotes are being removed by Wildlife Services employees at this farm as requested by the dairy. The effort should reduce this threat to dairy cattle at the site (USDA 2004).

1.4.3.3 Impacts to the Goat Industry

Coyotes and dogs are the largest predators of goats in 3 major goat producing states (AZ, NM, and TX) accounting for 35.6% (21,700 head) and 17.5% (10,700 head) of predator losses, respectively (NASS 2000). The value of goats lost in those 3 states from all predators was $3.4 million. Between 1999 and 2003, The Bureau of Dog Law received claims that coyotes killed 16 goats and dogs killed 29 goats in Pennsylvania (Figure 1.3.) (Mary Bender, Director of The Bureau of Dog Law Enforcement, Personal Communication 5/4/04).

1.4.3.4 Indirect Effects of Predation on Livestock

Direct effects of predation (i.e., killing of animals) can result in significant economic losses to livestock producers as shown by the statistics previously mentioned. Although direct losses of livestock due to depredation are often conspicuous and economically significant, they likely underestimate the total loss to producers because they do not consider indirect effects of carnivores as a result of livestock being exposed to the threat of predation without being killed (Howery and DeLiberto 2004).

Laundré et al. (2001) suggested that behavioral responses by prey species to impending predation might have more far-reaching consequences for ungulate behavioral ecology than the actual killing of individuals by predators. Potential negative, indirect impacts associated with the mere presence of predators include, but are not limited to, increased vigilance and reduced foraging efficiency by prey species, and being forced by predators to forage in suboptimal habitats that contain lower quality or quantity of nutrients, and higher levels of toxins. Moreover, overuse of and lowered carrying capacity in suboptimal habitats could contribute to resource degradation (e.g., overgrazing in marginal habitats, increased erosion and sedimentation) and lower producer profits due to declines in livestock production (e.g., weight gain, body condition, lamb or calf crop).

The following are examples of how domestic herbivores respond to and are impacted by impending predation:

- Cattle production suffered in Wyoming when cows and calves were stalked and killed by grizzly bears. Cattle formed groups to ward off grizzly bear attacks and restricted themselves to areas where predation risk was reduced which resulted in overuse of the range (Howery and DeLiberto 2004).

- In eastern Arizona, where calf losses to wolves on one ranch were estimated to be 50% in 2002, cattle were observed to huddle and move together in smaller groups. Cattle "were always on the move and never in the same area during a 24-hour period" while grazing an 8,000-acre pasture in wolf country. Other behaviors observed included increased vigilance, cows running through fence lines, cows fighting wolves to protect their calves, diarrhea, increased stillborns and abortion, and cows and calves running from domestic cow dogs after being exposed to wolves. By fall round-up, cow dogs could no longer control cattle movements. Cows that lost their calves to wolf predation had spoiled teats due to lack of suckling, and new calves had to be bottle-fed the following year. Cows with spoiled teats eventually had to be culled. Incessant wolf predation resulted in the decision to truck the cows to a wolf-free allotment that did not have adequate forage quantity and quality. Cows were not observed to rebreed while on this allotment (Howery and DeLiberto 2004).

When sheep are pursued by predators at night they likely suffer from exhaustion and weight loss, which can negatively influence forage intake and reproductive performance of both males and females. Rams need food and rest to service 50-60 ewes, and ewes that lose weight may not cycle or carry lambs to term compared to rested animals. When a band of 2,000 sheep are chased by predators they move "shoulder to shoulder like an amoeba" which can damage soils and vegetation, especially when wet. In addition to increased energy expenditure as a result of being harassed by predators at night, animals also have less time to ruminate, which can reduce digestibility of plant material harvested earlier in the day. Thus, harassment by predators may directly cause weight loss due to increased energy expenditure associated with running and loss of sheep, but may also

indirectly reduce the ability of ruminants to convert plant nutrients into weight gain due to decreased rumination time (Howery and DeLiberto 2004).

Thus, indirect impacts of predation may have negative impacts on the ecological integrity of the land, as well as negative impacts on personal, local, and regional economics that depend on livestock production (Howery and DeLiberto 2004).

1.4.4 Summary of Coyote and Dog Predation on Livestock

The need exists for effective management of predation associated with coyotes and feral dogs on livestock in Pennsylvania because many livestock producers lack the expertise and specialized equipment to effectively and efficiently manage livestock predation. Predator management can become very complex because of the numerous jurisdictions involved when assisting property owners throughout a state. Local, state, and Federal agencies should be involved or notified when implementing a damage management program and restrictions by those agencies must be incorporated into the program, including those intended to protect threatened and endangered species. In addition, some IWDM methods can only be implemented by the WS program, as legal restrictions prevent livestock producers from using these tools (e.g., Livestock Protection Collars) in Pennsylvania.

Many livestock producers lack the expertise to effectively use damage management methods, do not have the appropriate certifications to use certain control methods, and have limited time to devote to developing the expertise necessary to remove livestock predators. In addition, large livestock operations also have a need to efficiently use large acreage to cost effectively raise livestock for profit. The large number of animals raised by large livestock operations may prohibit effective use of some non-lethal methods (e.g., night penning) because of labor, time constraints, and disease concerns. At this time, Pennsylvania's most useful predator population management tools are Livestock Protection Collars (LPC), traps, snares, and shooting. The reduction in predation rates through the use of these integrated predation management tools have proven to be effective in targeting and removing offending predators.

1.4.5 Impacts to White-tailed Deer Populations in Pennsylvania

White-tailed deer fawn mortality studies in other areas have demonstrated coyote predation is an important factor influencing fawn survival. In Pennsylvania, many deer hunters believe coyote predation is suppressing deer populations, and that reducing coyote populations would result in increased deer populations. Although effects of predators on prey populations are inconclusive, some evidence suggests predators may limit or regulate prey populations. Predation on deer may be additive or compensatory; however, coyotes likely are ineffective at suppressing deer populations for extended periods (Vreeland 2002).

In a study that looked at white-tailed deer fawn mortality in two areas of central Pennsylvania it was reported that; coyotes, bears, bobcats, and unidentified predators were responsible for 35.7%, 32.7%, 6.1%, and 24.5% of predation mortalities, respectively (Vreeland 2002). Coyotes were responsible for 17%, bears for 15.1%,

bobcats for 2.8%, and unidentified predators were responsible for 11.3% of all mortalities (Vreeland 2002). It was also reported that in heavily forested regions in Pennsylvania, where black bear densities are great, black bears appear to be at least as efficient predators of fawns as are coyotes (Vreeland 2002).

1.4.6 Need to Protect Human Health and Safety

Pennsylvania WS currently protects human health and safety at airports by removing coyotes and feral dogs that are found on airport properties that have requested WS assistance. Coyotes and feral dogs, like all animals, can cause a great deal of economic damage and human injuries or deaths when they cross paths with airplanes on airports. Between 1990 and 2002 there were 269 aircraft strikes due to carnivores in the U.S.; 135 of these strikes were due to coyotes. The reported damage of the 135 coyote strikes totaled $660,628 (http://wildlife-mitigation.tc.faa.gov). From FY 2001 to March of 2004, WS in Pennsylvania lethally removed a total of 13 coyotes for human health and safety issues at airports throughout the state (Unpublished MIS data).

Coyote attacks on humans, once thought to be rare, have increased in frequency over the past decade. In expanding suburban areas residential developments are often near steep, brushy wildland areas. Coyotes inhabiting such wildlands are drawn into suburban landscaped environments that can support an abundance of rodents and rabbits, and where they can utilize water sources, pet food, household refuse, and even house cats and small dogs as prey. Research observations indicate that in the absence of harassment by residents, coyotes can lose their fear of people and come to associate humans with this safe, resource-rich environment. This problem is exacerbated by people who intentionally feed coyotes. In such situations, some coyotes have begun to act aggressively toward humans, chasing joggers and bicyclists, confronting people walking their dogs, and stalking small children.

In Timm et al. 2004; they queried representatives of various federal, state, county, and city agencies as well as private wildlife control companies about coyote attacks on humans occurring in Southern California during the past three decades. From the information gathered, they listed 89 coyote attacks in California (incidents when one or more coyotes made physical contact with a child or adult, or attacked a pet while in close proximity to its owner). In 56 of these attacks, one or more persons suffered an injury. In 77 additional encounters, coyotes stalked children, chased individuals, or aggressively threatened adults. In 35 incidents, where coyotes stalked or attacked small children, the possibility of serious or fatal injury seems likely if the child had not been rescued (Timm et al. 2004).

Based on an analysis of the coyote attacks listed above, there is a predictable sequence of observed changes in coyote behavior that indicates an increasing risk to human safety. These changes are now defined, in order of their usual pattern of occurrence, as follows:

1) An increase in observing coyotes on streets and in yards at night
2) An increase in coyotes approaching adults and/or taking pets at night

3) Early morning and later afternoon daylight observance of coyotes on streets and in parks and yards
4) Daylight observance of coyotes chasing or taking pets
5) Coyotes attacking and taking pets on leash or in close proximity to their owners; coyotes chasing joggers, bicyclists, and other adults
6) Coyotes seen in and around children's play areas, school grounds, and parks in mid-day
7) Coyotes acting aggressively toward adults during mid-day

In addition to the human safety issue, coyotes' presence in close association with humans can represent a potential health risk to people and their pets. Rabies, if it were to become established in suburban coyote populations, could easily put humans and domestic animals at risk (Timm et al. 2004).

As coyotes continue to adapt to suburban environments and as their populations continue to expand and increase throughout North America, coyote attacks on humans can be expected to occur and to increase. To reverse this trend, authorities and citizens must act responsibly to correct coyote behavior problems before they escalate into public health and safety risks for children and adults (Timm et al. 2004).

1.5 PENNSYLVANIA WILDLIFE SERVICES OBJECTIVES

The need to manage predator impacts on livestock, poultry and pets, and human health and safety in Pennsylvania was used by WS to define the objectives for the WS program in Pennsylvania:

- Respond to 100% of the requests for assistance with the appropriate action (technical assistance or direct control) as determined by Pennsylvania WS personnel, applying the WS Decision Model (Slate et al. 1992).
- Reduce coyote and feral dog predation on livestock, poultry and pets in Pennsylvania to the greatest extent possible on properties where WS assistance is requested.
- Reduce coyote and feral dog human health and safety risks in Pennsylvania to the greatest extent possible on properties where WS assistance is requested.
- Minimize the lethal take of non-target species.
- Encourage livestock producers to adopt non-lethal control methods.
- Provide predator management workshops to livestock producers and agency personnel.

1.6 RELATIONSHIP OF THIS ENVIRONMENTAL ASSESSMENT TO OTHER ENVIRONMENTAL DOCUMENTS

1.6.1 ADC Programmatic Environmental Impact Statement

WS conducted a NEPA process and developed a FEIS on the national WS program (USDA 1997a). The FEIS contains detailed discussions of potential environmental impacts from various wildlife damage management methods. Pertinent information available in the FEIS has been incorporated by reference into this EA. The FEIS may be

obtained by contacting: USDA APHIS WS Operational Support Staff, 4700 River Rd., Unit 87, Riverdale, MD 20737-1234.

1.7 DECISION TO BE MADE

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

- Should the Pennsylvania WS program implement an integrated wildlife damage management program to reduce coyote and feral dog damage and conflicts to those entities that request WS assistance?
- If not, how should WS fulfill its legislative responsibilities for managing coyote and feral dog damage and conflicts in Pennsylvania?
- Would the proposed action have any significant impacts requiring preparation of an EIS?

1.8 RELATIONSHIP OF AGENCIES DURING PREPARATION OF THIS EA

Based on agency relationships, MOU's and legislative authorities, the Pennsylvania WS program is the lead agency for this EA, and therefore, responsible for the scope, contents and decisions made. The PDA and PGC contributed input throughout the EA preparation to ensure an interdisciplinary approach in compliance with NEPA, and agency mandates, policies, and regulations.

1.9 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

1.9.1 Actions Analyzed

This EA evaluates coyote and feral dog damage management by WS to protect livestock, pets, and human health and safety on private and public lands within the Commonwealth of Pennsylvania wherever such management is requested to the Pennsylvania WS program.

1.9.2 American Indian Lands and Tribes

Currently WS does not have any MOU's or signed agreements with any American Indian tribe in Pennsylvania. If WS enters into an agreement with a tribe for coyote and feral dog damage management, this EA would be reviewed and supplemented, if appropriate, to insure compliance with NEPA.

1.9.3 Period for Which this EA is Valid

This EA will remain valid until WS determines that new needs for action or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document will be reviewed and revised as necessary. This EA will be reviewed each year to ensure that it is complete and still appropriate to the scope of WS activities.

1.9.4 Site Specificity

This EA analyzes the potential impacts of WS' coyote and feral dog damage management activities and addresses activities on all lands in the Commonwealth of Pennsylvania under MOU, Cooperative Agreement, and in cooperation with the appropriate public land

management agencies. It also addresses the impacts of coyote and feral dog damage management activities on areas where additional agreements may be signed in the future. Because the proposed action is to reduce damage and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional damage management efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program. Because livestock production and human health and safety risks occur throughout Pennsylvania and coyotes are found in every county in Pennsylvania (Warner et al. 2001), it is conceivable that WS direct control activities could occur anywhere in the Commonwealth.

Planning for the management of coyote and feral dog damage must be viewed as being conceptually similar to Federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will 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, insurance companies, etc. Although some of the sites where coyote and feral dog damage will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. This EA emphasizes major issues as they relate to specific areas whenever possible, however, many issues apply wherever coyote and feral dog damage and resulting management occurs and are treated as such. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Pennsylvania (*see* Chapter 3 for a description of the Decision Model and its application).

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

1.9.5 Public Involvement/Notification

As part of this process, and as required by the Council on Environmental Quality (CEQ) and APHIS-NEPA implementing regulations, this document and its Decision are being made available to the public through "Notices of Availability" (NOA) published in local media and through direct mailings of NOA to parties that have specifically requested to be notified. New issues or alternatives raised after publication of public notices will be fully considered to determine whether the EA and its Decision should be revisited and, if appropriate, revised.

1.10 AUTHORITY AND COMPLIANCE

1.10.1 Authority of Federal and State Agencies for Coyote and Feral Dog Damage Management in Pennsylvania

See Chapter 1 of USDA (1997a) for a complete discussion of Federal laws pertaining to WS.

1.10.1.1 Wildlife Services Legislative Mandate

The USDA is authorized by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Services program is the Act of 1931 (7 U.S.C. 426-426c; 46 Stat. 1468), as amended in the Fiscal Year 2001 Agriculture Appropriations Bill, which provides that:

> *"The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program. The Secretary shall administer the program in a manner consistent with all of the wildlife services authorities in effect on the day before the date of the enactment of the Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2001."*

Since 1931, with the changes in societal values, WS policies and programs place greater emphasis on the part of the Act discussing "*bringing (damage) under control*," rather than "*eradication*" and "*suppression*" of wildlife populations. In 1988, Congress strengthened the legislative authority of WS with the Rural Development, Agriculture, and Related Agencies Appropriations Act. This Act states, in part:

> *"That hereafter, the Secretary of Agriculture is authorized, except for urbanrodent control, to conduct activities and to enter into agreements with States,local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases,and to deposit any money collected under any such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."*

1.10.1.2 U.S. Department of Interior, Fish and Wildlife Service Legislative Mandate

The USFWS authority for action is based on the Migratory Bird Treaty Act of 1918 (as amended), which implements treaties with the United States, Great Britain (for Canada), the United Mexican States, Japan, and the Soviet Union. Section 3 of this Act authorized the Secretary of Agriculture:

> *"From time to time, having due regard to the zones of temperature and distribution, abundance, economic value, breeding habits, and times and lines of migratory flight of such birds, to determine when, to what extent, if at all, and by what means, it is compatible with the terms of the convention to allow hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any such bird, or any part, nest, or egg thereof, and to adopt suitable regulations permitting and governing the same, in accordance with such determinations, which regulations shall become effective when approved by the President."*

The authority of the Secretary of Agriculture with respect to the Migratory Bird Treaty was transferred to the Secretary of the Interior in 1939 pursuant to Reorganization Plan No. II. Section 4(f), 4 Fed. Reg. 2731, 53 Stat. 1433.

CFR 50 Subchapter C - The National Wildlife Refuge System - Part 30 - Feral Animals Subpart B-30.11 - Control of feral animals states: (a) Feral animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership that have reverted to the wild from a domestic state may be taken by authorized Federal or state personnel or by private persons operating under permit in accordance with applicable provisions of Federal or State law or regulation.

1.10.1.3 The Pennsylvania Department of Agriculture
The Pesticide Division of PDA enforces state laws pertaining to the use and application of pesticides. Under the Pennsylvania Pesticide Use and Application Act this section monitors the use of pesticides in a variety of pest management situations. It also licenses private and commercial pesticide applicators and pesticide contractors. Under the Pennsylvania Pesticide Control Act the division licenses restricted use pesticide dealers and registers all pesticides for sale and distribution in Pennsylvania.

The PDA currently has a MOU with WS, which establishes a cooperative relationship between WS and the PDA, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving wildlife damage management conflicts in Pennsylvania.

1.10.1.4 Pennsylvania Game Commission (PGC)
The Pennsylvania Game Commission is charged by law 322(a) Title 34 "to protect, propagate, manage, and preserve the game or wildlife of this Commonwealth and to enforce, by proper actions and proceedings, the law of this Commonwealth relating thereto."

1.10.2 Compliance with Other Federal Laws
Several other Federal laws authorize, regulate, or otherwise affect WS wildlife damage management activities. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

1.10.2.1 National Environmental Policy Act (NEPA)
WS prepares analyses of the environmental impacts of program activities to meet procedural requirements of this law. This EA meets the NEPA requirement for the proposed action in Pennsylvania. When WS operational assistance is requested by another Federal agency, NEPA compliance is the responsibility of the other Federal agency. However, WS could agree to complete NEPA documentation at the request of the other Federal agency.

1.10.2.2 Endangered Species Act
It is Federal policy, under the Endangered Species Act (ESA), that all Federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the

purposes of the Act (Sec.2(c)) (Appendices C and D list Federal and State listed T&E species in Pennsylvania). WS conducts Section 7 consultations with the 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 shall use the best scientific and commercial data available*" (Sec.7(a)(2)). WS obtained a Biological Opinion (BO) from the USFWS in 1992 describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997a).

1.10.2.3 Migratory Bird Treaty Act
The Migratory Bird Treaty Act (MBTA) provides the USFWS regulatory authority to protect species of birds that migrate outside the United States. The law prohibits any "take" of the species, except as permitted by the USFWS or by Federal agencies within the scope of their authority.

1.10.2.4 Federal Insecticide, Fungicide, and Rodenticide Act
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires the registration, classification, and regulation of all pesticides used in the United States. The Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA. All chemical methods used or recommended by the WS program are or will be registered with, and regulated by, the EPA and PDA, Pesticide Division and are used by WS in compliance with labeling procedures and requirements.

1.10.2.4 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.

1.10.2.4 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.

1.10.2.4 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 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 *undated*). APHIS-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.

1.10.3 Compliance with Other State Laws
Several other State laws authorize, regulate, or otherwise affect WS wildlife damage management activities. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

1.10.3.1 Bureau of Dog Law Enforcement Article V-A: Offenses of Dogs
Section 501: Killing Dogs; Dogs as Nuisances

(a) **Legal to Kill Certain Dogs-** Any person may kill any dog which he sees in the act of pursuing or wounding or killing any domestic animal, wounding or killing other dogs, cats, or household pets, or pursuing, wounding or attacking human beings, whether or not such a dog bears the license tag required by the provisions of this act. There shall be no liability on such persons in damages or otherwise for such killing.

(b) **Private Nuisance-** Any dog that enters any field or enclosure where domestic animals are confined, provided that the enclosure is adequate for the purpose intended, shall constitute a private nuisance and the owner or tenant of such field, or their agent or servant, may detain such dog and turn it over to the local police authority or State dog warden or employee of the department. While so detained, the dog shall be treated in a humane manner.

(c) **Licensed Dogs Not Included-** Licensed dogs, when accompanied by their owner or handler, shall not be included under the provisions of this section, unless caught in the act of pursuing, wounding or killing any domestic animal, wounding or killing any dogs, cats or household pets, or pursuing, wounding or attacking human beings.

1.10.3.2 Bureau of Dog Law Enforcement Article V-A: Offenses of Dogs
Section 507-A: Construction of Article

(e) **Farm Dogs-** No farmer who owns a dog kept on the farm shall be guilty of keeping a dangerous dog if:

(1) The dog does not leave the farm property to attack; and
(2) The farm is conspicuously posted alerting visitors to the presence of a watch or guard dog at all points of ingress and egress.

1.10.3.3 Bureau of Dog Law Enforcement Article VI: Injury to Dogs
Section 601: Theft; Poison; Abandonment of Animals by Owner

(b) **Placement of Poison Illegal-** It shall be unlawful for a person to place any poison or harmful substances of any description in any place, on his own premises or elsewhere, where it may be easily found and eaten by dogs. Anyone convicted of violating this subsection commits a summary offense.

(b.1) **Intentional Poisoning of Dogs Illegal-** It shall be unlawful for any person to place any poison or harmful substance of any description in any place, on his own premises or elsewhere, with the intent that the poison or substance be eaten by dogs. Anyone convicted of violating this subsection commits a misdemeanor of the second degree and shall be sentenced to pay a fine of not less than $1,000 nor more than $2,000 or to imprisonment for not more than two years, or both. A subsequent conviction under this subsection shall constitute a felony of the third degree.

1.10.3.4 Bureau of Dog Law Enforcement Article VII: Dog Caused Damages
Section 701: Reimbursement for Damages; Complaints

(a) **Reimbursement-** A person may make application to the department for reimbursement for damage to a domestic animal by a dog, whether or not the domestic animal is directly damaged by the dog or is necessarily destroyed due to damage caused by the dog, if all of the following apply:

(1) The damage occurs when the domestic animal is confined in a field or other enclosure, adequate for confinement of such animal.
(2) The damage was not caused by a dog owned or harbored by the owner of such damaged domestic animal.
(3) The owner of the offending dog is unknown.

1.10.3.5 Bureau of Dog Law Enforcement Article VII: Dog Caused Damages
Section 706: Damages Caused by Coyotes; Complaints; Liability

(a) **Reimbursement-** Any person may make application to the department for reimbursement for damage to a domestic animal by a coyote, whether or not the domestic animal is directly damaged by the coyote or is necessarily destroyed due to damage caused by the coyote, if the damage occurs when the domestic animal is confined in a field or other enclosure, adequate for the confinement of such animal.

(i) **Payment of Claims-** All damage claims shall be paid from the Dog Law Restricted Account. No payment shall be made for any claim which has already been paid by the claimant's insurance carrier. The claimant must certify to the department that he has not received payment for any damages under this section by any person. Claims paid under this section shall not exceed $20,000 annually.

1.10.3.6 Destruction for Agricultural Protection (killing game or wildlife to protect property) (PGC:Chapter 21, subchapter B, Section 2121)

General rule—Subject to any limitations in this subchapter, nothing in this title shall be construed to prohibit any person from killing any game or wildlife:

(1) which the person may witness actually engaged in the material destruction of cultivated crops, fruit trees, vegetables, livestock, poultry or beehives;

(2) anywhere on the property under the person's control, including detached lands being cultivated for the same or similar purposes, immediately following such destruction; or

(3) where the presence of the game or wildlife on any cultivated lands or fruit orchards is just cause for reasonable apprehension of additional imminent destruction. Lands divided by a public highway shall not be construed as detached lands. Any person who wounds any game or wildlife shall immediately make a reasonable effort to find and kill the game or wildlife. Every person shall comply with all other regulations in this subchapter pertaining to the method and manner of killing, reporting the killing and the disposition of game or wildlife and their skins and carcasses.

In Pennsylvania, it is legal for a person to kill a coyote to protect their resources as long as they are using authorized means. However, the use of snares for coyotes is not authorized and therefore a permit is required.

There is no closed season and take is unlimited in Pennsylvania for coyote hunting; with exceptions during deer and spring turkey seasons. Coyote trapping is unlimited from October 17 to February 19, 2005.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.0 INTRODUCTION

Chapter 2 contains a discussion of the issues, including those that will receive detailed environmental impact analysis in Chapter 4 (Environmental Consequences), and those that were used to develop mitigation measures and/or SOP's, and the issues that will not be considered in detail, with rationale. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Additional descriptions of affected environments will be incorporated into the discussion of the environmental impacts in Chapter 4.

Various issues cause concern with the public and/or professional communities about potential environmental problems that might occur from a proposed Federal action. Such issues must be considered in the NEPA decision process. Issues relating to the management of wildlife damage were raised during the scoping process in preparing the programmatic ADC FEIS (USDA 1997a) and were considered in the preparation of this EA. These issues are fully evaluated within the FEIS, which analyzed specific data relevant to the Pennsylvania WS program.

2.1 AFFECTED ENVIRONMENT

The proposed action may include any property owner or manager who has suffered human health and safety risks or threats of such risks from coyotes or feral dogs; or has suffered damage or loss or threats of such damage or loss of livestock, poultry, and pets from coyotes and feral dogs within Pennsylvania. Control areas may include Federal, state, county, city, private, or other lands, where WS assistance has been requested by a landowner or manager. The control areas may also include property in or adjacent to identified sites where damage activities could occur. WS coyote and feral dog damage management may be conducted when requested by a landowner or manager, where a need exists, and only on properties with a Cooperative Service Agreement with WS.

2.2 ISSUES ADDRESSED IN DETAIL IN CHAPTER 4

Potential environmental impacts of the Proposed Action and Alternatives in relation to the following issues are discussed in Chapter 4. The following issues have been identified as areas of concern requiring consideration in this EA.

- Effects on Target (Coyote) Species Populations
- Effects on Dogs
- Effects on Non-target Wildlife Populations, including T&E Species
- Effects on Human Health and Safety
- Humaneness of Control Methods Used by WS
- Effects on the Aesthetic Values of Target and Non-target Species

2.2.1 Effects on Target (Coyote) Species Populations

Some persons and groups are concerned that the proposed action or any of the alternatives would result in the loss of local coyote populations or could have a cumulative adverse impact on regional or statewide populations. The PGC estimates that

there are at least 30,000 coyotes in Pennsylvania; however no absolutely reliable estimate exists (Matt Lovallo, PGC Furbearer Biologist, personal communication). Based upon anticipated requests for assistance, no more than 500 coyotes are likely to be killed by WS use of lethal control methods under the proposed action or any of the alternatives in any one year.

2.2.2 Effects on Dogs

A common concern among members of the public and wildlife professionals, including WS personnel, is the potential impact of damage control methods and activities on dogs, including both target and non-target dogs.

Feral Dogs

The public is concerned that some dogs involved in killing or injuring livestock may be killed. Feral dogs are those dogs that are wild; not seemingly owned by a person; or having returned to an untamed state from domestication. Many dogs in Pennsylvania are considered feral, abandoned, or liberated and are considered ownerless, living in a semi-wild or wild state, and without the care of an owner. Some pet owners release unwanted pets into the country after they find they cannot keep these animals as pets for various reasons (e.g., amount of food required, size and aggressiveness, etc.). These animals become hungry and indiscriminate killers and because they are not afraid of humans, they attack and kill pets and livestock. Since there are many feral and unwanted dogs in Pennsylvania, local government and humane societies must euthanize thousands of dogs annually. The Commonwealth of Pennsylvania does not compile data on the number of dogs euthanized.

Livestock producers and dog owners are very sensitive to the issue of dogs killing livestock because of the brutal means in which dogs kill or injure livestock, the attachment pet owners place on dogs, monetary losses incurred by livestock producers from dog damage, the difficulty some pet owners have in accepting responsibility for actions of their dogs, and the legal responsibility and liability dog owners bear for controlling their animals.

The Bureau of Dog Law Enforcement Article V-A: Offenses of Dogs Section 501: Killing Dogs; Dogs as Nuisances states;

(a) **Legal to Kill Certain Dogs-** Any person may kill any dog which he sees in the act of pursuing or wounding or killing any domestic animal, wounding or killing other dogs, cats, or household pets, or pursuing, wounding or attacking human beings, whether or not such a dog bears the license tag required by the provisions of this act. There shall be no liability on such persons in damages or otherwise for such killing.

(b) **Private Nuisance-** Any dog that enters any field or enclosure where domestic animals are confined, provided that the enclosure is adequate for the purpose intended, shall constitute a private nuisance and the owner or tenant of such field, or their agent or servant, may detain such dog and

turn it over to the local police authority or State dog warden or employee of the department. While so detained, the dog shall be treated in a humane manner.

(c) **Licensed Dogs Not Included-** Licensed dogs, when accompanied by their owner or handler, shall not be included under the provisions of this section, unless caught in the act of pursuing, wounding or killing any domestic animal, wounding or killing any dogs, cats or household pets, or pursuing, wounding or attacking human beings.

Non-target Dogs

The ownership of dogs as pets and hunting companions has a long tradition in Pennsylvania. The public is concerned that damage control methods may unintentionally kill or injure non-target dogs. Special efforts are made to avoid harming dogs not involved in livestock depredation. WS SOP's include measures intended to mitigate or reduce the effects on non-target species, including pet dogs and hunting dogs, and are presented in Chapter 3.

Under the proposed action or any of the alternatives, it is unlikely that WS activities will adversely impact pet dogs and hunting dogs of law-abiding citizens since WS activities will be communicated to the property owner and adjoining landowners. Hunters which are pursuing game must have permission from the appropriate landowners and therefore should be aware of any potential exposure to damage management tools prior to releasing any hunting dogs on affected properties. There is no closed season for training dogs but because you can not kill dogs unless they are in the process of wounding or killing livestock the likelihood of a training dog being killed would be very small. Licensed dogs when accompanied by their owner, and not included under the above Bureau of Dog Law Enforcement provisions, should not be adversely affected since the dog owner would be required to obtain the necessary landowner permission prior to entering an affected property, and it would be reasonable to assume that the owner would have control over the dog's actions. In the unlikely event that a licensed dog (pet dog) would get caught in a trap associated with the proposed action; the dog could be turned over to the owner or to the local animal control agency.

WS reviewed MIS data for the entire WS Program since 1996 and examined the likelihood that hunting dogs or free-ranging pets would be exposed to control methods resulting in unintentional death. A review of all control methods (described in detail in Appendix B) identified Livestock Protection Collar (LPC) and guard animals as methods which may result in the unintentional death of a hunting dog or free-ranging pet. Guard animals may be recommended by WS, but implementation would be the landowner's responsibility. The LPC is in the process of being registered for use in Pennsylvania and would be used by WS under strict guidelines (see SOP's in Chapter 3). LPCs are only used on private property within a fenced area and are designed to target those predators which are in the act of killing livestock. Therefore, if a dog was in a fenced pasture where LPC's were being used, that dog would have to bite the necks of those livestock animals wearing LPCs. However, because livestock producers may legally kill a dog for

chasing, injuring, or killing livestock (Bureau of Dog Law V-A, 501-a), it would be the dog owners responsibility to avoid these situations.

2.2.3 Effects on Non-Target Wildlife Populations, Including T&E Species

A common concern among members of the public and wildlife professionals, including WS personnel, is the potential for damage control methods and activities used in the proposed action or any of the alternatives to inadvertently capture or kill non-target animals, or to potentially cause adverse impacts to non-target species populations, particularly T&E species. There is a risk of non-target species being killed or captured whenever control methods are employed to stop damage from occurring. Non-target species that may be affected may include, but are not necessarily limited to, raccoons, opossums, skunks, fox, and feral and free-ranging cats. WS mitigation and SOP's are designed to reduce the effects on non-target species populations and are presented in Chapter 3.

To reduce the risks of adverse impacts to non-target species, WS selects damage management methods that are as target species-specific as possible or apply such methods in ways to reduce the likelihood of killing or capturing non-target species. Before initiating control techniques, WS select locations which are extensively used by the target species and use baits or lures which are preferred by the target species. As discussed in section 2.2.2 above, LPCs is a lethal method used by WS that could result in the unintentional death of a non-target species. The use restrictions that accompany the use of Livestock Protection Collars are designed to minimize the take of non-target animals while targeting the offending predator. Livestock Protection Collars would only be used in areas where it is determined that non-target species would not likely be affected by the use of this control method.

The PGC has issued trapping permits to WS personnel allowing WS to address predation complaints with traps and snares. This permit also allows for take of non-target species if the need arises.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions and mitigation measures. WS has consulted with the USFWS under Section 7 of the Endangered Species Act (ESA) concerning potential impacts of WS IWDM methods on T&E species and has obtained a Biological Opinion (BO) (USDI 1992). For the full context of the BO, see Appendix F of the ADC FEIS (USDA 1997a). WS is also in the process of reinitiating Section 7 consultation at the National level to assure that potential effects on T&E species have been adequately addressed.

WS has obtained and reviewed the list of federal listed T&E species for Pennsylvania. Based on the conclusions made by USFWS during their 1992 programmatic consultation of WS' activities and subsequent BO, it was determined that management activities being utilized for coyote and feral dog damage management in Pennsylvania are not likely to adversely affect any T&E species or critical habitat listed in Pennsylvania. Furthermore,

Pennsylvania WS has determined no effect on those Pennsylvania T&E species not included in the 1992 BO.

As stated in the 1992 BO, the USFWS has determined that the only predator damage methods that might adversely affect the bald eagle are the use of leg-hold traps and snares. The use of traps and snares near a partial or whole animal carcass was identified as the primary situation where bald eagles are most likely to be exposed to these types of devices. In accordance with WS policy, when using traps and snares, WS will not place these devices within 30 feet of any exposed bait or animal carcass. Therefore, WS coyote and feral dog damage management activities in Pennsylvania are not likely to have adverse effects on bald eagles.

The inherent safety features of LPC's that preclude or minimize hazards to mammals and plants are described in Appendix B and in a formal risk assessment in the ADC FEIS (USDA 1997a, Appendix P). Those measures and characteristics assure there would be no jeopardy to T&E species or adverse impacts on mammalian or non-T&E bird scavengers from the use of this method.

WS has obtained and reviewed the list of Pennsylvania State listed T&E species, species of concern, and species of special interest (Appendix C). WS has determined that management activities being utilized for coyote and feral dog damage management in Pennsylvania are not likely to adversely impact any state listed endangered or threatened species. The Pennsylvania Game Commission concurs with this determination (Matt Lovallo, PGC Furbearer Biologist, personal communication).

Coyotes and feral dogs are opportunistic predators and may feed on many bird and mammal species including white-tailed deer (*Odocoileus virginianus*), groundhogs (*Marmota spp.*), rabbits (*Sylvilagus spp.* and *Lepus spp.*), mice (*Peromyscus spp.*), voles (*Microtus spp.*), ruffed grouse (*Bonasa umbellus*), and wild turkey (*Meleagris gallopavo*). In contrast to adverse impacts on non-target animals from direct take, some species and resource owners may actually benefit indirectly from WS damage management program in some circumstances. Some examples include: coyotes killing fawn and adult white-tailed deer which some people enjoy watching, photographing, and legally hunting. In contrast, others may argue that coyotes prey on deer which may help reduce the number of deer-vehicle collisions and crop damage in an area.

2.2.4 Effects on Human Health and Safety

A common concern among the public is whether the proposed action or any of the alternatives pose an increased threat to human health and safety. Specifically, there is concern that the lethal methods of coyote and feral dog removal (i.e., chemicals, firearms) may be hazardous to people. A formal risk assessment of WS operational management methods found that risks to human safety were low (USDA 1997a, Appendix P). WS SOP's include measures intended to mitigate or reduce the effects on human health and safety and are presented in Chapter 3.

2.2.4.1 Safety and Efficacy of Chemical Control Methods

Members of the public have expressed concerns that chemical control methods should not be used because of potential adverse effects on people from direct exposure to chemical toxicants or from animals that have died as a result of toxicants. Under the alternatives proposed in this EA, the primary toxicant proposed for use as a chemical control method by WS would be sodium fluoroacetate (Livestock Protection Collar). A less commonly used toxicant proposed for use by WS would be sodium nitrate (Large Gas Cartridge). Sodium fluoroacetate, and sodium nitrate use is regulated by the EPA through FIFRA and by WS Directives.

The use of sodium fluoroacetate and sodium nitrate for predator damage management poses negligible human risk when used according to directives, policies, laws, and label directions (USDA 1997a, Appendix P). WS SOP's include measures intended to mitigate or reduce the effects on human health and safety and are presented in Chapter 3. WS personnel who apply pesticides are certified restricted use pesticide applicators and apply pesticides according to label instructions. Each WS employee that use LPC's in Pennsylvania is certificated to use this device after passing a written test administered by the PDA.

2.2.4.2 Safety and Efficacy of Non-chemical Control Methods

There may be concern that WS use of firearms, traps, and snares could cause injuries to people. WS personnel may occasionally use rifles and shotguns to remove coyotes and feral dogs that are causing damage. Handguns may be used to humanely euthanize trapped or snared animals. WS personnel use special restraining traps and snares to humanely capture coyotes and feral dogs.

Firearm use in wildlife damage management can be a publicly sensitive issue. Safety issues related to the misuse of firearms and the potential human hazards associated with firearms use are concerns both to the public and WS. To ensure safe use, 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 every 2 years afterwards (WS Directive 2.615). WS employees who carry and use firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

The use of restraining traps such as foothold traps or snares is a sensitive issue because of the lack of understanding and experience by the public in using these devices. Some people believe they could be captured and restrained by these traps. Some people believe these traps indiscriminately and automatically capture people who may unknowingly approach locations where these traps or snares are set. These concerns are without empirical support; however, to mitigate some of these concerns, WS personnel may meet with cooperators and their adjacent landowners to explain and demonstrate the use of traps and snares to alleviate anxiety some may have. WS also is assisting with the development of Best Management Practices (BMP's) for improving traps and trapping

programs in the U.S. These BMP's evaluate the animal welfare and efficiency of various traps for species which can be legally harvested in North America.

2.2.5 Humaneness of Control Methods Used by WS

The issue of humaneness, 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 pest damage management for societal benefits could be compatible with animal welfare concerns, if *". . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."*

Suffering is described as a *". . . highly unpleasant emotional response usually associated with pain and distress."* However, suffering *". . . can occur without pain . . . ,"* and *". . .pain can occur without suffering . . . "* (AVMA 2000). Because suffering carries with it the implication of a time frame, a case could be made for *". . . little or no suffering where death comes immediately . . . "* (CDFG 1991), such as shooting.

Defining pain as a component in humaneness of WS methods appears to be a greater challenge than that of suffering as pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would *". . . probably be causes for pain in other animals . . . "* (AVMA 2000). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1991).

Pain and suffering, as it relates to WS damage management methods, has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since *". . . neither medical or veterinary curricula explicitly address suffering or its relief"* (CDFG 1991).

Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

Animal welfare organizations are concerned that some methods used to manage wildlife damage expose animals to unnecessary pain and suffering. Research suggests that with some methods, such as restraint in foothold traps, changes in the blood chemistry of trapped animals indicate "stress." Blood measurements indicated similar changes in foxes that had been chased by dogs for about five minutes as those restrained in traps (USDA 1997a). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

WS is very concerned about animal welfare and where possible, more humane methods are used to capture or kill animals. WS has been funding research to develop Best, Management Practices for the use of restraining traps since 1997 and funding trap research for decades (Phillips and Mullis 1996, and Engeman et al. 1997). This would include the use of foothold traps and snares. Traps and snares used by WS embrace

many innovations reported in the scientific literature. Coyote size traps must have smooth rounded offset jaws or padded jaws, and pan-tension devices (WS Directive 4.450). There is concern about captured animals remaining in traps and either chewing their feet or dying. Recent studies have found that coyotes rarely chewed their feet (< 1% of captures) and no animals died in coyote traps from the trap (BMP workshop, unpublished data). To reduce the chance for injury, restraining traps (e.g., foothold traps) and snares are checked daily by WS personnel or by cooperators.

The decision making process involves tradeoffs between managing damage and the aspect of humaneness. The challenge in coping with this issue is how to achieve the least amount of animal suffering with the constraints imposed by current technology, yet provide sufficient damage management to resolve problems.

WS has improved the selectivity of management devices through research and development such as pan tension devices for traps and breakaway snares. Research is continuing to bring new findings and products into practical use. Until such time as new findings and products are found to be practical, a certain amount of alleged animal suffering will occur if management objectives are to be met in those situations where non-lethal control methods are not practical or effective.

WS personnel in Pennsylvania are experienced and professional in their use of management methods. Consequently, control methods are implemented in the most humane manner possible under the constraints of current technology. Mitigation measures and SOP's used to maximize humaneness are listed in Chapter 3.

2.2.6 Effects on the Aesthetic Values of Target and Non-target Species

The human attraction to animals has been well documented throughout history and prompted humans to domesticate animals. The American public shares a similar bond with animals and/or wildlife in general, and today a large percentage of American households have pets. However, some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals, especially people who enjoy coming in contact with wildlife. Therefore, the public reaction is variable and mixed to wildlife damage management because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife.

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

Wildlife populations provide a wide range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive

use (e.g., wildlife-related recreation, observation, harvest, sale, etc.), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing, etc.), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using parts of, or the entire animal) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits comein two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Some people have an idealistic view of wildlife and believe that all wildlife should be captured and relocated to another area to alleviate damage or threats to protected resources. Those directly affected by the problems caused by wildlife usually support removal. Whereas, individuals not directly affected by wildlife damage may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Wildlife damage management practices are controversial in nature because they may affect each individual differently. WS goals are to assist resource owners in reducing damages while considering all possible non-lethal and lethal methods and employing those methods in a caring, humane, and professional manner. In addition, Pennsylvania WS would only conduct coyote and feral dog damage management at the request of the affected property owner or resource manager.

2.2.6.1 Effects on Aesthetic Values of Coyotes to the General Public

With the increase in urban sprawl, human encounters with wildlife are becoming more common. Many people enjoy feeding animals and/or otherwise develop emotional attitudes toward wildlife that results in aesthetic enjoyment. In addition, some people consider individual wild animals as "pets," or exhibit affection toward these animals. WS Proposed Action will have minimal effects on animals which provide aesthetic enjoyment to the general public. However, it is possible that WS may occasionally remove a predator that is involved with livestock predation or human health and safety concerns and also provides aesthetic enjoyment. Dispersal of young coyotes in the fall and late winter from other areas would likely replace animals removed during a damage management action; thus, providing continued aesthetic enjoyment to the general public.

Similarly, predators located in public areas (e.g., State Park or Wildlife Area) where the general public may enjoy (i.e., viewing, photography, feeding, etc.) the presence of predators, should not be concerned that WS Proposed Actions would have an adverse effect on these predators. It is possible that WS actions may remove predators on a farm in close proximity to a public area if that livestock producer is experiencing predator damage; however, those occurrences are expected to be rare.

2.2.6.2 Effects on Aesthetic Values of Coyotes to Livestock Owners and Hunters

Livestock and poultry producers who have experienced losses by coyotes feel these predators have little to no positive value. Some hunters feel coyotes compete with them for the same game animals they are pursuing. Other landowners who benefit from leasing land to hunters may feel coyotes are depriving them of monetary gain because coyotes are eating game animals which hunters would be willing to lease land to hunt. These individuals may feel the environment would be better off if fewer coyotes existed in Pennsylvania. In these instances coyotes have low or no aesthetic value to these stakeholders.

2.3 ISSUES USED TO DEVELOPE MITIGATION

2.3.1 Environmental Justice and Executive Order 12898 - *"Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Population"*

Environmental Justice (EJ) is a movement promoting the fair treatment of all races, income, and culture with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no person or group of people should endure a disproportionate share of the negative environmental impacts resulting either directly or indirectly from the activities conducted to execute this country's domestic and foreign policies or programs. EJ has been defined as the pursuit of equal justice and equal protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. (The EJ movement is also known as Environmental Equity - which is the equal treatment of all individuals, groups or communities regardless of race, ethnicity, or economic status, from environmental hazards).

Environmental Justice is a priority both within the USDA/APHIS and WS. Executive Order 12898 requires Federal agencies to make EJ part of their mission, and to identify and address disproportionately high adverse human health and environmental effects of Federal programs, policies, and activities on minority and low-income persons or populations. A critical goal of Executive Order 12898 is to improve the scientific basis for decision-making by conducting assessments that identify and prioritize environmental health risks and procedures for risk reduction. WS developed a strategy that: 1) identifies major programs and areas of emphasis to meet the intent of the Executive Order, 2) minimize any adverse effects on the human health and environment of minorities and low-income persons or populations, and 3) carries out the APHIS mission. To that end, APHIS operates according to the following principles: 1) promote outreach and partnerships with all stakeholders, 2) identify the impacts of APHIS activities on minority and low-income populations, 3) streamline government, 4) improve the day-to-day operations, and 5) foster nondiscrimination in APHIS programs. In addition, APHIS plans to implement Executive Order 12898 through its compliance with the provisions of NEPA.

All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898 to insure EJ. WS personnel use wildlife damage management methods as selectively and environmentally conscientiously as possible. All chemicals used by WS are regulated by the EPA through FIFRA; by the FDA; the PDA Pesticide Division; by MOU's with Federal land management agencies, and program directives. Based on a thorough risk assessment, APHIS concluded that when WS program chemicals are used following label directions, they are selective to target individuals or populations and such use has negligible impacts on the environment (USDA 1997a, Appendix P). The WS operational program, discussed in this document, 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 or low-income persons or populations. In contrast, WS activities may actually benefit those with low-income or those whose sole source of income is livestock production. Assistance by WS with predation to livestock may allow those individuals relying on livestock production for income to continue their practices.

2.3.2 Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

WS prioritizes the identification and assessment of environmental health and safety risks that may disproportionately affect children. Children may suffer disproportionately from environmental health and safety risks for many reasons, including their physical and mental status. WS has concluded that the proposed management program would not create environmental health or safety risks to children because the program would only make use of legally available and approved damage management methods applied where such methods are highly unlikely to adversely affect children.

2.3.3 National Historic Preservation Act 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 has 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 firearms or other noise-making methods are used at or in close proximity to such sites for purposes of removing predators. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage problem, which means such use, would be to 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.

2.3.4 The Native American Graves and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act require 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.

2.4 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

2.4.1 Legal Constraints on Implementation of Control

WS is required to follow and adhere to all Federal and state regulations. All methods proposed for use in coyote and feral dog damage management are permitted by Federal and state laws, or the appropriate exemptions/permits will be obtained.

2.4.2 Appropriateness of Preparing an EA (Instead of an EIS) for Such a Large Area

Some individuals might question whether preparing an EA for an area as large as Pennsylvania would meet the NEPA requirements for site specificity. Wildlife damage management falls within the category of Federal or other agency actions in which the exact timing or location of individual activities cannot usually be predicted well enough ahead of time to accurately describe such locations or times in an EA or EIS. The WS program is analogous to other agencies or entities with damage management missions such as fire and police departments, emergency cleanup organizations, insurance companies, etc. Although WS can predict some of the possible locations or types of situations and sites where some kinds of wildlife damage will occur, the program cannot predict the specific locations or times at which affected resource owners will determine a coyote and feral dog damage problem has become intolerable to the point that they request assistance from WS. Nor would WS be able to prevent such damage in all areas where it might occur without resorting to destruction of wild animal populations over broad areas at a much more intensive level than would be desired by most people, including WS and state agencies. Such broad scale population control would also be impractical, if not impossible, to achieve.

If a determination is made through this EA that the proposed action would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire Commonwealth may provide a better analysis than multiple EA's covering smaller zones.

2.4.3 Cost Effectiveness of Coyote Feral Dog Damage Management

NEPA does not require preparation of a specific cost-benefit analysis, and consideration of this issue would not be essential to making a reasoned choice among the alternatives being considered. However, cost-effectiveness of WS activities was a common concern among many comments received from other predator EA's written by other WS offices during the public involvement process and therefore is included in this EA.

Connolly (1981) examined the issue of cost effectiveness of Federal predator damage management programs and concluded that public policy decisions have been made to steer the program away from being as cost effective as possible. This is because of the elimination of damage management methods believed to be effective but less environmentally preferable, such as toxic baits. In addition, the increased costs of implementing the remaining available methods were to achieve other public benefits besides livestock protection and could be viewed as mitigation for the loss of effectiveness in reducing damage. USDA (1997a) stated that "Cost effectiveness is not, nor should it be, the primary goal of the WS program." Additional constraints, such as environmental protection, land management goals, and others, are considered whenever a request for assistance is received (USDA 1997a). These constraints increase the cost of the program while not necessarily increasing its effectiveness, yet they are considered a vital part of the WS program.

A cost-benefit analysis is usually limited to quantifiable values and does not consider a number of values that would be difficult to measure. When sheep are repeatedly harassed by predators, for example, they become extremely alarmed and weary and do not disperse and feed normally. Therefore, they would not find the quality and quantity of feed that they would have if unstressed, resulting in lower lamb weights at the end of the grazing season. This is a form of predator damage, but it would be difficult to quantify. Jahnke et al. (1988) and Wagner (1988) discussed additional examples of indirect predator damage, including increased labor costs and producer efforts to find sheep scattered by predators and range damage related to the tighter herding required in response to the presence of predators.

Cost-effectiveness of WS coyote and feral dog damage management can be assessed by looking at the difference between: 1) the value of actual losses with the program in place, plus the cost of the program, and 2) the value of what losses could reasonably be expected without the program in place. USDA (1997a) cites four studies where sheep losses to predators were documented with no damage management program in place (Table 2.1). Annual predation loss rates during these studies varied from 6.3 to 29.3% for lambs and 0 to 20.8% for adult sheep. The average rate of loss to predators was about 7% for sheep and 17% for lambs. It is reasonable to assume losses without damage

management in place could be similar to those found in the studies examined in Table 2.1 in areas with historic coyote predation.

Table 2.1. Annual predation loss rates for sheep and lambs in 5 studies in the United States (USDA 1997a).

Source	Annual loss rates		Location	Year	Sheep
	Lambs				
Henne (1977)	29.3%		Montana	1974/1975	20.8%
Munoz (1977)	24.4%		Montana	1975/1976	16%
McAdoo and Klebenow (1978)	6.3%		California	1976	N/A
Delorenza and Howard (1976)	12.1%		New Mexico	1975	0%
Delorenza and Howard (1976)	15.6%		New Mexico	1976	0%

2.4.4 Effects on Legal Hunting and Trapping

Some people may be concerned that WS coyote and feral dog damage management activities would affect regulated hunting and trapping by reducing local wild canid populations and that lethal and non-lethal damage management methods may interfere with regulated hunting and trapping.

It is anticipated that PA WS will kill no more than 500 coyotes in any one year under the proposed action. This lethal take by WS is very minimal compared to the 11,444 coyotes taken by licensed hunters/trappers during the 2002-2003 season (See Section 4.1.1). WS activities may result in reduced coyote densities on project area properties and on adjacent properties, hence slightly reducing the number of coyotes that may otherwise be available to local licensed hunters/trappers. Coyote densities on other properties outside the project area would likely not be affected, thus providing ample opportunities for hunters and trappers to harvest these animals. Although WS may remove coyotes in areas where hunters or trappers pursue predators, WS actions will typically be on privately owned property during the non-hunting/trapping seasons when pelts are not

prime for sale. Instead of competing with hunters and trappers, WS will recommend hunting and trapping to producers as additional predator control methods.

2.4.5 Lethal Methods may Increase Damage and the Coyote Population through Compensatory Reproduction

Mortality in coyote populations can range from 19%-100%, with 40%-60% mortality most common (USDI 1979). Several studies of coyote survival rates, which include calculations based on the age distribution of coyote populations, show typical annual survival rates of only 45% to 65% for adult coyotes. High mortality rates have also been shown in four telemetry studies involving 437 coyotes that were older than 5 months of age; 47% of the marked animals are known to have died (USDI 1979). Mortality rates of "unexploited" coyote populations were reported to be between 38%-56%. Thus, most natural coyote populations are not stable (USDI 1979). In studies where reported coyote mortality was investigated, only 14 of 326 (4%) recorded mortalities were due to WS activities (USDI 1979).

Dispersal of "surplus" young coyotes is the main factor that keeps coyote populations distributed throughout their habitat (Knowlton 1972, Harrison et al. 1991, Harrison 1992). Such dispersal of subdominant animals removes surplus animals from higher density areas and repopulates areas where artificial reductions have occurred. Studies (Connolly et al. 1976, Gese and Grothe 1995, Gese 1999) which investigated the predatory behavior of coyotes, determined that the more dominant (alpha) animals (adult breeding pairs) were the ones that initiated and killed most of the prey items. Thus, it appears the above concern is unfounded because the removal of local territorial (dominant, breeding adult) coyotes actually removes the individuals that are most likely to kill livestock and generally results in the immigration of subdominant coyotes that are less likely to prey on livestock.

Coyotes in areas of lower population densities may reproduce at an earlier age and have more offspring per litter; however, these same populations generally sustain higher mortality rates (Connolly and Longhurst 1975). Therefore, the overall population of the area does not change. The number of breeding coyotes does not substantially increase without exploitation and individual coyote territories produce one litter per year independent of the population being exploited or unexploited (Connolly and Longhurst 1975). Connolly and Longhurst (1975) demonstrated that coyote populations in exploited and unexploited populations do not increase at significantly different rates and that an area will only support a population to its carrying capacity.

CHAPTER 3: ALTERNATIVES

3.0 INTRODUCTION

Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992) as described in Chapter 2 (pages 20-35), Appendix J (Methods of Control), Appendix N (Examples of WS Decision Model), and Appendix P (Risk Assessment of Wildlife Damage Control Methods Used by USDA, Wildlife Services Program) of the ADC FEIS (USDA 1997a).

Chapter 3 of this EA contains a discussion of the project alternatives, including those that will receive detailed environmental impacts analysis in Chapter 4 (Environmental Consequences), alternatives considered but not analyzed in detail, with rationale, and mitigation measures and SOP's for wildlife damage management techniques. Pertinent portions of the affected environment will be included in this chapter in the discussion of issues used to develop mitigation measures. Evaluation of the affected environments will be addressed in more detail in Chapter 4.

ALTERNATIVES ANALYZED IN DETAIL

Alternative 1 - Technical Assistance Only - This alternative precludes any and all IWDM direct control activities by WS to reduce coyote and feral dog damage in Pennsylvania. If requested, affected individuals would be provided with technical assistance information only.

Alternative 2 - Non-lethal Control Only - This alternative would involve the use and recommendation of non-lethal management techniques only by WS.

Alternative 3 - Non-lethal Control before Lethal Control - This alternative would not allow the use or recommendation of lethal control by WS until all available non-lethal methods had been applied and determined to be inadequate in each damage situation.

Alternative 4 - Lethal Control Only - This alternative would involve the use and recommendation of lethal management techniques only by WS.

Alternative 5 - Integrated Wildlife Damage Management (Proposed Action) - This alternative would involve an IWDM program using components of the wildlife damage management techniques and methods addressed in Alternatives 1-4 as deemed appropriate by WS and other participating entities.

Alternative 6 - No Action - This alternative would result in no Federal WS Coyote and Feral Dog Damage Management in Pennsylvania. WS would not provide technical assistance or operational damage management services.

3.1 DESCRIPTION OF THE ALTERNATIVES

3.1.1 Alternative 1 - Technical Assistance Only

This alternative precludes any and all direct control activities by WS to reduce coyote and feral dog damage in Pennsylvania. If requested, affected individuals would be provided with technical assistance information only. Individuals or agencies might choose to implement WS recommendations, implement methods not recommended by WS, use contractual services of private businesses, use volunteer services of private organizations, or take no action. In some cases, control methods employed by others could be contrary to the intended use or in excess of what is necessary.

3.1.2 Alternative 2 - Non-lethal Control Only

Under this alternative, only non-lethal direct control activities and recommendations would be provided by WS to resolve coyote and feral dog damage. Requests for information regarding lethal management approaches would be referred to the PGC, local animal control agencies, or private businesses or organizations. Individuals or agencies might choose to implement WS non-lethal recommendations, implement lethal methods or other methods not recommended by WS, contract for WS direct control services, use contractual services of private businesses, use volunteer services of private organizations, or take no action. In some cases, control methods employed by others could be contrary to the intended use or in excess of what is necessary.

Non-lethal control methods may include, but are not limited to, fencing, shed birthing, guard animals (i.e., dogs, llamas, and donkeys), harassment, and shepherds. These are discussed in detail in Appendix B. Persons receiving non-lethal assistance could still resort to lethal methods, but not with WS assistance. Lethal control methods which could be implemented by the public may include: shooting, gas cartridges, calling and shooting, snares, and trapping. Livestock Protection Collars are registered in the Commonwealth of Pennsylvania for use by WS employees only. Therefore, use of this chemical by private individuals and state and local government agency personnel would be illegal.

3.1.3 Alternative 3 - Non-lethal Control before Lethal Control

This alternative would require that all methods or techniques described in 3.1.2 be applied and determined to be inadequate in each damage situation prior to the implementation of any of the methods or techniques described in 3.1.4. This would be the case regardless of the severity or intensity of the damage.

3.1.4 Alternative 4 - Lethal Control Only

This alternative would involve the use and recommendation of lethal management techniques only by WS and would not require use of or consideration of non-lethal methods. Lethal control methods would be applied in all areas of control operations. Lethal methods of wildlife control are often very effective when used properly. Specific problem animals can be targeted and removed without negatively affecting the local population of a species (Bailey 1984). Requests for information regarding non-lethal management approaches would be referred to the PGC, local animal control agencies, or private businesses or organizations. Individuals or agencies might choose to implement

WS lethal recommendations, implement non-lethal methods or other methods not recommended by WS, contract for WS direct control services, use contractual services of private businesses, use volunteer services of private organizations, or take no action. In some cases, control methods employed by others could be contrary to the intended use or in excess of what is necessary. Not all of the methods listed in Appendix B as potentially available to WS would be legally available to all other agencies or individuals (e.g.,LPC's). All control measures would be implemented in accordance with applicable Federal, state, and local laws, and WS policy. Deceased animals would be disposed of in accordance with WS policy and State Regulations. Local population reduction of coyotes to reduce immediate damage losses and potential damage threats may be implemented by WS personnel with assistance from the participating land managers. Target individuals would be lethally removed using the methods and techniques listed in Appendix B.

Coyotes and feral dogs caught in traps or snares would be euthanized on site in a humane manner utilizing American Veterinary Medical Association (AVMA) approved methods and WS SOP's. Euthanization would occur by either injection with a WS approved drug or shooting. Weather and environmental conditions permitting, traps and snares would be checked at least once each day. If daily checking is not possible, this equipment would be removed from the site. LPC's would be checked according to label specifications.

3.1.5 Alternative 5 - Integrated Wildlife Damage Management (Proposed Action)
This alternative would involve an IWDM program using components of the wildlife damage management techniques and methods addressed in Alternatives 1-4 as deemed appropriate by WS and other participating entities. Wildlife Services proposes to implement an integrated coyote and feral dog damage management program in Pennsylvania to assist livestock producers in reducing losses to sheep, cattle, goats, pigs, poultry, and other livestock; entities with reducing pet losses and injury; and any other entities with human health or safety concerns. An IWDM approach would be implemented on all private and public lands of Pennsylvania where a need exists, assistance is requested from landowners or public officials, and funding is available. An IWDM strategy would be recommended and used, encompassing 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 would provide technical assistance and operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al.1992). Cooperators requesting assistance would be provided with information regarding the use of effective non-lethal and lethal techniques (See Appendix B). Most non-lethal methods are best implemented by the cooperator and the following methods may be recommended by WS: guard dogs, llamas, and donkeys; Electronic Predator Guard (Linhart et al. 1992); fencing; moving livestock to other pastures; birthing in buildings; night penning; habitat alteration; herders and scare devices. Additional methods used by WS, or recommended to producers may include shooting, calling and shooting, trapping, snares, dogs, Livestock Protection Collars, and gas cartridges. 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. All management actions comply with appropriate Federal, state, and local laws.

3.1.6 Alternative 6 - No Action

This alternative would result in no Federal WS Coyote and Feral Dog Damage Management program in Pennsylvania. WS would not provide technical assistance or direct control damage management services. However, producers, property owners, agency personnel, or any other entity directed at preventing or reducing damage could conduct management activities in the absence of WS involvement. Requests for WS assistance would be referred to the PGC, local animal control agencies, or private businesses or organizations. Individuals or agencies might choose to implement their own damage management program, use contractual services of private businesses, use volunteer services of private organizations, or take no action. In some cases, control methods employed by others could be contrary to the intended use or in excess of what is necessary.

3.2 STRATEGIES AND METHODOLOGIES AVAILABLE TO WS IN PENNSYLVANIA

The strategies and methodologies described below include those that could be used or recommended under the Alternatives 1, 2, 3, 4 and 5 described above, Alternative 6 would eliminate any assistance by WS. Alternative 1 would not allow WS to conduct direct control activities. See Appendix B for a description of the methods that could be used or recommended by WS.

3.2.1 Integrated Wildlife Damage Management

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. Knowlton et al. (1999) states that "Various techniques can prevent or curtail predation on livestock but none are universally effective", "...removing coyotes to solve depredation problems is typically more effectively done by wildlife management personnel", and that "successful depredation management requires a variety of techniques used in an integrated program." The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., animal husbandry), habitat modification (e.g., exclusion), animal behavior modification (e.g., harassment), removal of individual offending animals, local population reduction, or any combination of these and other effective methods, depending on the circumstances of the specific damage problem. WS considers the biology and behavior of the damaging species and other factors using the WS Decision Model (Slate et al 1992). The recommended strategy(ies) may include any combination of preventive and corrective actions that could be implemented by the requester, WS, or other agency personnel, as appropriate. Two strategies are available:

3.2.1.1 Preventive Damage Management

Preventive damage management is applying wildlife damage management strategies before damage occurs, based on historical problems and data. All non-lethal methodologies, whether applied by WS or resource owners, are employed to prevent damage from occurring, and therefore, fall under this heading. When requested, WS personnel provide information and conduct demonstrations, or take action to prevent additional losses from recurring. For example, in areas where lamb or calf depredations have occurred historically, WS may provide information about livestock guarding animals, fencing or other husbandry techniques, or if requested, conduct coyote removal activities before lambing or calving begins.

The rationale for conducting preventive damage management to reduce damage differs little in the accepted management principle of holding controlled hunts for deer or elk in areas where agricultural damage has been a historical problem. By reducing the number of deer near agricultural fields, or the number of coyotes near a herd of sheep, the likelihood of damage is reduced. Shelton and Klindt (1974) documented a strong correlation between coyote densities and levels of sheep loss in Texas, and Robel et al. (1981) found a similar correlation in Kansas. In southeastern Idaho, Stoddart and Griffiths (1986) documented an increase in lamb losses followed by a decrease in lamb losses as coyote populations rose and fell, respectively. Gantz (1990) concluded that late winter removal of territorial coyotes from mountain grazing allotments would reduce predation on sheep grazing on those allotments the following summer.

Blejwas et al. (In Press) and Sacks et al. (1999a, 1999b) found that breeding adults whose territories contained sheep were typically responsible for the killing of livestock and that targeting those individuals for removal reduced predation to livestock. Wagner and Conover (1999) found that preventive damage management in areas of historic predation on livestock significantly reduced predation to livestock and was cost effective. Conner et al. (1998) suggested that coyote removal efforts should occur just prior to known peaks of predation.

3.2.1.2 Corrective Damage Management

Corrective damage management is applying wildlife damage management to stop or reduce current losses. As requested and appropriate, WS personnel provide information and conduct demonstrations, or take action to prevent additional losses from recurring. For example, in areas where verified and documented livestock depredations are occurring, WS may provide information about livestock guarding animals, fencing or husbandry techniques, or conduct direct control activities to stop the losses. The U.S. General Accounting Office (GAO) concluded that, according to available research, localized lethal damage management is effective in reducing coyote damage (GAO 1990).

3.2.2 The IWDM Strategies that WS Employs in Pennsylvania

3.2.2.1 Technical Assistance Recommendations (implementation is the responsibility of the requester)

"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate wildlife damage management methods. Technical assistance may require substantial effort by WS personnel in the decision making process, but the implementation of damage management actions is the responsibility of the requester. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities to use. Technical assistance may be provided following a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems, these strategies are based on the level of risk, need, and the practicality of their application.

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

3.2.2.2 Direct Control Damage Management Assistance (assistance conducted or supervised by WS personnel)

Direct control damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone or to make technical assistance methods more effective, and when *Agreements for Control* or other comparable instruments provide for WS direct control damage management. The initial investigation defines the nature, history, extent of the problem, species or property directly and indirectly damaged species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of WS personnel are often required to effectively resolve problems, especially if restricted use pesticides are necessary, or if the problem is complex.

3.2.2.3 Educational Efforts in Pennsylvania

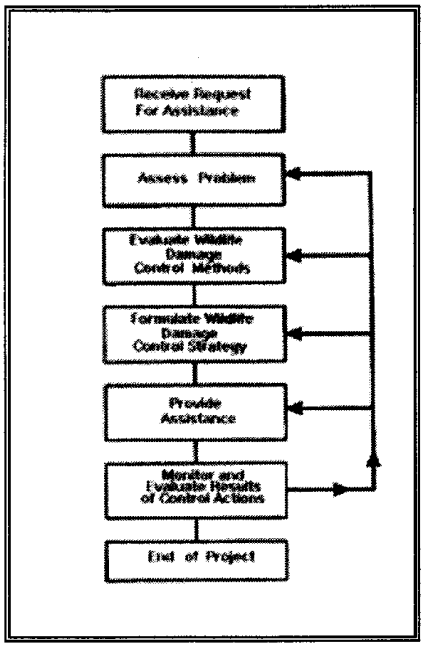
Education is an important element of WS program activities because wildlife damage management is about finding "balance" or coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to producers, homeowners, state and county agents, and other interested groups. WS frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are periodically updated on recent developments in damage management technology, laws and regulations, and agency policies.

WS provides informational leaflets about identifying coyote and feral dog damage, biology and ecology of the wildlife involved, specific methods and products most effective in reducing losses, and sources for supplies/products.

3.2.3 WS Decision Making

WS personnel use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model described by Slate et al. (1992) (Figure 3.1). WS personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. WS personnel assess the problem; evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, the methods deemed to be practical for the situation are developed into a management strategy. After the management strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a documented process, but a mental problem-solving process common to most if not all professions.

Figure 3-1
WS Decision Model



3.2.4 Decision Making by Producers and Other Potential Cooperators

The WS program in Pennsylvania follows the "Co-managerial approach" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS provides technical assistance regarding the biology and ecology of coyotes and feral dogs and effective, practical, and reasonable methods available to the

individuals to reduce damage. This includes non-lethal and lethal methods. Some technical assistance on alleviating damage caused by wildlife is available from the PGC, PDA, County Extension Agents, County Soil and Water Conservation Districts, county animal control, and private nuisance wildlife control agents. WS and other state and Federal wildlife or wildlife damage management agencies may facilitate discussions at local community meetings when resources are available. Producers, property owners, agency personnel, and others directly affected by damage have direct input into the resolution of such problems. Individuals may implement management recommendations provided by WS or others, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

3.3.1 Compensation for Wildlife Damage Losses

The Pennsylvania Department of Agriculture Bureau of Dog Law Enforcement does currently reimburse livestock producers for losses due to dog and coyote predation. Damage claim payments from 1999-2003 totaled $59,695 for dogs and $69,672 for coyotes (Figure 1.2.) (Mary Bender, Director of The Bureau of Dog Law Enforcement, Personal Communication 5/4/04). The amounts paid by The Bureau for coyote damage claims is likely underestimated because paid claims shall not exceed $20,000 per annum for coyote damages (Zerphey 1995). Also, the Bureau only tracks statistics for the indemnity payments, and does not have data on pets killed, nor livestock killed which was not reported for damage claims (Mary Bender, Director of The Bureau of Dog Law Enforcement, Personal Communication 5/4/04). Reimbursement provides producers monetary compensation for losses, it does not remove the problem nor does it assist with reducing future losses from predation.

Analysis of this alternative in USDA (1997a) shows that it has many drawbacks:

- Compensation is not practical for public health and safety problems.
- It requires larger expenditures of money to investigate and validate all losses, and to determine and administer appropriate compensation.
- Timely responses to all requests to assess and confirm losses difficult, and many losses may not be verified.
- Compensation gives little incentive to limit losses through other management strategies.
- Not all resource managers/owners would rely completely on a compensation program and unregulated lethal control would probably continue and escalate.

Regardless of the predator, compensation for losses does not resolve the initial problem of predation for producers and losses continue.

3.3.2 Coyote Bounties

During the early years of game management, many states relied on massive killing efforts (bounties) to reduce predator numbers (e.g., wolves, coyotes, foxes) which were competing with man for game animals (e.g., white-tailed deer). Bounties are not used by most wildlife agencies nor are they supported by WS for wildlife damage control because:

- Bounties are not effective in reducing damage.
- Circumstances surrounding take of animals is largely unregulated.
- No process exists to prohibit taking of animals from outside the damage management area for compensation purposes.
- Bounty hunters may mistake dogs and foxes as coyotes.
- Officials responsible for checking in coyotes may mistake dogs and foxes as coyotes.
- Coyote bounties have a long history (>100 years in the U.S.) of use in many states without ever achieving the intended results of reducing damage and population levels (Parker 1995).

The overwhelming disadvantage of coyote bounties is the misdirection of funds meant to, but not effectively and economically able to, reduce coyote damage.

3.3.3 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 National Wildlife Research Center (NWRC) (the research branch of the WS program) 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.

Fertility control could not be attempted without a permit (research or otherwise) from the PGC. One Wildlife Biologist for the PGC stated that he is "quite certain that this is not a practical option" (Matt Lavallo, PGC Furbearer Biologist, Personal Comminication 2/27/04). 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.

3.3.4 Corrective Coyote and Feral Dog Damage Management Only, No Preventative Damage Management

Some people believe lethal management actions should be implemented to stop predation on livestock only after predation has started. These people oppose preventative lethal management actions which may involve removal of coyotes living near livestock operations even though these same livestock operations have chronic historic predation.

Gantz (1990) concluded that late winter removal of territorial coyotes from mountain grazing allotments would reduce predation on sheep grazing on those allotments the following summer. Blejwas et al. (2002) and Sacks et al. (1999a, 1999b) found that breeding adults whose territories contained sheep were typically responsible for the killing of livestock and that targeting those individuals for removal reduced predation to livestock. Conner et al. (1998) suggested that coyote removal efforts should occur just prior to known peaks of predation.

While WS is unable to predict which predator will kill livestock or which livestock operations will have substantial predator losses, WS can look at historical records for each farm and draw inferences. On livestock operations with historic predator losses, it is likely there will be future losses. Therefore, it is prudent for the livestock manager to have predators removed as good husbandry, especially prior to lambing, kidding, or calving. WS is able to better serve the livestock industry when requests for assistance are more evenly distributed rather than being overwhelmed with requests for service, especially during spring lambing, kidding, and calving.

3.3.5 Require Producers to Help Themselves before Receiving Assistance from WS

Although no law or policy requires livestock producers to employ husbandry or other predator prevention practices to protect their livestock; cattle, sheep, and goat producers in the U.S. spent $184.9, $8.8, and $1.0 million on non-lethal management methods, respectively (NASS 2000, 2001).

Livestock producers in the U.S. employ many lethal and non-lethal management methods to reduce predator losses. The most frequently used non-lethal methods include: guard

animals, fencing, shed birthing, herding, night penning, and frightening tactics (NASS 1999). WS policy is to respond to all requests for assistance within program authority, responsibility, and budget. If improved husbandry and other non-lethal methods would reduce predation on livestock, then WS will recommend these practices following the IWDM approach.

3.3.6 No Use of Chemical Methods

Much of the public's concern over the use of registered toxicants for coyote and feral dog damage management is based on an erroneous perception that WS uses non-selective, outdated chemical methodologies. In reality, the chemical methods currently used by WS have a high degree of selectivity (see section 4.1.4). WS use of registered toxicants is regulated by the EPA through the FIFRA, by MOU's with other agencies, and by program directives. In addition, APHIS conducted a thorough risk assessment and concluded that chemicals used according to label directions are selective for target individuals or populations, and therefore, have negligible impacts on the environment (USDA 1997a, Appendix P).

The decision to use registered toxicants falls within the WS Decision Model (see section 3.2.3) (Slate et al. 1992). Chemical methods are used because they allow for efficient and effective delivery of service to more individuals than would be served if registered toxicants were unavailable. Most registered toxicants have the ability to work during inclement weather and solve damage problems, whereas, traps and snares may be inoperable and shooting impractical in the same inclement weather.

3.3.7 Relocation of Coyotes Killing Livestock

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 (Nielsen 1988). The American Veterinary Medical Association, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists all oppose the relocation of mammals because of the risk of disease transmission (CDC 1990).

3.4 MITIGATION AND SOP'S FOR WILDLIFE DAMAGE MANAGEMENT TECHNIQUES

3.4.1 Mitigation Measures

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for impacts that otherwise might result from that action. The current WS program, nationwide and in Pennsylvania, use many such mitigation measures and these are discussed in detail in Chapter 5 of the ADC FEIS (USDA 1997a).

Some key mitigating measures pertinent to the proposed action and alternatives that are incorporated into WS SOP's include the following:

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

- Reasonable and prudent alternatives and measures would be established through consultation with the USFWS and would be implemented to avoid adverse impacts to T&E species.
- EPA-approved label directions would be followed for all pesticide use. The registration process for chemical pesticides is intended to assure minimal adverse impacts to the environment when chemicals are used in accordance with label directions.
- All WS employees in the Commonwealth of Pennsylvania who use "Restricted Use Pesticides" are trained and certified as Public Applicators by the PDA Pesticide Division.
- Non-target animals captured in traps or snares would be released unless it is determined by a WS employee that the animal would not survive and/or that the animal cannot be released safely.
- Conspicuous, bilingual warning signs alerting people to the presence of traps, snares, and chemical control agents would be placed at major access points to areas where WS will be conducting active damage management operations.
- Research is being conducted to improve management 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 impacts.
- Preference would be given to non-lethal methods, when practical and effective. If practical and effective non-lethal control methods are not available and if lethal control methods are available and appropriate for WS to implement, WS may implement lethal methods.
- All WS personnel in Pennsylvania using 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 these materials. Management controls are in place within WS and its I&E Committee to maintain personnel training and certification.

3.5 ADDITIONAL MITIGATION MEASURES SPECIFIC TO THE ISSUES

The following is a summary of additional mitigation measures that are specific to the issues listed in Chapter 2 of this document.

3.5.1 Effects on Target (Coyote) Species Populations

- WS activities conducted to resolve damage conflicts would be directed towards individual problem animals, or local populations or groups, and not towards the eradication of a species or population within an entire area, region, or ecosystem.
- WS lethal take (kill) data would be regularly monitored by WS biologists and would be in compliance with the recommended or authorized levels of harvest allowed by the Commonwealth of Pennsylvania (See Chapter 4).
- Animals taken by WS would be considered with the statewide total harvest when estimating the impact on native wildlife species. These data would be used to maintain a magnitude of harvest below the level that would affect the viability of a native population.

3.5.2 Effects on Dogs

- Cooperators would be instructed to notify hunters requesting and receiving permission to hunt, that LPC's, snares, traps, and other control methods are in place on the property.
- Non-target dogs captured by WS would be returned to the owner if the animals wear identification and are known not to be the offending predator.

3.5.3 Effects on Non-target Wildlife Populations, Including T&E Species

- The WS Decision Model (Slate et al. 1992) was designed to identify the most appropriate damage management strategies and their impacts and would be used to minimize impacts on non-target wildlife and avoid impacts on T&E species.
- WS has consulted with the USFWS regarding the nationwide and Pennsylvania programs and would continue to implement all applicable measures identified by the USFWS to ensure protection of T&E species.
- The PGC was involved in the development of this EA, and was consulted to mitigate impacts to T&E species.
- Animals taken by WS would be considered with the statewide total harvest when estimating the impact on native wildlife species. These data would be used to maintain a magnitude of harvest below the level that would affect the viability of a native population.
- When conducting removal operations via shooting, WS would shoot only target species or animals and would not shoot an animal that can not be accurately identified.
- WS employees would use lures, trap placements (sets), and capture devices that are strategically placed at locations likely to capture a target animal and minimize the potential of non-target animal captures.
- No traps would be set within 50 feet of an exposed carcass to preclude capture of eagles and other birds.
- Traps would be selected so foot injuries to captured animals are kept to a minimum (e.g., laminated, offset, or padded jaws; swivels, shock springs, etc.) and would incorporate pan tension devices to avoid capture of non-target species.
- Traps and snares would be checked on a 24-hour basis and would not be placed in areas or trails habitually used by deer or other non-target animals, unless measures are taken to avoid those non-target animals (e.g., jump stick for deer).
- Current regulations require a deer stop (prevents the snare from closing to no more than 2 ½ inches in diameter) or break away device (breaks open at 350 pounds or less) on all snares used in Pennsylvania.
- The use of traps and snares would conform to current laws and regulations administered by the PGC and WS policy.
- Healthy, uninjured non-target animals captured in traps or snares would be released.
- Injured non-target animals will be treated by a rehabilitator or veterinarian or euthanized, depending on the extent of injury.

- LPC's are placed within fenced areas where livestock graze to target offending predators and to reduce exposure to non-target wildlife.

3.5.4 Effects on Human Health and Safety

- The WS Decision Model (Slate et al. 1992) was designed to identify the most appropriate damage management strategies and their impacts and would be used to minimize impacts on human health and safety.
- WS uses control devices and conducts activities for which the risk of hazards to public safety and hazard to the environment have been determined to be low according to a formal risk assessment (USDA 1997a, Appendix P). Additionally, because most of WS activities would be conducted on private lands or other lands of restricted public access, the risk of hazard to the public and their pets would be even further reduced.
- WS control operations would be conducted professionally and in the safest manner possible. Most trapping and snaring would be conducted away from areas of high human activity and signs are placed to warn the public of any potential hazards.
- All pesticides used by WS are registered with EPA and PDA. EPA label directions are followed by WS for all pesticides used in Pennsylvania.
- All WS certified pesticide applicators who use "Restricted-Use Pesticides" participate in PDA approved continuing education to keep informed of developments and maintain their certifications.
- All LPC applicators are required to wear waterproof gloves when handling collared sheep or goats and pass a written test prior to receiving certification to use LPC's.
- Warning signs indicating the placement of traps, snares, or LPC's on a farm would be placed at the main entry points.
- WS damage management via shooting is conducted professionally and in the safest manner possible. Shooting would be conducted during time periods when public activity and access to the control areas are restricted. WS personnel involved in shooting operations are fully trained in the proper and safe application of this method.
- All WS employees using firearms receive firearms training at least every 2 years.

3.5.5 Humaneness of Control Methods Used by WS

- WS employees are well trained in the latest and most humane devices/methods for removing problem wildlife.
- WS personnel would attempt to dispatch captured target animals as quickly and humanely as possible. In most field situations, a precise shot to the brain using a small caliber firearm would be performed. This method causes rapid unconsciousness followed by the cessation of heart and respirator functions, resulting in a humane and rapid death. This method is in concert with the AVMA definition of euthanasia (AVMA 2000).

- The NWRC is continually conducting research, with the goal, to improve the selectivity and humaneness of wildlife damage management devices used by WS personnel in the field.

3.5.6 Effects on the Aesthetic Values of Target and Non-target Species

- Dead animals would be kept from public view when placed in government vehicles traveling on public roads. In addition, dead animals would not disposed of in locations where the public is likely to see the animals.
- WS employees will avoid euthanizing animals when the public is present.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

Chapter 4 provides information needed for making informed decisions on the coyote and feral dog damage management objectives outlined in Chapter 1 and the issues and affected environment discussed in Chapter 2. This chapter analyzes the environmental consequences of each alternative identified for detailed analysis in Chapter 3 in relation to the issues. This chapter analyzes the environmental consequences of each alternative in comparison with the No Action Alternative to determine if the real or potential impacts would be greater, lesser, or the same. Therefore, the No Action Alternative (Alternative 6) serves as the baseline for the analysis and the comparison of expected impacts among the alternatives. The analysis also takes into consideration WS mandates, directives, and the procedures used in the WS decision process (USDA 1997a).

The following resource values within the Commonwealth of Pennsylvania are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, critical habitats (areas listed in T&E species recovery plans), air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

Cumulative Impacts: Discussed in relationship to each of the potentially affected species analyzed in this chapter.

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.

Impacts on sites or resources protected under the NHPA: WS actions are not undertakings that could adversely affect historic resources (See Section 2.3.3).

4.1 DETAILED ANALYSIS OF ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES

4.1.1 Effects on Target (Coyote) Species Populations

The analysis for magnitude of impact generally follows the process described in Chapter 4 of USDA (1997a). Magnitude is described in USDA (1997a) as "*. . . a measure of the number of animals killed in relation to their abundance.*" Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available. Generally, WS would only conduct damage management on species where population densities are considered high and only after they have caused damage.

Ecology of Coyotes

Historically, the coyote was mainly restricted to the prairie regions west of the Mississippi River. It is thought that the coyote moved into northern and eastern

Pennsylvania from New York's Catskill Mountains in the 1960s; from there, coyotes spread south and west across the state, perhaps augmented by individuals migrating east from Ohio (Fergus 2000). Today the coyote is found in nearly all of the continental United States and all Canadian provinces and territories (Boer 1992).

The cost to accurately determine absolute coyote densities over large areas would be prohibitive (Connolly 1992) and would not appear to be warranted for this EA given the coyote's relative abundance. Because determinations of absolute coyote densities are frequently limited to educated guesses (Knowlton 1972), many researchers have estimated coyote populations throughout the west and east (Pyrah 1984, Camenzind 1978, Knowlton 1972, Clark 1972, USDI 1979). The presence of unusual food concentrations and non-breeding helpers at the den can influence coyote densities and complicate efforts to estimate abundance (Danner and Smith 1980). Coyote densities range from $0.2/mi^2$ when populations are low (pre-whelping) to $3.6/mi^2$ when populations are high (post-whelping) (USDI 1979, Knowlton 1972). Knowlton (1972) concluded that coyote densities may approach a high of $5\text{-}6/mi^2$ under extremely favorable conditions with densities of 0.5 to $1.0/mi^2$ possible throughout much of their range.

The literature on coyote spatial organization is confusing (Windberg and Knowlton 1988, Messier and Barrette 1982). Coyotes are highly mobile animals with home ranges that vary by sex, age of the animal, and season of the year (Pyrah 1984, Althoff 1978, Todd and Keith 1976). Ozoga and Harger (1966), Edwards (1975), and Danner (1976) observed overlap between coyote home ranges and did not consider coyotes to be territorial. Other studies have shown that coyotes occupy territories and that each territory may have several non-breeding helpers at the den during whelping (Allen et al. 1987, Bekoff and Wells 1982). Therefore, each coyote territory may support more than just a pair of coyotes. Gese et al. (1988) reported that coyote groups of 2, 3, 4, and 5 comprised 40%, 37%, 10% and 6% of the resident population, respectively, and Messier and Barrette (1982) reported that during November through April, 35% of the coyotes were in groups of 3 to 5 animals.

The unique resilience of the coyote, its ability to adapt, and its perseverance under adverse conditions is commonly recognized among biologists and land managers. Despite intensive historical damage management efforts in livestock production areas and despite sport hunting and trapping for fur, coyotes continue to thrive and expand their range, occurring widely across North and Central America (Miller 1995). Connolly and Longhurst (1975) determined that, *"if 75% of the coyotes are killed each year, the population would be exterminated in slightly over 50 years."* However, the authors go on to explain that their *"model suggests that coyotes, through compensatory reproduction, can withstand an annual population mortality of 70%"* and that coyote populations would regain pre-control densities (through recruitment, reproduction and migration) by the end of the fifth year after control was terminated even though 75% mortality had occurred for 20 years. In addition, other researchers (Windberg and Knowlton 1988) recognized that immigration, (not considered in the Connolly and Longhurst (1975) model) can result in rapid occupancy of vacant territories, which helps to explain why coyotes have thrived in spite of early efforts to exterminate them (Connolly 1978).

Coyote Populations in Pennsylvania
The PGC estimates that there are at least 30,000 coyotes in Pennsylvania; however no absolutely reliable estimate exists (Matt Lovallo, PGC Furbearer Biologist, personal communication). The PGC provided Pennsylvania furbearer harvest data from 1996-2003 (Table 4.1) (Lovallo 2003).

Table 4.1. Pennsylvania Furbearer Harvest Estimates from 1995-1996 through 2002-2003.

	HARVEST*							
Species	**1995-96**	**1996-97**	**1997-98**	**1998-99**	**1999-00**	**2000-01**	**2001-02**	**2002-03**
Mink	8602	9315	14063	12238	13774	8614	13214	10069
Muskrat	130442	146013	216066	148205	94215	79880	121994	75340
Beaver	6454	9789	12628	8727	8377	8408	10934	4538
Gray Fox	23518	23307	26043	32922	26794	24452	23275	18805
Red Fox	31110	29623	36923	47202	36860	33060	33003	33007
Weasel	687	589	1172	662	319	340	657	406
Skunk	9995	11571	12344	11190	6723	7534	9245	7207
Opossum	29688	48549	60717	56287	33723	29093	27192	34787
Raccoon	120462	214958	194696	195110	107407	108890	121810	106485
Coyote	6662	7959	6685	11652	9586	10383	12363	11444
Bobcat	Closed	Closed	Closed	Closed	Closed	58	146	135
Black Bear	2190	1793	2101	2598	1740	3075	3063	2686
Estimated # Trappers**	8061	11131	11859	10817	7845	8994	7210	6693
# Furtakers(trappers&hunters)	21376	25636	27413	25877	19574	18551	19410	20676

*Harvest figures are estimates based on furtaker and gametake surveys, except for beaver and black bear which are exact counts from mandatory tagging.
**Estimate based on furtaker license sales and furtaker survey information.

Alternative 1 - Technical Assistance Only
Under this alternative, WS would not be involved in control of coyote and feral dog damage, other than by providing technical assistance. WS would have no direct impact on coyote populations. Impacts on coyotes under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by resource owner/land managers, but would likely be less than Alternative 6 since WS would be providing information. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which could lead to real but unknown impacts on coyote populations. For the same reasons shown in the population effects analysis under the proposed action, it is unlikely that coyote populations would be adversely impacted by implementation of this alternative.

Alternative 2 - Non-lethal Control Only
Under this alternative, WS would only implement non-lethal control methods and therefore would not have an impact on coyote populations. If non-lethal methods were successful in alleviating damage and the resource owner/land manager did not implement lethal control actions there would be no impact to coyote populations. However, in those

situations where non-lethal methods were ineffective, the resource owner would likely reject WS non-lethal assistance and implement their own lethal control program resulting in impacts similar to Alternative 6.

Alternative 3 - Non-lethal Control Before Lethal Control
Under this alternative, WS would implement non-lethal control prior to the use of lethal methods. WS impacts to coyote populations would be similar to Alternative 2 in those cases were non-lethal methods effectively reduced damage levels to acceptable levels and would be similar to the proposed action when lethal methods were implemented by WS. However, because non-lethal control must be applied before lethal control, damage may not be reduced in a timely and effective manner. In those situations, resource owners/land managers may be unwilling to accept further losses as all available non-lethal methods are applied. This could result in resource owners/land managers rejecting WS non-lethal methods and implement their own lethal control program resulting in impacts similar to Alternative 6.

Alternative 4 - Lethal Control Only
Under this alternative, WS would implement and recommend lethal control methods without applying or considering non-lethal methods. In many situations, WS lethal methods would be applied as a result of unsuccessful attempts by resource owners/land managers to alleviate coyote damage through non-lethal methods resulting in impacts similar to the proposed action. In those situations where non-lethal methods were not implemented by resource owners/land managers, it is likely that a greater number of coyotes would have to be removed lethally by WS. However, based upon the population analysis provided under the proposed action, this potential increase in lethal take would not result in adverse effects to local, regional or statewide coyote populations.

Alternative 5 - Integrated Wildlife Damage Management (Proposed Action)
Under this alternative, WS would incorporate select components form Alternatives 1, 2, 3, and 4. As presented in the population impact analysis below, it is unlikely that WS would negatively impact target coyote populations on a local, regional or statewide scale under this alternative. Some reduction in coyote populations may occur in localized areas where lethal control activities are implemented, but not to an extent that coyotes would be permanently extirpated from an area. Local and regional immigration and emigration of coyotes would be expected to replace removed target animals after a relatively short period of time.

Coyote Population Impact Analysis

Coyotes are killed by farmers and other citizens because of the damage coyotes cause to livestock, agricultural crops, property, threats to human safety, or natural resources. The number of coyotes killed in Pennsylvania by farmers and other citizens is unknown and not measured by any survey. There are no regulated season or harvest restrictions on coyotes in Pennsylvania. Hunters and trappers removed at least 11,444 coyotes in Pennsylvania during the 2002-03 hunting and trapping season as reported by the PGC

(Table 4.1) (Lovallo 2003). This number could be underestimating the actual take of coyotes because the numbers are based on furtaker and gametaker surveys.

Even though there is no season or restriction of harvest, the coyote population seems to be stable. Tom Hardisky, a furbearer biologist with the PGC, believes the coyote population is no longer growing, having leveled off in the mid-1990s (Mulhollem 2004). Gary San Julian, wildlife resources professor at Penn State's College of Agricultural Sciences, noted, "Out West they've hunted coyotes for years and years, and they have not affected the population." Hardisky agreed, "They've been doing that for 50-60 years and yet they're still loaded with coyotes." (Schneck 2004).

WS has not adversely impacted the coyote population in similar programs in the Eastern U.S. (e.g., Virginia, West Virginia). WS expects that the lethal take of coyotes in Pennsylvania by WS will be minor compared to sport hunting, trapping and other depredation take allowed by the PGC. WS anticipates that no more than 500 coyotes will be killed annually under the proposed action. Therefore, 500 coyotes is used to analyze potential impacts to the statewide coyote population in Pennsylvania. Using the 2002-2003 harvest estimate of 11,444 coyotes killed in PA and the fact that WS will not kill more than 500 coyotes in any one year (a total of 11,944 coyotes); the likelihood of reducing the PA coyote population to unsustainable levels is highly unlikely considering a 75% annual reduction in the population for 50 years would be necessary to achieve an unsustainable level (Connolly and Longhurst 1975). Using the population estimate of 30,000 coyotes, 22,500 coyotes would need to be killed each year for about 50 consecutive years to eliminate coyotes from Pennsylvania. Furthermore, Connolly and Longhurst (1975) model suggests that coyotes, through compensatory reproduction, can withstand an annual population mortality of 70%. Using this model, the coyote population in Pennsylvania can withstand an annual mortality up to 21,000 coyotes, therefore even if WS lethal take was twice the predicted level of lethal take (1,000 coyotes), it would be highly unlikely that WS management activities would adversely affect coyote populations throughout the State.

The ADC FEIS (USDA 1997a) determined magnitude of total harvest using qualitative information based on State population trends. Magnitude is defined as a measure of the number of animals killed in relation to their abundance. Using the annual take of 500 coyotes by WS, the hunter/trapper harvest of over 10,000 coyotes per year for the past 5 years, and the stable trend of coyote populations in the Commonwealth, the magnitude is considered extremely low for WS take of coyotes in Pennsylvania. Thus, cumulative take appears to be far beneath the level that would begin to cause a decline in the coyote population.

Based on the above information, PGC oversight, and WS limited lethal take of coyotes in Pennsylvania, WS should have minimal effects on local, regional or statewide coyote populations.

Alternative 6 - No Action
This alternative would result in no Federal WS Coyote and Feral Dog Damage Management in Pennsylvania. WS would not provide technical assistance or operational damage management services. Coyote populations could increase where trapping, hunting, and depredation take was low and some populations would decline or stabilize where trapping, hunting and depredation take was adequate. Some resource owners/land managers experiencing damage would trap or shoot coyotes, or hire private trappers but would receive no guidance from WS regarding these options. Resource owners/land managers experiencing damage may take illegal or unsafe action against local populations of coyotes out of frustration of continued damage. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which could lead to real but unknown impacts on coyote populations. Impacts on coyotes under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by the resource owner/land managers. For the same reasons shown in the population effects analysis under the proposed action, it is unlikely that coyote populations would be adversely impacted by implementation of this alternative.

4.1.2 Effects on Dogs

Alternative 1 - Technical Assistance Only
Under this alternative, WS would not be involved in control of coyote and feral dog damage and conflicts, other than by providing technical assistance. WS would have no direct impact on target or non-target dog populations. Impacts on dogs under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by the resource owner/land owner, but would likely be less than Alternative 6 since WS would be providing information. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which could lead to real but unknown impacts on dogs.

Alternative 2 - Non-lethal Control Only
Under this alternative, WS would only implement non-lethal control methods and therefore would not have an impact on target or non-target dog populations. If non-lethal methods were successful in alleviating damage and the resource owner/land manager did not implement lethal control actions there would be no impact to dogs, except if livestock producers use guard animals (a non-lethal method that may be recommended by WS). In this situation some hunting or companion dogs may be killed by guard animals if those dogs enter protected pastures. However in those situations where non-lethal methods were ineffective, the resource owner would likely reject WS non-lethal assistance and implement their own lethal control program resulting in impacts similar to Alternative 6.

Alternative 3 - Non-lethal Control Before Lethal Control
Under this alternative, WS would implement non-lethal control prior to the use of lethal methods. WS impacts to target and non-target dog populations would be similar to Alternative 2 in those cases were non-lethal methods effectively reduced damage levels to acceptable levels and would be similar to the proposed action when lethal methods

were implemented by WS. However, because non-lethal control must be applied before lethal control, damage may not be reduced in a timely and effective manner. In those situations, resource owners/land managers may be unwilling to accept further losses as all available non-lethal methods are applied. This could result in resource owners/land managers rejecting WS non-lethal methods and implement their own lethal control program resulting in impacts similar to Alternative 6.

Alternative 4 - Lethal Control Only
Under this alternative, WS would implement and recommend lethal control methods without applying or considering non-lethal methods. In many situations, WS lethal methods would be applied as a result of unsuccessful attempts by resource owners/land managers to alleviate damage through non-lethal methods resulting in impacts similar to the proposed action. In those situations where non-lethal methods were not implemented by resource owners/land managers, it is likely that a greater number of feral dogs would have to be removed lethally by WS. However, even if complete removal of a local feral dog population could be achieved, this would be considered a beneficial impact on the human environment since these species are not considered part of the native ecosystem.

It is unlikely that WS activities will adversely impact pet dogs and hunting dogs of law-abiding citizens since WS activities will be communicated to the property owner and adjoining landowners. Unfortunately, some dog owners fail to follow state laws by not restraining their dogs, putting these dogs at risk. Some hunting dogs are at risk because some hunters fail to get landowner permission and trespass unaware of the hazards their dogs may encounter.

Alternative 5 - Integrated Wildlife Damage Management (Proposed Action)
Under this alternative, WS would incorporate select components form Alternatives 1, 2, 3, and 4. Removal of the feral dogs may occur in localized areas where lethal control activities are implemented. However, even if complete removal of a local feral dog population could be achieved, this would be considered a beneficial impact on the human environment since these species are not considered part of the native ecosystem.

It is unlikely that WS activities will adversely impact pet dogs and hunting dogs of law-abiding citizens since WS activities will be communicated to the property owner and adjoining landowners. Unfortunately, some dog owners fail to follow state laws by not restraining their dogs, putting these dogs at risk. Some hunting dogs are at risk because some hunters fail to get landowner permission and trespass unaware of the hazards their dogs may encounter.

Alternative 6 - No Action
This alternative would result in no Federal WS Coyote and Feral Dog Damage Management in Pennsylvania. WS would not provide technical assistance or operational damage management services. Some resource owners/land managers experiencing damage would lethally remove feral dogs but would receive no guidance from WS. Resource owners/land managers experiencing damage may take illegal or unsafe action against local populations of dogs out of frustration of continued damage. It is

hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which could lead to real but unknown impacts on dog populations. Impacts on dog populations under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by the resource owner/land manager.

4.1.3 Effects on Non-target Wildlife Populations, including T&E Species

Alternative 1 - Technical Assistance Only
Under this alternative, WS would not be involved in any direct control activities to reduce coyote and feral dog damage; therefore, WS would have no impact on any non-target or T&E species. Efforts by resource owners/land managers and other entities to reduce or prevent coyote and feral dog damage may result in less experienced persons implementing control methods and may lead to greater take of non-target and T&E species than the proposed action. For example, trapping or snaring by persons not proficient at mammal sign identification could lead to the killing of non-target species such as deer, fox, raccoon, bobcats, and other animals. Even though WS is providing technical information, measures to avoid capturing non-target and T&E species may not be employed by resource owners/land managers, leading to impacts similar to Alternative 6. It is hypothetically possible that frustration caused by the inability to reduce damage could lead to illegal use of chemical toxicants which could adversely impact non-target and T&E species. Hazards to raptors, including bald eagles, could also be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

Alternative 2 - Non-lethal Control Only
Under this alternative, no risks to non-target wildlife populations or T&E species by WS activities are anticipated since WS would only implement non-lethal control methods to reduce damage. If livestock producers use guard animals (a non-lethal method that may be recommended by WS), some non-target species may be killed if those animals enter protected pastures. In those situations where non-lethal methods are ineffective at reducing damage to acceptable levels, resource owners/land managers would likely resort to other means of control such as use of shooting, trapping, and snaring or even illegal use of chemical toxicants. These measures may result in less experienced persons implementing control methods and may lead to greater take of non-target and T&E species than the proposed action. For example, trapping or snaring by persons not proficient at mammal sign identification could lead to the killing of non-target species such as deer, fox, raccoon, bobcats, and other animals. It is hypothetically possible that frustration caused by the inability to reduce losses could lead to illegal use of chemical toxicants which could lead to unknown impacts on non-target and T&E species populations. Hazards to raptors, including bald eagles, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

Alternative 3 - Non-lethal Control Before Lethal Control
Under this alternative, WS would implement non-lethal control prior to the use of lethal methods. WS impacts to non-target and T&E species populations would be similar to Alternative 2 in those cases were non-lethal methods effectively reduced damage levels to acceptable levels and would be similar to the proposed action when lethal methods were implemented by WS. However, because non-lethal control must be applied before lethal control, damage may not be reduced in a timely and effective manner. In those situations, resource owners/land managers may be unwilling to accept further losses as all available non-lethal methods are applied. This could result in resource owners/land managers rejecting WS non-lethal methods and implement their own lethal control program resulting in impacts similar to Alternative 6.

Alternative 4 - Lethal Control Only
Under this alternative, WS would implement and recommend lethal control methods without applying or considering non-lethal methods. WS impacts to non-target and T&E species would be similar to the proposed action.

Alternative 5 - Integrated Wildlife Damage Management (Proposed Action)
Under this alternative, WS would incorporate select components from Alternatives 1, 2, 3, and 4. There is a risk of non-target species being captured or killed whenever control methods are employed to stop damage from occurring. WS take of non-target species during coyote and feral dog damage management activities is expected to be extremely low to non-existent. WS personnel are experienced and trained in wildlife identification, and to select the most appropriate methods for taking targeted animals and excluding non-target species. Shooting is virtually 100% selective for the target species; therefore no adverse impacts are anticipated from use of this method. WS personnel use animal lures and set traps and snares in locations that are conducive to capturing target animals while minimizing potential impacts to non-target species. Any non-target species captured unharmed in a live trap would be subsequently released on site. No adverse impacts from the use of registered chemical methods are anticipated. Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemical methods are used in accordance with label directions, they are highly selective to target individuals or populations, and such use has negligible effects on the environment (USDA 1997). Mitigation measures designed and implemented to avoid adverse effects on non-target species are described in Chapter 3.

WS will make every attempt to avoid capturing non-target animals. Non-target species that are inadvertently captured in live traps (i.e., foothold traps and snares) would be released, if it is determined that it is safe to do so and if the animal is injury free. Non-target species captures are minimized by WS selection of appropriate trap size, pan tension, attractants (baits), and site selection. Daily trap checks would further minimize risk to non-target species. Risks associated with snares are greatest for animals that frequent the areas where snares are placed and travel along paths of the targeted animals. Non-target species risks will further be minimized by adjusting the size of the snare loop and the height of placement. Proper loop size and placement allows animals smaller than the target species to pass under or through the snare unharmed and those animals larger than the target species to step or jump over the snare. The use of break-away locks and

stops (device used to prevent a snare from completely closing) would allow animals larger than the target species to break free of the snare or to be released.

If lethal take of non-target species would occur, these occurrences are expected to be rare and should not affect the overall populations of any species. Non-target species that may be affected may include, but are not necessarily limited to, raccoons, opossums, skunks, fox, and feral and free-ranging cats. As shown in Table 4.1, many of the non-target species that may be captured or killed by WS are as also harvested by Pennsylvania hunters and trappers. WS lethal take of non-target species would be minimal in proportion to the number of animals harvested by Pennsylvania hunters and trappers on an annual basis (less than 1%) and would not be expected to negatively impact any non-target populations on a local, regional, or statewide scale under this alternative.

As described in section 2.2.3, no adverse impacts on federal or Pennsylvania state T&E listed birds, mammals, invertebrates, fish, reptiles, amphibians, or plants (Appendix C) are expected by WS operational activities.

WS coyote and feral dog damage management activities may indirectly benefit some species that are preyed upon by coyotes and feral dogs. The benefits would be highly localized and most likely on the property WS is assisting, or on adjacent properties of those landowners.

Alternative 6 - No Action
Under this alternative, WS would not be involved in coyote and feral dog damage management activities in Pennsylvania and therefore would have no impact on any non-target or T&E species. Efforts by resource owners/land managers and other entities to reduce or prevent coyote and feral dog damage may result in less experienced persons implementing control methods and may lead to greater take of non-target and T&E species than the proposed action. For example, trapping or snaring by persons not proficient at mammal sign identification could lead to the killing of non-target species such as deer, fox, raccoon, bobcats, and other animals. It is hypothetically possible that frustration caused by the inability to reduce damage could lead to illegal use of chemical toxicants which could adversely impact non-target and T&E species. Hazards to raptors, including bald eagles, could also be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

4.1.4 Effects on Human Health and Safety

Alternative 1 - Technical Assistance Only
Under this alternative, WS would not be involved in any direct control activities to reduce coyote and feral dog damage; therefore, WS would have no impact on human health or safety. Efforts by resource owners/land managers and other entities to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially leading to greater risk to human health and safety than the Proposed Action, although not to the point that they would be substantial. However, because some of these individuals would be receiving

advice and instruction from WS, concerns about human health risks from the use of damage management methods should be less than under Alternative 6. Hazards could be greater under this alternative if persons using firearms, traps and snares are poorly or improperly trained. Hazards to humans could be greater under this alternative if chemicals that are less selective and cause secondary poisoning are used. It is hypothetically possible that frustration caused by the inability to alleviate damage could lead to illegal use of certain toxicants that could pose secondary poisoning hazards to pets. Some chemicals that could be used illegally would present greater risks of adverse effects on humans than those used under the Proposed Action.

Alternative 2 - Non-lethal Control Only
Under this alternative, only non-lethal methods would be used or recommended by WS. A formal risk assessment of WS operational management methods found that risks to human safety were low (USDA 1997a, Appendix P). Therefore, no adverse affects on human safety from WS's use of these methods are expected. There are currently no registered non-lethal chemicals available for use on predators; therefore, any concerns of WS use of chemicals would be eliminated under this alternative. However, excessive cost or ineffectiveness of non-lethal techniques could result in some entities rejecting WS assistance and resorting to other means of control, including the possibility of illegal use of pesticides, resulting in impacts similar to Alternative 6.

Alternative 3 - Non-lethal Control Before Lethal Control
Under this alternative, WS would be required to implement non-lethal methods prior to the implementation of lethal methods. WS impacts on human health and safety would be similar to Alternative 2 in those cases where non-lethal methods effectively reduced predation levels to acceptable levels and would be similar to the proposed action when lethal methods were implemented by WS. However, because non-lethal control must be applied before lethal control, damage may not be reduced in a timely and effective manner. In those situations, resource owners/land managers may be unwilling to accept further losses as all available non-lethal methods are applied. This could result in resource owners/land managers rejecting WS non-lethal methods and implement their own lethal control program resulting in impacts similar to Alternative 6.

Alternative 4 - Lethal Control Only
Under this alternative, WS would implement and recommend lethal control methods without applying or considering non-lethal methods. WS impacts on human health and safety would be similar to the proposed action.

Alternative 5 - Integrated Wildlife Damage Management (Proposed Action)
Under this alternative, WS would incorporate select components from Alternatives 1, 2, 3, and 4. A formal risk assessment of WS operational management methods found that risks to human safety were low (USDA 1997a, Appendix P). In addition, APHIS conducted a thorough Risk Assessment, and concluded that, WS use of chemical methods are in accordance with label directions, and are highly selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997a). Therefore, no adverse affects on human safety from WS's use of coyote and feral dog

damage management methods are expected. WS SOP's include measures intended to mitigate or reduce the effects on human health and safety and are presented in Chapter 3.

Damage management methods that may raise concern include: trapping, snaring, shooting, and calling and shooting, LPC, and Large Gas Cartridge.

Trapping and snaring
Traps and snares may be used or recommended by WS and do not pose a threat to human health and safety. There are many misconceptions about foothold traps and snares. Regulations exist to prohibit use of traps that cause damage to the user or anyone that may encounter a set trap. For example, in Pennsylvania the legal jaw spread for terrestrial traps can not exceed 6 1/2", and traps are not to be set on human or livestock paths. In addition, the BMP process addresses user safety ensuring that traps and snares are safe. It is possible that an individual may accidentally step into a trap and get their toe caught; however, a person can easily pull their foot out of the trap without damage or even a bruise. Similarly, it is unlikely that an individual would get entangled in a snare set for a target species. However, one can easily remove a snare by pushing the locking device in the opposite direction to open up the snare loop. More detailed information about traps and snares are provided in Appendix B.

Shooting and calling and shooting
WS personnel may occasionally employ or recommend the use of rifles and shotguns to remove target species causing damage. Handguns may also be used to humanely euthanize trapped or snared animals. Safety issues related to the misuse of firearms and the potential human hazards associated with firearms use are concerns both to the public and WS. 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 every 2 years afterwards (WS Directive 2.615). WS employees who carry and use firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence. The Pennsylvania WS program conducts firearms training at least every 2 years for all personnel. More detailed information about shooting practices is provided Appendix B.

Livestock Protection Collars
The LPC is a chemical method that could be used in Pennsylvania by WS registered applicators. Appendix B provides more detailed information on this chemical.

The LPC consists of a rubber collar with two rubber reservoirs (bladders), each of which contains 15 milliliters (ml) of a 1-percent solution of sodium fluoroacetate. The LPC has Velcro straps for attachment around the neck of a sheep or goat with the reservoirs positioned just behind the jaw. Two collar sizes are available to accommodate various size livestock.

Coyotes typically attack sheep and goats by biting them on the throat and crushing the larynx, causing suffocation. Coyotes that attack collared sheep generally puncture the collar with their teeth (in 75% or more of attacks) and receive a lethal oral dose of toxicant. There has been limited use of LPC's in the Eastern U.S.; for example in Virginia during FY 1996-2001, 375 ml of sodium fluoroacetate from LPC's was exposed from puncturing by coyotes. Factors which virtually eliminate any risks of public health or safety problems from use of LPC's include:

- The toxicant (sodium fluoroacetate) is contained within rubber bladders worn by livestock which makes it unlikely the public will come into contact with LPC's.
- A human would need to ingest liquid toxicant from one of the rubber bladders to have any chance of receiving the chemical into his/her system, which is highly unlikely to occur.
- Secondary hazard studies with mammals and birds have shown that there is very little hazard of secondary poisoning.
- Warning signs are placed at the entrance of farms where sheep or goats collared with LPC's are located within fenced pastures.
- Warning labels are attached to all LPC's informing a person about the toxic nature of the contents.
- WS personnel are certified in Pennsylvania as restricted-use pesticide applicators.
- There is a yellow dye mixed with the sodium fluoroacetate in the LPC which serves as a warning that the LPC has been punctured and precautionary measures such as wearing rubber gloves need to be taken.
- WS personnel follow label instructions and directions in the Predator Management Training Manual (Lowney 1996) or a similar publication.
- LPC devices are checked daily by the cooperator and weekly by the applicator to ensure proper fit and that they were unbroken.

The above analysis indicates that human health risks from sodium fluoroacetate (LPC) use would be virtually nonexistent.

Large Gas Cartridges

Another lethal chemical which may be used or recommended by WS includes the Large Gas Cartridge (Sodium nitrate). The Large Gas Cartridge is in the process of being registered for use in Pennsylvania by registered applicators for livestock protection. The Large Gas Cartridge is placed in burrows/dens and is burned to create carbon monoxide gas to euthanize animals. Applicators must exercise caution to avoid burns to the skin or surrounding vegetation. Registered chemicals, such as the Large Gas Cartridge, must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they are registered by EPA. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on human health and safety.

Alternative 6 - No Action
Under this alternative, WS would not be involved in damage management activities to reduce coyote and feral dog damage; therefore, WS would have no impact on human health or safety. Efforts by resource owners/land managers and other entities to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially leading to greater risk to human health and safety than the Proposed Action, although not to the point that they would be substantial. Hazards could be greater under this alternative if persons using firearms, traps and snares are poorly or improperly trained. Hazards to humans could be greater under this alternative if chemicals that are less selective and cause secondary poisoning are used. It is hypothetically possible that frustration caused by the inability to alleviate damage could lead to illegal use of certain toxicants that could pose secondary poisoning hazards to pets. Some chemicals that could be used illegally would present greater risks of adverse effects on humans than those used under the Proposed Action.

4.1.5 Humaneness of Control Methods Used by WS

Alternative 1 - Technical Assistance Only
Under this alternative, WS would not be involved in any direct control activities to reduce coyote and feral dog damage. Therefore, WS would have no impact on any wildlife species. Efforts by resource owners/land managers and other entities to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially resulting in inhumane captures or deaths of the target species and non-target species including T&E species, pets, and native wildlife. However, because some of these individuals would be receiving advice and instruction from WS, concerns about the humane use of damage management methods should be less than under Alternative 6. It is hypothetically possible that frustration caused by the inability to alleviate damage could lead to illegal use of certain toxicants that could pose secondary poisoning hazards and inhumane death or sickness to pets and to mammalian and avian scavengers.

Alternative 2 - Non-lethal Control Only
Under this alternative, only non-lethal methods would be used or recommended by WS. Lethal methods, viewed as inhumane by some persons, would not be used by WS. Persons or groups opposed to the live capturing and restraining of animals (i.e., traps and snares) or any type of lethal control by WS would most likely prefer this alternative to Alternatives 3, 4, or 5. If livestock producers use guard animals, a non-lethal method that could be recommended by WS, it is possible that guard animals may attack predators or non-target animals that are perceived as a threat and cause, by some people's perception, an inhumane attack or death. However, because non-lethal control may not always reduce damage in a timely and effective manner, resource owners/land managers may reject WS non-lethal methods and implement their own lethal control program resulting in impacts similar to Alternative 6.

Alternative 3 - Non-lethal Control Before Lethal Control
Under this alternative, WS would be required to implement non-lethal methods prior to the implementation of lethal methods. WS impacts on humaneness would be similar to Alternative 2 in those cases were non-lethal methods effectively reduced damage levels to acceptable levels and would be similar to the proposed action when lethal methods were implemented by WS. However, because non-lethal control must be applied before lethal control, damage may not be reduced in a timely and effective manner. In those situations, resource owners/land managers may be unwilling to accept further losses as all available non-lethal methods are applied. This could result in resource owners/land managers rejecting WS non-lethal methods and implement their own lethal control program resulting in impacts similar to Alternative 6.

Alternative 4 - Lethal Control Only
Under this alternative, WS would implement and recommend lethal control methods without applying or considering non-lethal methods. Lethal methods are often applied by WS as a result of unsuccessful attempts by land managers to alleviate damage through non-lethal methods. WS impacts on humaneness would be similar to the proposed action.

Alternative 5 - Integrated Wildlife Damage Management (Proposed Action)
Under this alternative, WS would incorporate select components from Alternatives 1, 2, 3, and 4. 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 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. Shooting results in a relatively humane death because the animals die instantly or within seconds. However, shooting is also considered inhumane by some individuals. WS uses EPA registered and approved chemical methods, such LPC and gas cartridges to manage damage. Some individuals consider the use of such chemicals to be inhumane. Carbon monoxide, the active ingredient in gas cartridges, is recognized by the AVMA as an approved and humane euthanasia method to kill animals (AVMA 2001).

WS personnel are experienced and professional in their use of management methods, and methods are applied as humanely as possible. Under this alternative, coyotes and feral dogs would be removed as humanely as possible by experienced WS personnel using the best methods available. Some persons may perceive methods used under this alternative as inhumane because they oppose all lethal methods of damage management. This alternative allows WS to consider non-lethal methods, and WS would implement non-lethal methods when appropriate.

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 damage management methods are used in situations where nonlethal damage management methods are not practical or effective.

Alternative 6 - No Action
Under this alternative, WS would not be involved in damage management activities to reduce coyote and feral dog damage. Therefore, WS would have no impact on any wildlife species. This alternative would be considered humane by many people opposed to WS and the assistance provided.

Livestock producers may consider this alternative inhumane because of the gruesome injuries and deaths their livestock experience from predators. Resource owners/land managers could use lethal and non-lethal methods to reduce damage. Efforts by resource owners/land managers and other entities to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially resulting in inhumane captures or deaths of the target species and non-target species including T&E species, pets, and native wildlife. It is hypothetically possible that frustration caused by the inability to alleviate damage could lead to illegal use of certain toxicants that could pose secondary poisoning hazards and inhumane death or sickness to pets and to mammalian and avian scavengers.

4.1.6 Effects on the Aesthetic Values of Target and Non-target Species

Alternative 1 - Technical Assistance Only
Under this alternative, WS would not be involved in any direct control activities to reduce coyote and feral dog damage. Therefore, WS effects on aesthetic values to target and non-target species would be nonexistent. Some people and/or groups who oppose any wildlife damage direct control activities by WS would likely support this alternative. People and/or groups who have affectionate bonds with individual animals or animals in general, would not be affected by WS activities under this alternative. However, it is likely that resource owners/land managers or other individuals would conduct coyote and feral dog damage management resulting in impacts similar to the proposed action.

Alternative 2 - Non-lethal Control Only
Under this alternative, only non-lethal methods would be used or recommended by WS. No impacts to the aesthetic values of target and non-target species would be expected as the direct result of WS non-lethal activities or recommendations. People and/or groups who have affectionate bonds with individual animals or animals in general, would not be affected by WS activities under this alternative. However, because non-lethal control may not always reduce damage in a timely and effective manner, resource owners/land managers may reject WS non-lethal methods and implement their own lethal control program resulting in impacts similar to proposed action.

Alternative 3 - Non-lethal Control Before Lethal Control
Under this alternative, WS would implement non-lethal control methods prior to the use of lethal methods. WS impacts on aesthetic values would be similar to Alternative 2 in those cases were non-lethal methods effectively reduced damage levels to acceptable

levels and would be similar to the proposed action when lethal methods were implemented by WS. However, because non-lethal control must be applied before lethal control, damage conflicts may not be reduced in a timely and effective manner. In those situations, resource owners/land managers may be unwilling to accept further losses as all available non-lethal methods are applied. This could result in resource owners/land managers rejecting WS non-lethal methods and implement their own lethal control program resulting in impacts similar to the proposed action.

Alternative 4 - Lethal Control Only
Under this alternative, WS would implement and recommend lethal control methods without applying or considering non-lethal methods. WS impacts on aesthetic values of target species would likely be greater under this alternative than proposed action since lethal methods would be used in all damage situations. WS impacts on non-target species would be similar to the proposed action.

Lethal removal of target animals would occur in localized areas. In these localized areas, target species populations may be impacted in the short term; however, as discussed in section 4.1.1, the lethal removal of target species would not result in adverse effects to local, regional or statewide populations. Therefore, target species would remain common and abundant for hunting and viewing opportunities for the general public. Target predator species are typically secretive in nature and viewing opportunities are limited because of their habits. It may be perceived by some that WS activities may contribute to limited viewing opportunities. Others like to listen to coyotes and consider it important to know that they are in an area. However, animals that are removed by WS will likely be replaced by immigrants from outlying areas in a relatively short period of time.

Some individuals or groups are opposed to any killing of animals. Some do not believe that predators should be harassed or killed to stop or reduce damage problems and that predation is part of doing business as a livestock producer.

Resource owners/land managers negatively affected by damage and those individuals that feel predators are negatively affecting their aesthetic values of other wildlife species would likely support this alternative since this alternative has the potential of reducing damage to acceptable levels in many situations.

Alternative 5 - Integrated Wildlife Damage Management (Proposed Action)
Under this alternative, WS would incorporate select components from Alternatives 1, 2, 3, and 4. Removal of coyotes and feral dogs may occur in localized areas where lethal control activities are implemented. In these localized areas, target species populations may be impacted in the short term; however, as discussed in section 4.1.1, the lethal removal of target species would not result in adverse effects to local, regional or statewide populations. Therefore, target species would remain common and abundant for hunting and viewing opportunities for the general public. Target predator species are typically secretive in nature and viewing opportunities are limited because of their habits. It may be perceived by some that WS activities may contribute to limited viewing opportunities. Others like to listen to coyotes and consider it important to know that they

are in an area. However, animals that are removed by WS will likely be replaced by immigrants from outlying areas in a relatively short period of time.

As discussed in section 4.1.3, it is not expected that WS damage management activities will negatively impact any non-target populations on a local, regional, or statewide scale. 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. If lethal take of non-target species would occur, these occurrences are expected to be rare and should not affect the overall populations of any species. Therefore, non-target species would remain common and abundant for hunting and viewing opportunities for the general public.

Some individuals or groups are opposed to any killing of animals, under this alternative some lethal control will occur and those individuals or groups would continue to be opposed regardless of methods used. Some do not believe that predators should be harassed or killed to stop or reduce damage problems and that predation is part of doing business as a livestock producer.

Resource owners/land managers negatively affected by damage and those individuals that feel predators are negatively affecting their aesthetic values of other wildlife species would likely support this alternative. This alternative has the greatest potential of reducing damage to acceptable levels since all control methods could be considered and used under this alternative.

Alternative 6 - No Action
Under this alternative, WS would not be involved in damage management activities to reduce coyote and feral dog damage. Therefore, WS effects on aesthetic values to target and non-target species would be nonexistent. Some people and/or groups who oppose any wildlife damage activities by WS would likely support this alternative. Animal and environmental activists would prefer this alternative because activists believe it is morally wrong to kill or use animals for any reason. Some people would support this alternative because they enjoy seeing predators, or having predators nearby. People and/or groups who have affectionate bonds with individual animals or animals in general, would not be affected by WS activities under this alternative. However, it is likely that resource owners/land managers or other individuals would conduct coyote and feral dog damage management resulting in impacts similar to the proposed action.

The impacts of this alternative to stakeholders would be variable depending on their values towards wildlife and compassion for their neighbors. Resource owners/land managers receiving damage would likely strongly oppose this alternative because they would bear the damage caused by depredating coyotes and feral dogs.

4.2 CUMULATIVE IMPACTS

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other

past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Under Alternatives 1, 2, 3, 4 and 5, WS would address damage associated with coyotes and feral dogs in a number of situations throughout the State. WS would be the primary federal program with wildlife damage management responsibilities; however, some state and local government agencies may conduct damage management activities as well. Through ongoing coordination with these agencies, WS is aware of such management activities and may provide technical assistance in such efforts. WS does not normally conduct direct damage management activities concurrently with such agencies in the same area, but may conduct management activities at adjacent sites within the same time frame. In addition, affected resource owners/land managers and/or Wildlife Control Operators may conduct damage management activities in the same area. The potential cumulative impacts analyzed below could occur either as a result of WS coyote and feral dog damage management program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and individuals.

Cumulative Impacts on Wildlife Populations
Coyote and feral dog damage management methods used or recommended by the WS program in Pennsylvania will likely have no cumulative adverse effects on target and non-target wildlife populations. WS limited lethal take of target species is anticipated to have minimal impacts on target species populations in Pennsylvania. When control actions are implemented by WS the potential lethal take of non-target wildlife species is expected to be minimal to non-existent.

Cumulative Impact Potential from Chemical Components
Coyote and feral dog damage management programs which include the use of pesticides/chemicals as a lethal population management component may have the greatest potential for cumulative impacts on the environment as such impacts relate to deposit of chemical residues in the physical environment and environmental toxicosis. LPCs (sodium fluoroacetate (Compound 1080)) and gas cartridges are the chemical methods used or recommended by the Pennsylvania WS program for the purpose of obtaining lethal effects on target animal species. These chemicals have been evaluated for possible residual effects which might occur from buildup of the chemicals in soil, water, or other environmental sites. Based on use patterns, the chemical and physical characteristics of control toxicants, and factors related to the environmental fate of these pesticides, no cumulative impacts are expected from the lethal chemical components used or recommended by the WS program in Pennsylvania.

Cumulative Impact Potential from Non-chemical Components
Non-chemical methods used or recommended by WS may include exclusion through use of various barriers, habitat modification of structures or vegetation, animal husbandry, harassment, trapping, snaring, and shooting. No cumulative impacts from WS use of

these methods to remove animals are expected, since take would be authorized and/or permitted with PGC oversight.

SUMMARY

No significant cumulative environmental impacts are expected from any of the 6 alternatives. Under the Proposed Action, the lethal removal of target animals by WS would not have significant impacts on overall target species populations in Pennsylvania, but some local reductions may occur. No risk to public safety is expected when WS's services are provided and accepted by requesting individuals in Alternatives 1, 2, 3, 4 and 5 since only trained and experienced wildlife biologists/specialists would conduct and recommend management activities. There is a slight increased risk to public safety when persons reject WS assistance and recommendations and conduct their own damage management activities, and when no WS assistance is provided in Alternative 6. In all 6 Alternatives, however, it 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 Wildlife Damage Management program will not result in significant cumulative adverse impacts on the quality of the human environment. Table 4.2 summarizes the expected impact of each of the alternatives on each of the issues.

Table 4.2. Summary of the potential effects of the Alternatives as it pertains to the identified Issues. Potential effects include both positive and negative, when applicable.

ISSUES	ALTERNATIVE 1 Technical Assistance Only	ALTERNATIVE 2 Non-lethal Control Only	ALTERNATIVE 3 Non-lethal Control Before Lethal Control	ALTERNATIVE 4 Lethal Control Only	ALTERNATIVE 5 Integrated Wildlife Damage Management (Proposed Action)	ALTERNATIVE 6 No Action
EFFECTS ON TARGET SPECIES POPULA-TIONS (COYOTE)	No impact would occur from WS activities. Low effect - reductions in local target coyote numbers by non-WS personnel likely; would not significantly affect local, regional or state populations.	No impact would occur from WS activities. Low effect - reductions in local target coyote numbers by non-WS personnel likely; would not significantly affect local, regional or state populations.	Low effect - reductions in local target coyote numbers; would not significantly affect local, regional or state populations.	Low effect - reductions in local target coyote numbers; would not significantly affect local, regional or state populations.	Low effect - reductions in local target coyote numbers; would not significantly affect local, regional or state populations.	No impact would occur from WS activities. Low effect - reductions in local target coyote numbers by non-WS personnel likely; would not significantly affect local, regional or state populations.
EFFECTS ON DOGS	No impact would occur from WS activities. Impacts by non-WS personnel would be variable.	Low effect on pet/hunting dogs-methods used by WS would be highly selective with very little risk to non-target	Low effect on pet/hunting dogs-methods used by WS would be highly selective with very little risk to non-target	Low effect on pet/hunting dogs-methods used by WS would be highly selective with very little risk to non-target	Low effect on pet/hunting dogs-methods used by WS would be highly selective with very little risk to non-target species.	No impact would occur from WS activities. Impacts by non-WS personnel would be variable.

		species. No impact would occur from WS activities on feral dogs. Impacts by non-WS personnel would be variable.	species. Local feral dog numbers could be reduced or eliminated. Impacts by non-WS personnel would be variable.	species. Local feral dog numbers could be reduced or eliminated.	Local feral dog numbers could be reduced or eliminated.	
EFFECTS ON NON-TARGET WILDLIFE POPULATIONS, INCLUDING T&E SPECIES	No impact would occur from WS activities. Impacts by non-WS personnel would be variable.	Low effect - methods used by WS would be highly selective with very little risk to non-target species. Impacts by non-WS personnel would be variable.	Low effect - methods used by WS would be highly selective with very little risk to non-target species. Impacts by non-WS personnel would be variable.	Low effect - methods used by WS would be highly selective with very little risk to non-target species.	Low effect - methods used by WS would be highly selective with very little risk to non-target species.	No impact would occur from WS activities. Impacts by non-WS personnel would be variable.
EFFECTS ON HUMAN HEALTH AND SAFETY	No risk to human health and safety from WS activities. A low to moderate risk may occur from an inexperienced	No risk to human health and safety from WS activities. A low to moderate risk may occur from an inexperienced	Low risk to human health and safety from WS activities. A low to moderate risk may occur from an inexperienced	Low risk to human health and safety from WS activities.	Low risk to human health and safety from WS activities.	No risk to human health and safety from WS activities. A low to moderate risk may occur from an inexperienced person conducting

	person conducting control efforts.	person conducting control efforts.	person conducting control efforts.			control efforts.
HUMANENESS OF CONTROL METHODS USED BY WS	No impact from WS activities. Impacts by non-WS personnel would be variable.	No impact from WS activities. Impacts by non-WS personnel would be variable.	Low to moderate impact from WS activities. WS impacts would be greater than Alternatives 1, 2 and 6 Impacts by non-WS personnel would be variable.	Low to moderate impact from WS activities. WS impacts would be greater than Alternatives 1, 2 and 6	Low to moderate impact from WS activities. WS impacts would be greater than Alternatives 1, 2 and 6	No impact from WS activities. Impacts by non-WS personnel would be variable.
EFFECTS ON THE AESTHETIC VALUES OF TARGET AND NON-TARGET SPECIES	No impact from WS activities. Impacts by non-WS personnel would be variable.	Low impact to the aesthetic values of target and non-target species from WS activities. Impacts by non-WS personnel would be variable.	Low impact to moderate to the aesthetic values of target and non-target species from WS activities. Impacts by non-WS personnel would be variable.	Low to moderate impact to the aesthetic values of target and non-target species from WS activities.	Low to moderate impact to the aesthetic values of target and non-target species from WS activities.	No impact from WS activities. Impacts by non-WS personnel would be variable.

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APPENDIX B: COYOTE AND FERAL DOG DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDED BY THE PENNSYLVANIA WILDLIFE SERVICES PROGRAM

PRODUCER-IMPLEMENTED NON-LETHAL METHODS

Producer implemented non-lethal control methods consist primarily of non-lethal preventive methods such as habitat modification and animal husbandry. Husbandry and other management techniques are implemented by the resource owner. Resource owners may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practicality. These methods include:

Habitat modification is used whenever practical to attract or repel certain wildlife species or to separate livestock from predators. For example, WS may recommend that a producer clear rock, brush, or trash piles near lambing or calving pastures to reduce available cover for predators.

Animal husbandry practices include modifications in the level of care or attention given to livestock (depending on the age and size of the flock or herd). Animal husbandry practices include, but are not limited to, the use of:

- **Guard animals** used in livestock protection are dogs, donkeys, and llamas. These animals can effectively reduce predator losses in some situations (Knowlton et al. 1999). Guard dogs most frequently used are Maremma and Great Pyrenees breeds. Anatolian shepherds and Akbash breeds are also effective. Success in using guard dogs is highly dependent on proper breeding and bonding with the type of livestock the dog is to protect. Effective use of guard dogs depends on training, obedience, care, and feeding (Green and Woodruff 1996). The efficacy of guard dogs is affected by the amount of predation loss, size and topography of the pasture, acceptance of the dog by the livestock, training, compatibility with humans, and compatibility with other predator control methods. Guard dog breeds mature at about 2 years of age and may begin protecting livestock at this age. Guard dogs have an effective working life of less than three years because of accidents, disease, and people misidentifying the guard dog as a threat to the livestock (Lorenz et al. 1986, Green 1989). Guard dogs may kill, injure, harass, or rape sheep and goats (Green and Woodruff 1983). The success of guard dogs in other programs (e.g., Virginia) is highly variable with a few livestock producers claiming all coyote predation stopped and some livestock producers reporting no effectiveness at stopping predation. Most livestock producers report they believe there was a reduction in coyote predation.

  Guard llamas have also been used with mixed success to protect livestock, but are typically aggressive toward dogs and appear to readily bond with sheep (Cavalcanti and Knowlton 1998). Llamas can be kept in fenced pastures, do not require special feeding programs, are usually tractable,

and have a relatively long working life compared with guard dogs (Knowlton et al. 1999). Meadows and Knowlton (2000) found llamas were able to reduce predation on sheep initially, but dogs and coyotes adapted to the protective nature of llamas over time, thus reducing their effectiveness.

Guard donkeys have been used to protect livestock with mixed results. The reported most effective guard donkey is a jenny with a foal. Guard donkeys are probably more effective at deterring dog predation than coyote predation.

- **Herders** or shepherds stay with the flock all day and night. This method historically was used with roving bands of sheep. It is rarely used in Pennsylvania because sheep and goats are confined to fenced pastures.

- **Barn/shed lambing** is birthing lambs, kids (baby goats), or calves in buildings. Lambs and goats may be born and kept in a building for the first one to two weeks of life. Cattle are rarely birthed in buildings because of cost, size, and number of buildings which would be required. Birthing in buildings adds additional labor costs and raises disease concerns among livestock producers. While this may initially enhance survival of young animals, predators may still remove young animals when they are placed out on pasture.

- **Carcass removal** is burying or incinerating dead livestock to remove an attractant for predators.

- **Pasture selection/rotation** is placing or moving sheep, goats, or cattle in pastures believed less likely to expose livestock to predation. Usually, moving livestock to pastures near human habitation is believed to expose livestock to fewer predators. Livestock producers eventually must move livestock to distant pastures to graze; however, they may wait until lambs, kids, and calves are larger and older in the hope to reduce their vulnerability to predation.

MECHANICAL MANAGEMENT METHODS

Mechanical management methods consist primarily of tools or devices used to repel, capture or kill a particular target animal or local population of wildlife to alleviate resource damage. All mechanical management methods can be used by resource owners if they have the knowledge, ability, and time. Mechanical methods are non-lethal devices. Although restraining devices (e.g., cage traps, foothold traps, snares) are perceived as a lethal control methods, they are designed to hold the target animal until they can be humanely dispatched (killed). If WS personnel apply mechanical methods on private lands, an *Agreement for Control on Private Property* must be signed by the landowner or administrator authorizing the use of each damage management method. Mechanical methods recommended or used by WS may include:

Animal behavior modification refers to tactics that deter or repel predators and thus, reduce predation. Unfortunately, many of these techniques are only effective for a short time before wildlife habituate to them (Pfeifer and Goos 1982, Conover 1982). Devices used to modify behavior include:

- **Predator-resistant fences** are woven wire or 9 or 11 strand electric fences. Woven wire fences generally are four-feet tall and may have a barb wire along the bottom of the fence to deter digging under by predators. Electric fences may be less expensive to erect but coyotes, dogs, and other wildlife can pass through electric fences. Electric fences must be maintained and tested regularly. Vegetation and fallen branches on the fence drain current, thus reducing efficacy. Additionally, dry soil conditions prevent grounding, and thus the animal can pass through the fence without being shocked. Electric fences also make the use of snares very difficult because of the reduced ability to detect where coyotes are passing through the fence.

- **Temporary fencing** is placing temporary electric polytape fence in a bedding area to deter predation for a day to a week or more while the livestock producer moves the animals to another pasture or market. The livestock must be released each morning to feed and water. The temporary fence may need to be moved daily to provide clean pasture for bedding because of the accumulation of fecal droppings which may foul and mat the sheep or goat wool/hair.

- **Electronic guards (siren strobe-light devices)** are battery powered units operated by a photocell. The unit emits a flashing strobe light and siren call at irregular intervals throughout the night. Efficacy of strobe-sirens is highly variable and usually lasts only a few weeks. The device is a short-term tool used to deter predation until livestock can be moved to another pasture, brought to market, or other predator control methods implemented.

Foothold traps can be utilized to live-capture a variety of mammals, but would primarily be used by the Pennsylvania WS program to capture coyotes and feral dogs. Foothold traps are difficult to keep operational during inclement weather, but when properly implemented can be highly selective. The use of foothold traps requires more time, expertise, and labor than some methods, but they are indispensable in resolving many depredation problems. Three advantages of the foothold trap are: 1) they can be set under a wide variety of situations, 2) pan-tension devices can be used to reduce the probability of capturing smaller non-target animals (Turkowski et al. 1984, Phillips and Gruver 1996), and 3) non-target wildlife can be released. Effective trap placement and the use of appropriate baits and lures by trained WS personnel also contribute to the foothold trap's selectivity.

Foothold traps are constantly being modified and tested to improve animal welfare of captured animals. The BMP testing process has identified some foothold traps that have acceptable capture efficiency and low-moderate-severe injury scores. This BMP process is ongoing and additional traps may be identified in the future as part of this ongoing process. 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. Also, the thickness of the jaws may vary to better distribute pressure on the animal's foot. Novak (1987) and Boggess et al. (1990) describe and diagram many types of foothold traps used throughout history in North America. Traps that the Pennsylvania WS program use, include, but are not limited to, the Woodstream Victor #3 padded jaw modified with 4 coils, a reinforced base plate, and bubble-tip welded jaws (Gruver et al. 1996) and the Sterling MJ600/MB650 #3 coil spring offset jaw foothold trap. Our primary foothold trap is the Number 3 Bridger with laminated jaws and four-coils. This trap was tested in Canada and passed the BMP process for capture efficiency and animal welfare.

Cage traps, typically constructed of wire mesh or plastic, are sometimes used or recommended to capture dogs. Cage traps pose minimal risks to humans, pets and non-target wildlife and allow for on-site release or relocation of dogs. However, cage traps are not effective in capturing wary predators such as coyotes.

Snares may be used in Pennsylvania (under a PGC Special Use Permit or as a PGC Certified Wildlife Control Operator) and are generally made of small diameter cable (e.g., 5/64 or 3/32 inch diameter cable) with a locking mechanism which stops closing when an animal stops pulling against the snare. Snares may be placed where an animal moves through a confined area (e.g., crawl holes under fences, trails through vegetation, etc.) and are easier to keep operational during periods of inclement weather than are foothold traps. Snares are set to catch canines by the neck and/or shoulder; however, snares may occasionally capture an animal around the body or leg. Deer stops allow the snare cable to close to a diameter of not less than 2 ½ inches and allow deer or other animals captured by the leg to escape. Another effective method is the use of break-away snares that allow larger non-target animals to break the snare and escape (Phillips et al. 1990, Phillips 1996).

Shooting is the practice of selectively removing target individuals by shooting with a rifle or shotgun. Shooting with rifles or shotguns may be used to manage predation problems when lethal methods are determined to be appropriate. Shooting may involve the use of spotlights, night-vision, Forward Looking Infra-Red (FLIR) devices, decoy dogs, and predator calling. The target animal is killed

as quickly and humanely as possible. Removal of one or two specific animals by calling and shooting in the problem area can sometimes provide immediate relief from predation. Because this method can be time consuming and inefficient, it is only occasionally used by WS.

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 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 (see discussion of Large Gas Cartridge under Chemical Management Methods).

Sport hunting and regulated trapping will be recommended as part of the IWDM approach to reduce local predator populations in areas that have historically had livestock losses. Hunters and trappers can provide a societal benefit by reducing local wild animal populations which can reduce damage. Although coyotes are considered a furbearer in Pennsylvania, they may be hunted or trapped anytime with a legal hunting permit. See the *Pennsylvania Digest of Hunting and Trapping regulations (2003-2004)* provided by the PGC for more information on seasons, limits and regulations.

CHEMICAL MANAGEMENT METHODS

All chemicals used by WS to reduce coyote and feral dog damage are or will be registered under the FIFRA and administered by the EPA and PDA, Pesticide Division. All WS personnel in Pennsylvania that use pesticides are registered as restricted-use pesticide applicators by PDA, Pesticide Division; which requires pesticide applicators to adhere to all certification requirements set forth in the FIFRA. No chemicals are used on private lands without authorization from the property owner or manager. The chemical methods listed below are or will be registered for use in Pennsylvania.

Livestock Protection Collars are in the process of being registered as a toxic collar in Pennsylvania for use on sheep or goats to kill depredating coyotes. 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. The LPC consists of a rubber collar with two rubber reservoirs, each of which contains 15 milliliters of a 1-percent solution of sodium fluoroacetate (Compound

1080). The LPC has Velcro straps for attachment around the neck of a sheep or goat with the reservoirs positioned just behind the jaw. Two collar sizes are available to accommodate various size livestock.

Coyotes typically attack sheep and goats by biting them on the throat and crushing the larynx, causing suffocation. Coyotes that attack collared sheep generally puncture the collar with their teeth (in 75% or more of attacks) and receive a lethal oral dose of toxicant.

Use of the LPC involves the establishment of a "target flock" of 20-50 collared lambs and their ewes. These animals are placed in a high risk pasture where recent coyote attacks have occurred. Other (uncollared) livestock on the farm are moved to a safe area or are penned until predation stops.

The greatest advantage of the LPC is its selectivity. Only coyotes causing damage are killed. Disadvantages of the collar include the death of some collared livestock by coyotes, time and cost of certification required to use collars, expense of collaring and monitoring target animals, mandatory record keeping, and management efforts needed to protect livestock displaced from the target flock's location.

Secondary poisoning risk is reduced because scavengers tend to feed preferentially in the thoracic cavity and hind portion of the carcass, while 1080 contamination would be primarily to the wool on the sheep's neck. The use of the LPC would pose little likelihood of a dog being poisoned because they usually attack flanks and not the throat, and that secondary hazards were at most minimal (USDA 1997, Appendix P).

Sodium fluoroacetate has been a subject of wide research in the United States and elsewhere and has been widely used for pest management in many countries. Fluoroacetic acid and related chemicals occur naturally in plants in many parts of the world and are not readily absorbed through intact skin (Atzert 1971). Sodium fluoroacetate is discriminatingly toxic to predators, being many times more lethal to them than to most nontarget species (Atzert 1971, Connolly and Burns 1990).

The **Large Gas Cartridge** is in the process of being registered as a fumigant by for use in Pennsylvania and is used in conjunction with denning operations. When ignited, the cartridge burns in the den of an animal and produces large amounts of carbon monoxide, a colorless, odorless, and tasteless, poisonous gas. The combination of oxygen depletion and carbon monoxide exposure kills the animals in the den. Carbon monoxide euthanasia is recognized by the AVMA as an approved and humane method to euthanize animals (AVMA 2000).

Ketamine hydrochloride is a dissociative anesthetic that is used to capture 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

capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

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

Yohimbine is a reversal agent for xylazine, and is typically administered to the animal approximately 45 minutes after the ketamine/xylazine dose.

Sodium Pentobarbital and its derivatives are barbiturates that rapidly depress the central nervous system to the point of respiratory arrest. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Nationally, certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA regulations.

Potassium Chloride used in conjunction with prior general anesthesia is used as a euthanasia agent for animals, and is considered acceptable and humane by the AVMA (AVMA 2000). Animals that have been euthanized with this chemical experience cardiac arrest followed by death, and are not toxic to predators or scavengers.

APPENDIX C

FEDERAL AND STATE LISTED THREATENED AND ENDANGERED SPECIES

Threatened and Endangered Species System (TESS)

Listings by State and Territory as of 04/28/2004

Pennsylvania

Notes:
- *Displays one record per species or population.*
- *The range of a listed population does not extend beyond the states in which that population is defined.*
- *This list does not include non-nesting sea turtles and whales in State/Territory coastal waters.*
- *Includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.*

Go to the Threatened and Endangered Wildlife and Plants Page
Go to the TESS Home Page

View All Listed Species in State

Return to US Map

- *Click on the highlighted scientific names below to view a Species Profile for each listing.*

Pennsylvania -- 1 listings

Animals -- 1

Status	*Listing*
C	Massasauga (=rattlesnake), eastern (*Sistrurus catenatus catenatus*)

Plants -- 0

Plants

Return to the PNHP Main Page

Last Revised 9/30/03 4/28/2004

Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
ACALYPHA DEAMII	THREE-SEEDED MERCURY	G4?	SX	N	PX	
ACONITUM RECLINATUM	WHITE MONKSHOOD	G3	S1	PE	PE	
ACONITUM UNCINATUM	BLUE MONKSHOOD	G4	S2	PT	PT	
ACORUS AMERICANUS	SWEET FLAG	G5	S1	PE	PE	
ADIANTUM ALEUTICUM	ALEUTIAN MAIDENHAIR FERN	G5?	SR	TU	TU	
AESCHYNOMENE VIRGINICA	SENSITIVE JOINT-VETCH	G2	SX	PX	PX	LT
AGALINIS AURICULATA	EARED FALSE-FOXGLOVE	G3	S1	PE	PE	
AGALINIS DECEMLOBA	BLUE-RIDGE FALSE-FOXGLOVE	G4Q	SX	PX	PX	
AGALINIS PAUPERCULA	SMALL-FLOWERED FALSE-FOXGLOVE	G5	S1	PE	PE	
AGROSTIS ALTISSIMA	TALL BENTGRASS	G4	SX	PX	PX	
ALETRIS FARINOSA	COLIC-ROOT	G5	S1	TU	PE	
ALISMA TRIVIALE	BROAD-LEAVED WATER-PLANTAIN	G5	S1	PE	PE	
ALNUS VIRIDIS	MOUNTAIN ALDER	G5	S1	PE	PE	
ALOPECURUS AEQUALIS	SHORT-AWN FOXTAIL	G5	S3	N	TU	(PS)
AMARANTHUS CANNABINUS	WATERHEMP RAGWEED	G5	S3	PR	PR	
AMELANCHIER BARTRAMIANA	OBLONG-FRUITED SERVICEBERRY	G5	S1	PE	PE	
AMELANCHIER CANADENSIS	SERVICEBERRY	G5	S?	N	UEF	
AMELANCHIER HUMILIS	SERVICEBERRY	G5	S1	TU	PE	
AMELANCHIER OBOVALIS	COASTAL JUNEBERRY	G4G5	S1	TU	PE	
AMELANCHIER SANGUINEA	ROUNDLEAF SERVICEBERRY	G5	S1	TU	PE	
AMMANNIA COCCINEA	SCARLET AMMANNIA	G5	S2	PE	PT	
AMMOPHILA BREVILIGULATA	AMERICAN BEACHGRASS	G5	S2	PT	PT	
ANDROMEDA POLIFOLIA	BOG-ROSEMARY	G5	S3	PR	PR	
ANDROPOGON GLOMERATUS	BUSHY BLUESTEM	G5	S3	TU	PR	
ANDROPOGON GYRANS	ELLIOTT'S BEARDGRASS	G5	S3	N	PR	
ANEMONE CYLINDRICA	LONG-FRUITED ANEMONE	G5	S1	PE	PE	
ANTENNARIA SOLITARIA	SINGLE-HEADED PUSSY-TOES	G5	S1	TU	PE	
ANTENNARIA VIRGINICA	SHALE BARREN PUSSYTOES	G4	S3	N	PR	
APLECTRUM HYEMALE	PUTTYROOT	G5	S3	PR	PR	
ARABIS HIRSUTA	WESTERN HAIRY ROCK-CRESS	G5	S1	TU	PE	
ARABIS MISSOURIENSIS	MISSOURI ROCK-CRESS	G4G5Q	S1	PE	PE	
ARABIS PATENS	SPREADING ROCKCRESS	G3	S2	N	PT	
ARCEUTHOBIUM PUSILLUM	DWARF MISTLETOE	G5	S2	PT	PT	
ARCTOSTAPHYLOS UVA-URSI	BEARBERRY MANZANITA	G5	SX	PX	PX	
ARETHUSA BULBOSA	SWAMP-PINK	G4	S1	PE	PE	
ARISTIDA DICHOTOMA VAR CURTISSII	THREE-AWNED GRASS	G5T5	SH	TU	TU	
ARISTIDA PURPURASCENS	ARROW-FEATHERED THREE AWNED	G5	S2	PT	PT	
ARNICA ACAULIS	LEOPARD'S-BANE	G4	S1	PE	PE	
ARTEMISIA CAMPESTRIS SSP CAUDATA	BEACH WORMWOOD	G5T5	S1	PE	PE	
ASCLEPIAS RUBRA	RED MILKWEED	G4G5	SX	PX	PX	
ASCLEPIAS VARIEGATA	WHITE MILKWEED	G5	S1	TU	PE	
ASPLENIUM BRADLEYI	BRADLEY'S SPLEENWORT	G4	S1	PT	PE	
ASPLENIUM PINNATIFIDUM	LOBED SPLEENWORT	G4	S3	N	PR	
ASPLENIUM RESILIENS	BLACK-STEMMED SPLEENWORT	G5	S1	PE	PE	
ASTER BOREALIS	RUSH ASTER	G5	S1	PE	PE	
ASTER DEPAUPERATUS	SERPENTINE ASTER	G2	S2	PT	PT	
ASTER DRUMMONDII	HAIRY HEART-LEAVED ASTER	G5	SH	N	PE	
ASTER DUMOSUS	BUSHY ASTER	G5	S2	TU	TU	
ASTER ERICOIDES	WHITE HEATH ASTER	G5	S3	TU	TU	
ASTER NEMORALIS	BOG ASTER	G5	S1	PE	PE	
ASTER NOVI-BELGII	NEW YORK ASTER	G5	S2	PT	PT	
ASTER PRAEALTUS	VEINY-LINED ASTER	G5	S3	N	TU	
ASTER RADULA	ROUGH-LEAVED ASTER	G5	S2	N	PT	
ASTER SOLIDAGINEUS	NARROW-LEAVED WHITE-TOPPED ASTER	G5	S1	PE	PE	
ASTER SPECTABILIS	LOW SHOWY ASTER	G5	S1	PE	PE	
ASTRAGALUS CANADENSIS	CANADIAN MILKVETCH	G5	S2	N	TU	
ASTRAGALUS NEGLECTUS	COOPER'S MILK-VETCH	G4	S1	PE	PE	
BACCHARIS HALIMIFOLIA	EASTERN BACCHARIS	G5	S3	PR	PR	
BAPTISIA AUSTRALIS	BLUE FALSE-INDIGO	G5	S3	N	TU	
BARTONIA PANICULATA	SCREW-STEM	G5	S3	N	TU	
BERBERIS CANADENSIS	AMERICAN BARBERRY	G3	SX	PX	PX	
BIDENS BIDENTOIDES	SWAMP BEGGAR-TICKS	G3	S1	PT	PE	
BIDENS DISCOIDEA	SMALL BEGGAR-TICKS	G5	S3	N	PR	

BIDENS LAEVIS	BEGGAR-TICKS	G5	S3	N	TU
BOLTONIA ASTEROIDES	ASTER-LIKE BOLTONIA	G5	S1	PE	PE
BOUTELOUA CURTIPENDULA	TALL GRAMMA	G5	S2	PT	PT
BROMUS KALMII	BROME GRASS	G5	S3	N	TU
BUCHNERA AMERICANA	BLUEHEARTS	G5?	SX	PX	PX
CACALIA MUEHLENBERGII	GREAT INDIAN-PLANTAIN	G4	S1	N	PE
CAKILE EDENTULA	AMERICAN SEA-ROCKET	G5	S3	PR	PR
CALYCANTHUS FLORIDUS VAR LAEVIGATUS	SWEET-SHRUB	G5T5Q	SH	N	TU
CAMASSIA SCILLOIDES	WILD HYACINTH	G4G5	S1	PT	PE
CARDAMINE MAXIMA	LARGE TOOTHWORT	G5Q	S1	N	TU
CARDAMINE PRATENSIS VAR PALUSTRIS	CUCKOOFLOWER	G5T5	S1	PE	TU
CAREX ADUSTA	CROWDED SEDGE	G5	SX	PX	PX
CAREX ALATA	BROAD-WINGED SEDGE	G5	S2	PT	PT
CAREX AQUATILIS	WATER SEDGE	G5	S2	PT	PT
CAREX ATHERODES	AWNED SEDGE	G5	S1	PE	PE
CAREX AUREA	GOLDEN-FRUITED SEDGE	G5	S1	PE	PE
CAREX BACKII	ROCKY MOUNTAIN SEDGE	G4	SX	PX	PX
CAREX BARRATTII	BARRATT'S SEDGE	G4	SX	PX	PX
CAREX BEBBII	BEBB'S SEDGE	G5	S1	PE	PE
CAREX BICKNELLII	BICKNELL'S SEDGE	G5	S1	PE	PE
CAREX BREVIOR	A SEDGE	G5?	S2?	N	TU
CAREX BULLATA	BULL SEDGE	G5	S1	PE	PE
CAREX BUXBAUMII	BROWN SEDGE	G5	S3	TU	PR
CAREX CAREYANA	CAREY'S SEDGE	G5	S1	PE	PE
CAREX CHORDORRHIZA	CREEPING SEDGE	G5	SX	PX	PX
CAREX COLLINSII	COLLIN'S SEDGE	G4	S2	PE	PT
CAREX CRAWFORDII	CRAWFORD'S SEDGE	G5	S1	TU	PE
CAREX CRINITA VAR BREVICRINIS	SHORT HAIR SEDGE	G5T5	S1	PE	PE
CAREX CRYPTOLEPIS	NORTHEASTERN SEDGE	G4	S1	PT	PE
CAREX DIANDRA	LESSER PANICLED SEDGE	G5	S2	PT	PT
CAREX DISPERMA	SOFT-LEAVED SEDGE	G5	S3	PR	PR
CAREX EBURNEA	EBONY SEDGE	G5	S1	PE	PE
CAREX FLAVA	YELLOW SEDGE	G5	S2	PT	PT
CAREX FOENEA	A SEDGE	G5	S1	PE	PE
CAREX FORMOSA	HANDSOME SEDGE	G4	S1	PE	PE
CAREX GARBERI	ELK SEDGE	G4	S1	PE	PE
CAREX GEYERI	GEYER'S SEDGE	G5	S1	PE	PE
CAREX HAYDENII	CLOUD SEDGE	G5	S1S2	TU	PT
CAREX HYALINOLEPIS	SHORE-LINE SEDGE	G4G5	SX	PX	PX
CAREX LASIOCARPA	SLENDER SEDGE	G5	S3	PR	PR
CAREX LIMOSA	MUD SEDGE	G5	S2	TU	PT
CAREX LONGII	LONG'S SEDGE	G5	SU	TU	TU
CAREX LUPULIFORMIS	FALSE HOP SEDGE	G4	S1	TU	TU
CAREX MEADII	MEAD'S SEDGE	G4G5	S1	TU	PE
CAREX MITCHELLIANA	MITCHELL'S SEDGE	G3G4	S1	PE	PE
CAREX OLIGOSPERMA	FEW-SEEDED SEDGE	G4	S2	PT	PT
CAREX ORMOSTACHYA	SPIKE SEDGE	G4	S2	N	TU
CAREX PAUCIFLORA	FEW-FLOWERED SEDGE	G5	S1	PE	PE
CAREX PAUPERCULA	BOG SEDGE	G5	S3	PT	PR
CAREX POLYMORPHA	VARIABLE SEDGE	G3	S2	PE	PT
CAREX PRAIREA	PRAIRIE SEDGE	G5?	S2	PT	PT
CAREX PSEUDOCYPERUS	CYPERUS-LIKE SEDGE	G5	S1	PE	PE
CAREX RETRORSA	BACKWARD SEDGE	G5	S1	PE	PE
CAREX RICHARDSONII	RICHARDSON'S SEDGE	G4	S1	N	PE
CAREX SARTWELLII	SARTWELL'S SEDGE	G4G5	SX	PX	PX
CAREX SCHWEINITZII	SCHWEINITZ'S SEDGE	G3	S1	PT	PE
CAREX SHORTIANA	SEDGE	G5	S3	N	PR
CAREX SICCATA	A SEDGE	G5	S2	N	TU
CAREX SPRENGELII	SEDGE	G5?	S3	N	PR
CAREX STERILIS	STERILE SEDGE	G4	S1	PT	PE
CAREX TETANICA	A SEDGE	G4G5	S2	PT	PT
CAREX TYPHINA	CATTAIL SEDGE	G5	S2	PE	PT
CAREX VIRIDULA	GREEN SEDGE	G5	S1	PE	PE
CAREX WIEGANDII	WIEGANDS SEDGE	G3	S1	PT	PT
CASTILLEJA COCCINEA	SCARLET INDIAN-PAINTBRUSH	G5	S2	TU	PT
CERASTIUM ARVENSE VAR VILLOSISSIMUM	SERPENTINE CHICKWEED	G5T1Q	S1	PE	PE
CHAMAECYPARIS THYOIDES	ATLANTIC WHITE CEDAR	G4	SX	PX	PX
CHAMAESYCE POLYGONIFOLIA	SMALL SEA-SIDE SPURGE	G5?	S2	PT	PT
CHASMANTHIUM LATIFOLIUM	WILD OAT	G5	S1	TU	PE
CHASMANTHIUM LAXUM	SLENDER SEA-OATS	G5	S1	PE	PE
CHENOPODIUM CAPITATUM	STRAWBERRY GOOSEFOOT	G5	SH	TU	TU
CHENOPODIUM FOGGII	FOGG'S GOOSEFOOT	G3Q	S1	PE	PE
CHIONANTHUS VIRGINICUS	FRINGE-TREE	G5	S3	N	PT
CHRYSOGONUM VIRGINIANUM	GREEN-AND-GOLD	G5	S1	PE	PE
CHRYSOPSIS MARIANA	MARYLAND GOLDEN-ASTER	G5	S1	PT	PE
CIMICIFUGA AMERICANA	MOUNTAIN BUGBANE	G4	S3	PT	PR
CIRSIUM HORRIDULUM	HORRIBLE THISTLE	G5	S1	PE	PE

CLADIUM MARISCOIDES	TWIG RUSH	G5	S2	PE	PE	
CLEMATIS VIORNA	VASE-VINE LEATHER-FLOWER	G5	S1	PE	PE	
CLETHRA ACUMINATA	MOUNTAIN PEPPER-BUSH	G4	S1	PE	PE	
CLITORIA MARIANA	BUTTERFLY-PEA	G5	S1	PE	PE	
COELOGLOSSUM VIRIDE	LONG-BRACTED GREEN ORCHID	G5	SH	TU	TU	
COMMELINA ERECTA	SLENDER DAY-FLOWER	G5	SX	PX	PX	
COMMELINA VIRGINICA	VIRGINIA DAY-FLOWER	G5	SX	PX	PX	
CONIOSELINUM CHINENSE	HEMLOCK-PARSLEY	G5	S1	PE	PE	
CORALLORHIZA WISTERIANA	SPRING CORAL-ROOT	G5	S1	TU	PE	
COREOPSIS ROSEA	PINK TICKSEED	G3	SX	PX	PX	
CORYDALIS AUREA	GOLDEN CORYDALIS	G5	S1	N	PE	
CRASSULA AQUATICA	WATER PIGMY-WEED	G5	SX	PX	PX	
CRATAEGUS BRAINERDII	BRAINERD'S HAWTHORNE	G5	SU	TU	TU	
CRATAEGUS DILATATA	A HAWTHORN	G4	SU	N	TU	
CRATAEGUS MOLLIS	DOWNY HAWTHORNE	G5	SU	TU	TU	
CRATAEGUS PENNSYLVANICA	RED-FRUITED HAWTHORN	G3Q	S2S3	N	TURF	
CRITESION PUSILLUM	LITTLE BARLEY	G5	SH	PX	PX	
CROTONOPSIS ELLIPTICA	ELLIPTICAL RUSHFOIL	G5	SX	PX	PX	
CRYPTOGRAMMA STELLERI	SLENDER ROCK-BRAKE	G5	S1	PE	PE	
CUSCUTA CAMPESTRIS	DODDER	G5T5	S2	N	TU	
CUSCUTA CEPHALANTHI	BUTTON-BUSH DODDER	G5	SU	TU	TU	
CUSCUTA COMPACTA	DODDER	G5	S3	N	TU	
CUSCUTA CORYLI	HAZEL DODDER	G5	SU	TU	TU	
CUSCUTA PENTAGONA	FIELD DODDER	G5	S3	N	TU	
CUSCUTA POLYGONORUM	SMARTWEED DODDER	G5	SU	TU	TU	
CYMOPHYLLUS FRASERIANUS	FRASER'S SEDGE	G4	S1	PE	PE	
CYNANCHUM LAEVE	SMOOTH SWALLOW-WORT	G5	SU	PE	PE	
CYNOGLOSSUM BOREALE	NORTHERN HOUND'S-TONGUE	G4	SH	PX	PX	
CYPERUS DIANDRUS	UMBRELLA FLATSEDGE	G5	S2	PE	PE	
CYPERUS HOUGHTONII	HOUGHTON'S FLATSEDGE	G4?	S1	PE	PE	
CYPERUS LANCASTRIENSIS	MANY-FLOWERED UMBRELLA SEDGE	G5	S2	N	TU	
CYPERUS POLYSTACHYOS	MANY-SPIKED FLATSEDGE	G5	SX	PX	PX	
CYPERUS REFRACTUS	REFLEXED FLATSEDGE	G5	S1	PE	PE	
CYPERUS RETRORSUS	RETRORSE FLATSEDGE	G5	SH	PE	PX	
CYPERUS SCHWEINITZII	SCHWEINITZ'S FLATSEDGE	G5	S2	PR	PR	
CYPRIPEDIUM CALCEOLUS VAR PARVIFLORUM	SMALL YELLOW LADY'S-SLIPPER	G5	S1	PE	PE	
CYPRIPEDIUM CANDIDUM	SMALL WHITE LADY'S-SLIPPER	G4	SX	PX	PX	
CYPRIPEDIUM REGINAE	SHOWY LADY'S-SLIPPER	G4	S2	PT	PT	
CYSTOPTERIS LAURENTIANA	LAURENTIAN BLADDER-FERN	G3	S1	TU	PE	
CYSTOPTERIS TENNESSEENSIS	BLADDER FERN	G5	S1	N	TU	
DELPHINIUM EXALTATUM	TALL LARKSPUR	G3	S1	PE	PE	
DESCHAMPSIA CESPITOSA	TUFTED HAIRGRASS	G5	S3	N	TU	
DESMODIUM GLABELLUM	TALL TICK-TREFOIL	G5	SU	TU	TU	
DESMODIUM LAEVIGATUM	SMOOTH TICK-TREFOIL	G5	SU	N	TU	
DESMODIUM NUTTALLII	NUTTALLS' TICK-TREFOIL	G5	S2	TU	TU	
DESMODIUM OBTUSUM	STIFF TICK-TREFOIL	G4G5	SU	N	TU	
DESMODIUM SESSILIFOLIUM	SESSILE-LEAVED TICK-TREFOIL	G5	SX	PX	PX	
DESMODIUM VIRIDIFLORUM	VELVETY TICK-TREFOIL	G5?	SU	N	TU	
DIARRHENA AMERICANA	AMERICAN BEAKGRAIN	G4?	S1	N	PE	
DICENTRA EXIMIA	WILD BLEEDING-HEARTS	G4	S1	PE	PE	
DIPHASIASTRUM SABINIFOLIUM	FIR CLUBMOSS	G4	SX	PX	PX	
DODECATHEON MEADIA	COMMON SHOOTING-STAR	G5	S1	PE	PE	
DODECATHEON RADICATUM	JEWELED SHOOTING-STAR	G?	S2	PT	PT	
DRABA REPTANS	CAROLINA WHITLOW-GRASS	G5	SH	PX	PX	
DRACOCEPHALUM PARVIFLORUM	AMERICAN DRAGONHEAD	G5	SH	TU	TU	
DRYOPTERIS CAMPYLOPTERA	MOUNTAIN WOOD FERN	G5	S1	PE	PE	
DRYOPTERIS CELSA	LOG FERN	G4	S1	N	PE	
DRYOPTERIS CLINTONIANA	CLINTON'S WOOD FERN	G5	S2	N	PT	
ECHINACEA LAEVIGATA	SMOOTH CONEFLOWER	G2	SX	PX	PX	LE
ECHINOCHLOA WALTERI	WALTER'S BARNYARD-GRASS	G5	S1	PE	PE	
ELATINE AMERICANA	LONG-STEMMED WATER-WORT	G4	SH	PX	PE	
ELEOCHARIS CARIBAEA	CAPITATE SPIKE-RUSH	G4G5	S1	PE	PE	
ELEOCHARIS COMPRESSA	FLAT-STEMMED SPIKE-RUSH	G4	S1	PE	PE	
ELEOCHARIS ELLIPTICA	SLENDER SPIKE-RUSH	G5	S2	PE	PE	
ELEOCHARIS INTERMEDIA	MATTED SPIKE-RUSH	G5	S2	PT	PT	
ELEOCHARIS OBTUSA VAR PEASEI	WRIGHTS SPIKE RUSH	G5T5	S1	PE	PE	
ELEOCHARIS PARVULA	LITTLE-SPIKE SPIKE-RUSH	G5	S1	PE	PE	
ELEOCHARIS PAUCIFLORA VAR FERNALDII	FEW-FLOWERED SPIKE-RUSH	G5T?Q	S1	PE	PE	
ELEOCHARIS QUADRANGULATA	FOUR-ANGLED SPIKE-RUSH	G4	S1	PE	PE	
ELEOCHARIS ROBBINSII	ROBBINS' SPIKE-RUSH	G4G5	S2	PT	PT	
ELEOCHARIS ROSTELLATA	BEAKED SPIKE-RUSH	G5	S1	PE	PE	
ELEOCHARIS TENUIS VAR VERRUCOSA	SLENDER SPIKE-RUSH	G5T3T5	S1	PE	PE	
ELEOCHARIS TRICOSTATA	THREE-RIBBED SPIKE-RUSH	G4	SX	PX	PX	
ELEOCHARIS TUBERCULOSA	LONG-TUBERCLED SPIKE-RUSH	G5	SX	PX	PX	
ELEPHANTOPUS CAROLINIANUS	ELEPHANT'S FOOT	G5	S1	PE	PE	

ELLISIA NYCTELEA	ELLISIA	G5	S2	PT	PT
ELODEA SCHWEINITZII	SCHWEINITZ'S WATERWEED	GHQ	SX	PX	PX
ELYMUS TRACHYCAULUS	SLENDER WHEATGRASS	G5	S3	N	TU
EPILOBIUM PALUSTRE	MARSH WILLOW-HERB	G5	S1	TU	TU
EPILOBIUM STRICTUM	DOWNY WILLOW-HERB	G5?	S3	PE	PR
EQUISETUM VARIEGATUM	VARIEGATED HORSETAIL	G5	S1	PE	PE
EQUISETUM X FERRISSII	SCOURING-RUSH	HYB	S1	N	PE
ERIANTHUS GIGANTEUS	SUGAR CANE PLUMEGRASS	G5	SX	PX	PX
ERIGENIA BULBOSA	HARBINGER-OF-SPRING	G5	S2	PT	PT
ERIOCAULON DECANGULARE	TEN-ANGLE PIPEWORT	G5	SX	PX	PX
ERIOCAULON PARKERI	PARKER'S PIPEWORT	G3	SX	PX	PX
ERIOPHORUM GRACILE	SLENDER COTTON-GRASS	G5	S1	PE	PE
ERIOPHORUM TENELLUM	ROUGH COTTON-GRASS	G5	S1	PE	PE
ERIOPHORUM VIRIDICARINATUM	THIN-LEAVED COTTON-GRASS	G5	S2	PT	PT
ERYNGIUM AQUATICUM	MARSH ERYNGO	G4	SX	PX	PX
ERYTHRONIUM ALBIDUM	WHITE TROUT-LILY	G5	S3	N	TU
EUPATORIUM ALBUM	WHITE THOROUGHWORT	G5	SH	PX	PX
EUPATORIUM AROMATICUM	SMALL WHITE-SNAKEROOT	G5	S3	N	PR
EUPATORIUM COELESTINUM	MISTFLOWER	G5	S3	N	TU
EUPATORIUM GODFREYANUM	VASEY'S EUPATORIUM	G4	S2	N	TU
EUPATORIUM LEUCOLEPIS	WHITE-BRACTED THOROUGHWORT	G5	SX	PX	PX
EUPATORIUM ROTUNDIFOLIUM	A EUPATORIUM	G5	S3	TU	UTF
EUPHORBIA IPECACUANHAE	WILD IPECAC	G5?	S1	PE	PE
EUPHORBIA OBTUSATA	BLUNT-LEAVED SPURGE	G5	S1	PE	PE
EUPHORBIA PURPUREA	GLADE SPURGE	G3	S1	PE	PE
EUTHAMIA TENUIFOLIA	GRASS-LEAVED GOLDENROD	G5	S1	PT	PT
FESTUCA PARADOXA	CLUSTER FESCUE	G5	S1	PE	PE
FILIPENDULA RUBRA	QUEEN-OF-THE-PRAIRIE	G4G5	S1S2	TU	TU
FIMBRISTYLIS ANNUA	ANNUAL FIMBRY	G5	S2	PT	PT
FIMBRISTYLIS PUBERULA	HAIRY FIMBRY	G5	SX	PX	PX
FRAXINUS PROFUNDA	PUMPKIN ASH	G4	S1	N	PE
FRAXINUS QUADRANGULATA	BLUE ASH	G5	S1	N	TUEF
GALACTIA REGULARIS	EASTERN MILK-PEA	G5	SX	PX	PX
GALACTIA VOLUBILIS	DOWNY MILK-PEA	G5	SX	PX	PX
GALIUM LABRADORICUM	LABRADOR MARSH BEDSTRAW	G5	S1	PE	PE
GALIUM LATIFOLIUM	PURPLE BEDSTRAW	G5	S3	N	TU
GALIUM TRIFIDUM	MARSH BEDSTRAW	G5	S2	N	PR
GAULTHERIA HISPIDULA	CREEPING SNOWBERRY	G5	S3	PR	PR
GAYLUSSACIA BRACHYCERA	BOX HUCKLEBERRY	G3	S1	PT	PE
GAYLUSSACIA DUMOSA	DWARF HUCKLEBERRY	G5	SH	PE	PE
GENTIANA ALBA	YELLOW GENTIAN	G4	SH	TU	PX
GENTIANA CATESBAEI	ELLIOTT'S GENTIAN	G5	SX	PX	PX
GENTIANA SAPONARIA	SOAPWORT GENTIAN	G5	S1S2	TU	PE
GENTIANA VILLOSA	STRIPED GENTIAN	G4	S1	TU	PE
GENTIANOPSIS VIRGATA	LESSER FRINGED GENTIAN	G5	SX	PX	PX
GERANIUM BICKNELLII	CRANESBILL	G5	S1	PE	PE
GLYCERIA OBTUSA	BLUNT MANNA-GRASS	G5	S1	PE	PE
GNAPHALIUM SYLVATICUM	CUDWEED	G5	SH	N	TU
GOODYERA REPENS	LESSER RATTLESNAKE-PLANTAIN	G5	S2	N	TU
GOODYERA TESSELATA	CHECKERED RATTLESNAKE-PLANTAIN	G5	S1	TU	PT
GRATIOLA AUREA	GOLDEN HEDGE-HYSSOP	G5	S1	TU	PE
GYMNOCARPIUM APPALACHIANUM	APPALACHIAN OAK FERN	G3	S1	TU	PE
GYMNOCARPIUM X HETEROSPORUM	A FERN HYBRID (STERILE TRIPLOID)	HYB	SX	N	PX
GYMNOPOGON AMBIGUUS	BROAD-LEAVED BEARDGRASS	G4	SX	PE	PX
HELIANTHEMUM BICKNELLII	BICKNELL'S HOARY ROCKROSE	G5	S2	PE	PE
HELIANTHEMUM PROPINQUUM	LOW ROCKROSE	G4	SU	N	TU
HELIANTHUS ANGUSTIFOLIUS	SWAMP SUNFLOWER	G5	SX	PX	PX
HELIANTHUS HIRSUTUS	SUNFLOWER	G5	S2	N	TU
HELIANTHUS MICROCEPHALUS	SMALL WOOD SUNFLOWER	G5	S3	N	TU
HELIANTHUS OCCIDENTALIS	SUNFLOWER	G5	SH	N	PX
HETERANTHERA MULTIFLORA	MULTIFLOWERED MUD-PLANTAIN	G4	S1	PE	PE
HIERACIUM KALMII	CANADA HAWKWEED	G5	S3	N	TU
HIERACIUM TRAILLII	MARYLAND HAWKWEED	G4	S1	PE	PE
HIEROCHLOE HIRTA SSP ARCTICA	COMMON NORTHERN SWEET GRASS	G5T5	S1	N	PE
HIEROCHLOE ODORATA	VANILLA SWEET-GRASS	G4G5	SX	PE	PX
HOTTONIA INFLATA	AMERICAN FEATHERFOIL	G4	SX	PX	PX
HOUSTONIA PURPUREA VAR PURPUREA	PURPLE BLUETS	G5T5	SU	TU	TU
HOUSTONIA SERPYLLIFOLIA	CREEPING BLUETS	G4?	S1	N	PE
HUPERZIA POROPHILA	ROCK CLUBMOSS	G4	S1	PE	PE
HYDROCOTYLE UMBELLATA	MANY-FLOWERED PENNYWORT	G5	SH	PX	PX
HYDROPHYLLUM MACROPHYLLUM	LARGE-LEAVED WATERLEAF	G5	S1	PE	PE
HYPERICUM ADPRESSUM	CREEPING ST. JOHN'S-WORT	G2G3	SX	PX	PX
HYPERICUM CRUX-ANDREAE	ST PETER'S-WORT	G5	SX	PX	PX
HYPERICUM DENSIFLORUM	BUSHY ST. JOHN'S-WORT	G5	S3	PT	PR

HYPERICUM DENTICULATUM	COPPERY ST. JOHN'S-WORT	G5	SX	PX	PX	
HYPERICUM DRUMMONDII	NITS-AND-LICE	G5	SX	TU	PX	
HYPERICUM GYMNANTHUM	CLASPING-LEAVED ST. JOHN'S-WORT	G4	S1	PX	PE	
HYPERICUM MAJUS	LARGER CANADIAN ST. JOHN'S-WORT	G5	S2	PT	PT	
HYPERICUM STRAGULUM	ST ANDREW'S-CROSS	G5	S2	N	TU	
ILEX GLABRA	INK-BERRY	G5	SX	PX	PX	
ILEX OPACA	AMERICAN HOLLY	G5	S2	PT	PT	
IODANTHUS PINNATIFIDUS	PURPLE ROCKET	G5	S1	PE	PE	
IRIS CRISTATA	CRESTED DWARF IRIS	G5	S1	PE	PE	
IRIS PRISMATICA	SLENDER BLUE IRIS	G4G5	S1	PE	PE	
IRIS VERNA	DWARF IRIS	G5	S1	PE	PE	
IRIS VIRGINICA	VIRGINIA BLUE FLAG	G5	S2	N	PE	
ISOETES VALIDA	QUILLWORT	G4?	SU	N	TU	
ISOETES X BRITTONII	QUILLWORT	HYB	SU	N	TU	
ISOTRIA MEDEOLOIDES	SMALL-WHORLED POGONIA	G2	S1	PE	PE	LT
ITEA VIRGINICA	VIRGINIA WILLOW	G4	S1	PX	PE	
JUNCUS ALPINOARTICULATUS SSP NODULOSUS	RICHARDSON'S RUSH	G5T5?	S2	PT	PT	
JUNCUS ARCTICUS VAR LITTORALIS	BALTIC RUSH	G5T5	S2	PT	PT	
JUNCUS BIFLORUS	GRASS-LEAVED RUSH	G5	S2	TU	PT	
JUNCUS BRACHYCARPUS	SHORT-FRUITED RUSH	G4G5	S1	PE	PE	
JUNCUS BRACHYCEPHALUS	SMALL-HEADED RUSH	G5	S2	PT	PT	
JUNCUS DEBILIS	WEAK RUSH	G5	S3	N	TU	
JUNCUS DICHOTOMUS	FORKED RUSH	G5	S1	PE	PE	
JUNCUS FILIFORMIS	THREAD RUSH	G5	S3	PR	PR	
JUNCUS GREENEI	GREENE'S RUSH	G5	SX	PX	PX	
JUNCUS MILITARIS	BAYONET RUSH	G4	S1	PE	PE	
JUNCUS SCIRPOIDES	SCIRPUS-LIKE RUSH	G5	S1	PE	PE	
JUNCUS TORREYI	TORREY'S RUSH	G5	S2	PT	PE	
JUNIPERUS COMMUNIS	COMMON JUNIPER	G5	S2	N	TU	
KOELERIA MACRANTHA	JUNEGRASS	G5	SX	PX	PX	
LACTUCA HIRSUTA	DOWNY LETTUCE	G5?	S3	N	TU	
LATHYRUS JAPONICUS	BEACH PEAVINE	G5	S2	PT	PT	
LATHYRUS OCHROLEUCUS	WILD-PEA	G4G5	S1	PT	PT	
LATHYRUS PALUSTRIS	VETCHLING	G5	S1	TU	PE	
LATHYRUS VENOSUS	VEINY PEA	G5	S2	N	TU	
LECHEA MINOR	THYME-LEAVED PINWEED	G5	SU	N	TU	
LEDUM GROENLANDICUM	COMMON LABRADOR-TEA	G5	S3	PR	PR	
LEIOPHYLLUM BUXIFOLIUM	SAND-MYRTLE	G4	SX	PX	PX	
LEMNA OBSCURA	LITTLE WATER DUCKWEED	G5	SX	PX	PX	
LEMNA PERPUSILLA	MINUTE DUCKWEED	G5	SU	N	TU	
LEMNA TURIONIFERA	A DUCKWEED	G5	SU	TU	TU	
LEMNA VALDIVIANA	PALE DUCKWEED	G5	SH	PX	PX	
LESPEDEZA ANGUSTIFOLIA	NARROWLEAF BUSHCLOVER	G5	S1	PE	PE	
LESPEDEZA STUEVEI	TALL BUSH CLOVER	G4?	SX	PX	PX	
LEUCOTHOE RACEMOSA	SWAMP DOG-HOBBLE	G5	S2S3	TU	PT	
LIATRIS SCARIOSA	ROUND-HEAD GAYFEATHER	G5?	S2	N	PT	
LIGUSTICUM CANADENSE	NONDO LOVAGE	G4	SH	PE	PE	
LIMOSELLA AUSTRALIS	AWL-SHAPED MUDWORT	G4G5	SX	PX	PX	
LINNAEA BOREALIS	TWINFLOWER	G5	S1	PT	PE	
LINUM INTERCURSUM	SANDPLAIN WILD FLAX	G4	S1	PE	PE	
LINUM SULCATUM	GROOVED YELLOW FLAX	G5	S1	PE	PE	
LIPOCARPHA MICRANTHA	COMMON HEMICARPA	G4	S1	PE	PE	
LISTERA AUSTRALIS	SOUTHERN TWAYBLADE	G4	S1	PE	PE	
LISTERA CORDATA	HEART-LEAVED TWAYBLADE	G5	S1	PE	PE	
LISTERA SMALLII	KIDNEY-LEAVED TWAYBLADE	G4	S1	PE	PE	
LITHOSPERMUM CANESCENS	HOARY PUCCOON	G5	S2	N	TU	
LITHOSPERMUM CAROLINIENSE	HISPID GROMWELL	G4G5	S1	PE	PE	
LITHOSPERMUM LATIFOLIUM	AMERICAN GROMWELL	G4	S3	PE	PR	
LOBELIA DORTMANNA	WATER LOBELIA	G4	S2	PT	PT	
LOBELIA KALMII	BROOK LOBELIA	G5	S1	PE	PE	
LOBELIA NUTTALLII	NUTTALL'S LOBELIA	G4G5	SX	PX	PX	
LOBELIA PUBERULA	DOWNY LOBELIA	G5	S1	PE	PE	
LONICERA HIRSUTA	HAIRY HONEYSUCKLE	G4G5	S1	TU	PE	
LONICERA OBLONGIFOLIA	SWAMP FLY HONEYSUCKLE	G4	S1	PE	PE	
LONICERA VILLOSA	MOUNTAIN FLY HONEYSUCKLE	G5	S1	PE	PE	
LUDWIGIA DECURRENS	UPRIGHT PRIMROSE-WILLOW	G5	S1	PE	PE	
LUDWIGIA POLYCARPA	FALSE LOOSESTRIFE SEEDBOX	G4	S1	PE	PE	
LUDWIGIA SPHAEROCARPA	SPHERICAL-FRUITED SEEDBOX	G5	SX	PX	PX	
LUPINUS PERENNIS	LUPINE	G5	S3	PR	PR	
LUZULA BULBOSA	SOUTHERN WOOD-RUSH	G5	S1	TU	PE	
LYCOPODIELLA ALOPECUROIDES	FOXTAIL CLUBMOSS	G5	S1	PE	PE	
LYCOPODIELLA APPRESSA	SOUTHERN BOG CLUBMOSS	G5	S2	PT	PT	
LYCOPODIELLA MARGUERITAE	A CLUBMOSS	G2	SU	N	PE	
LYCOPUS RUBELLUS	BUGLEWEED	G5	S1	PE	PE	
LYONIA MARIANA	STAGGER-BUSH	G5	S1	PE	PE	
LYSIMACHIA HYBRIDA	LANCE-LEAF LOOSESTRIFE	G5	S1	N	PT	
LYSIMACHIA QUADRIFLORA	FOUR-FLOWERED LOOSESTRIFE	G5?	SX	TU	PX	

LYTHRUM ALATUM	WINGED-LOOSESTRIFE	G5	S1	TU	PE
MAGNOLIA TRIPETALA	UMBRELLA MAGNOLIA	G5	S2	PT	PR
MAGNOLIA VIRGINIANA	SWEET BAY MAGNOLIA	G5	S2	PT	PT
MALAXIS BAYARDII	BAYARD'S MALAXIS	G2	S1	PR	PE
MALAXIS MONOPHYLLOS VAR BRACHYPODA	WHITE ADDER'S-MOUTH	G4Q	S1	TU	PE
MARSHALLIA GRANDIFLORA	LARGE-FLOWERED MARSHALLIA	G2	S1	PE	PE
MATELEA OBLIQUA	OBLIQUE MILKVINE	G4?	S1	PE	PE
MEEHANIA CORDATA	HEARTLEAF MEEHANIA	G5	S1	TU	PE
MEGALODONTA BECKII	BECK'S WATER-MARIGOLD	G4G5	S1	PE	PE
MELANTHIUM VIRGINICUM	VIRGINIA BUNCHFLOWER	G5	SU	N	TU
MELICA NITENS	THREE-FLOWERED MELIC-GRASS	G5	S2	PT	PT
MENZIESIA PILOSA	MINNIEBUSH	G4G5	S3	PR	PR
MICRANTHEMUM MICRANTHEMOIDES	NUTTALL'S MUD-FLOWER	GH	SX	PX	PX
MINUARTIA GLABRA	APPALACHIAN SANDWORT	G4	S2	PT	PT
MITELLA NUDA	NAKED BISHOP'S-CAP	G5	S1	PE	PE
MONARDA PUNCTATA	SPOTTED BEE-BALM	G5	SH	PE	PE
MONTIA CHAMISSOI	CHAMISSO'S MINER'S-LETTUCE	G5	S1	PE	PE
MUHLENBERGIA CAPILLARIS	SHORT MUHLY	G5	SX	PX	PX
MUHLENBERGIA CUSPIDATA	PLAINS MUHLENBERGIA	G4	SE	TU	TU
MUHLENBERGIA UNIFLORA	FALL DROPSEED MUHLY	G5	S2	PE	PT
MYRICA GALE	SWEET-GALE	G5	S2	PT	PT
MYRIOPHYLLUM FARWELLII	FARWELL'S WATER-MILFOIL	G5	S1	PE	PE
MYRIOPHYLLUM HETEROPHYLLUM	BROAD-LEAVED WATER-MILFOIL	G5	S1	PE	PE
MYRIOPHYLLUM SIBIRICUM	NORTHERN WATER-MILFOIL	G5	S1	PE	PE
MYRIOPHYLLUM TENELLUM	SLENDER WATER-MILFOIL	G5	S2	PT	PT
MYRIOPHYLLUM VERTICILLATUM	WHORLED WATER-MILFOIL	G5	S1	PE	PE
NAJAS MARINA	HOLLY-LEAVED NAIAD	G5	S1	PE	PE
NELUMBO LUTEA	AMERICAN LOTUS	G4	S1	PE	PE
NUPHAR MICROPHYLLA	YELLOW COWLILY	G4G5	S1	TU	PE
NYMPHOIDES CORDATA	FLOATING-HEART	G5	S2	PT	PT
OENOTHERA ARGILLICOLA	SHALE-BARREN EVENING-PRIMROSE	G3G4	S2	PT	PT
OENOTHERA OAKESIANA	EVENING-PRIMROSE	G4G5Q	S2	N	TU
ONOSMODIUM MOLLE VAR HISPIDISSIMUM	FALSE GROMWELL	G4G5T4	S1	PE	PE
ONOSMODIUM VIRGINIANUM	VIRGINIA FALSE-GROMWELL	G4	SH	PX	PX
OPHIOGLOSSUM ENGELMANNII	LIMESTONE ADDER'S-TONGUE	G5	S1	PE	PE
OPHIOGLOSSUM VULGATUM	ADDER'S TONGUE	G5	S3	PX	PR
OPUNTIA HUMIFUSA	PRICKLY-PEAR CACTUS	G5	S3	PR	PR
ORYZOPSIS PUNGENS	SLENDER MOUNTAIN-RICEGRASS	G5	S2	PE	PE
OXYDENDRUM ARBOREUM	SOURWOOD	G5	S3S4	TU	PT
OXYPOLIS RIGIDIOR	STIFF COWBANE	G5	S2	TU	PT
PANICUM AMARUM VAR AMARULUM	SOUTHERN SEA-BEACH PANIC-GRASS	G5T3T5	SH	PE	PE
PANICUM ANNULUM	SERPENTINE PANIC-GRASS	G?Q	S2	TU	PT
PANICUM BICKNELLII	BICKNELL'S PANIC GRASS	G4?Q	SU	TU	TU
PANICUM BOREALE	PANIC-GRASS	G5	SU	TU	TU
PANICUM COMMONSIANUM VAR COMMONSIANUM	COMMONS' PANIC-GRASS	G5T5	SH	TU	PX
PANICUM COMMONSIANUM VAR EUCHLAMYDEUM	CLOAKED PANIC-GRASS	G5T5	S2	PR	PE
PANICUM FLEXILE	WIRY WITCHGRASS	G5	S2S3	TU	TU
PANICUM LAXIFLORUM	LAX-FLOWER WITCHGRASS	G5	S?	N	PE
PANICUM LEIBERGII	LEIBERG'S PANIC-GRASS	G5	SX	PX	PX
PANICUM LONGIFOLIUM	LONG-LEAF PANIC-GRASS	G4	SH	TU	PE
PANICUM LUCIDUM	SHINING PANIC-GRASS	G?Q	S1	TU	PE
PANICUM OLIGOSANTHES	HELLER'S WITCHGRASS	G5	S3	N	TU
PANICUM RECOGNITUM	FERNALD'S PANIC-GRASS	G4	SH	TU	TU
PANICUM SCOPARIUM	VELVETY PANIC-GRASS	G5	S1	PE	PE
PANICUM SPRETUM	EATON'S WITCHGRASS	G5	SH	PX	PE
PANICUM TUCKERMANII	TUCKERMAN'S PANIC-GRASS	G3G5	S2	PT	PT
PANICUM VILLOSISSIMUM VAR VILLOSISSIMUM	LONG-HAIRED PANIC-GRASS	G5T5	SH	TU	TU
PANICUM XANTHOPHYSUM	SLENDER PANIC-GRASS	G5	S1	PE	PE
PANICUM YADKINENSE	YADKIN RIVER PANIC-GRASS	G3G4Q	S2	TU	TU
PARNASSIA GLAUCA	CAROLINA GRASS-OF-PARNASSUS	G5	S2	PE	PE
PARONYCHIA FASTIGIATA VAR NUTTALLII	FORKED-CHICKWEED	G5T3T5	S1S2	TU	PE
PARTHENIUM INTEGRIFOLIUM	AMERICAN FEVER-FEW	G5	SH	TU	PX
PASSIFLORA LUTEA	PASSION-FLOWER	G5	S1	PE	PE
PAXISTIMA CANBYI	CANBY'S MOUNTAIN-LOVER	G2	S1	PE	PE
PEDICULARIS LANCEOLATA	SWAMP LOUSEWORT	G5	S1S2	N	PE
PENSTEMON CANESCENS	BEARD-TONGUE	G4	S3	N	TU
PENSTEMON LAEVIGATUS	BEARD-TONGUE	G5	S3	N	TU
PHASEOLUS POLYSTACHIOS	WILD KIDNEY BEAN	G4	S1S2	N	TU
PHEMERANTHUS TERETIFOLIUS	ROUND-LEAVED FAME-FLOWER	G4	S2	PT	PT
PHLOX OVATA	MOUNTAIN PHLOX	G4	S1	PE	PE

PHLOX PILOSA	DOWNY PHLOX	G5	S1S2	TU	PE	
PHLOX SUBULATA SSP BRITTONII	MOSS PINK	G5T4?	S1	PE	PE	
PHORADENDRON LEUCARPUM	CHRISTMAS MISTLETOE	G5	SX	PX	PX	
PHYLLANTHUS CAROLINIENSIS	CAROLINA LEAF-FLOWER	G5	S1	PE	PE	
PHYSALIS VIRGINIANA	VIRGINIA GROUND-CHERRY	G5	S1S2	TU	PE	
PINUS ECHINATA	SHORT-LEAF PINE	G5	S1S2	N	TU	
PIPTOCHAETIUM AVENACEUM	BLACKSEED NEEDLEGRASS	G5	S1	N	PE	
PLATANTHERA BLEPHARIGLOTTIS	WHITE FRINGED-ORCHID	G4G5	S2S3	N	TU	
PLATANTHERA CILIARIS	YELLOW-FRINGED ORCHID	G5	S2	TU	PT	
PLATANTHERA CRISTATA	CRESTED YELLOW ORCHID	G5	SX	PX	PX	
PLATANTHERA DILATATA	LEAFY WHITE ORCHID	G5	S1	PE	PE	
PLATANTHERA HOOKERI	HOOKER'S ORCHID	G5	S1	TU	PE	
PLATANTHERA HYPERBOREA	LEAFY NORTHERN GREEN ORCHID	G5	S1	PE	PE	
PLATANTHERA LEUCOPHAEA	PRAIRIE WHITE-FRINGED ORCHID	G2	SX	PX	PX	LT
PLATANTHERA PERAMOENA	PURPLE-FRINGELESS ORCHID	G5	S2	TU	PT	
PLUCHEA ODORATA	SHRUBBY CAMPHOR-WEED	G5	S1	TU	PE	
POA AUTUMNALIS	AUTUMN BLUEGRASS	G5	S1	PE	PE	
POA LANGUIDA	DROOPING BLUEGRASS	G3G4Q	S2	TU	PT	
POA PALUDIGENA	BOG BLUEGRASS	G3	S3	PT	PR	
POLEMONIUM VANBRUNTIAE	JACOB'S-LADDER	G3	S1	PE	PE	
POLYGALA CRUCIATA	CROSS-LEAVED MILKWORT	G5	S1	PE	PE	
POLYGALA CURTISSII	CURTIS'S MILKWORT	G5	S1	PE	PE	
POLYGALA INCARNATA	PINK MILKWORT	G5	SH	PE	PE	
POLYGALA LUTEA	YELLOW MILKWORT	G5	SX	PX	PX	
POLYGALA NUTTALLII	NUTTALL'S MILKWORT	G5	S3	N	TU	
POLYGALA POLYGAMA	RACEMED MILKWORT	G5	S1S2	TU	PE	
POLYGONELLA ARTICULATA	EASTERN JOINTWEED	G5	S1	TU	PE	
POLYGONUM CAREYI	CAREY'S SMARTWEED	G4	S1	PE	PE	
POLYGONUM RAMOSISSIMUM	BUSHY KNOTWEED	G5	SH	TU	PX	
POLYGONUM SETACEUM VAR INTERJECTUM	A SWAMP SMARTWEED	G5T4	S2	PE	PE	
POLYMNIA UVEDALIA	LEAF-CUP	G4G5	SR	N	PT	
POLYSTICHUM BRAUNII	BRAUN'S HOLLY FERN	G5	S1	PE	PE	
POPULUS BALSAMIFERA	BALSAM POPLAR	G5	S1	PE	PE	
POPULUS HETEROPHYLLA	SWAMP COTTONWOOD	G5	SH	PX	PX	
POTAMOGETON CONFERVOIDES	TUCKERMAN'S PONDWEED	G4	S2	PT	PT	
POTAMOGETON FILIFORMIS	SLENDER PONDWEED	G5	SH	TU	PX	
POTAMOGETON FRIESII	FRIES' PONDWEED	G4	S1	PE	PE	
POTAMOGETON GRAMINEUS	GRASSY PONDWEED	G5	SH	PE	PE	
POTAMOGETON HILLII	HILL'S PONDWEED	G3	S1	PE	PE	
POTAMOGETON ILLINOENSIS	ILLINOIS PONDWEED	G5	S3S4	TU	PR	
POTAMOGETON OAKESIANUS	OAKES' PONDWEED	G4	S1S2	TU	PE	
POTAMOGETON OBTUSIFOLIUS	BLUNT-LEAVED PONDWEED	G5	S1	PE	PE	
POTAMOGETON PRAELONGUS	WHITE-STEMMED PONDWEED	G5	SH	PX	PE	
POTAMOGETON PULCHER	SPOTTED PONDWEED	G5	S1	PE	PE	
POTAMOGETON RICHARDSONII	RED-HEAD PONDWEED	G5	S3	PT	PR	
POTAMOGETON STRICTIFOLIUS	NARROW-LEAVED PONDWEED	G5	SH	PE	PE	
POTAMOGETON TENNESSEENSIS	TENNESSEE PONDWEED	G2	S1	PE	PE	
POTAMOGETON VASEYI	VASEY'S PONDWEED	G4	S1	PE	PE	
POTAMOGETON ZOSTERIFORMIS	FLAT-STEM PONDWEED	G5	S2S3	PR	PR	
POTENTILLA ANSERINA	SILVERWEED	G5	S3	PT	PR	
POTENTILLA FRUTICOSA	SHRUBBY CINQUEFOIL	G5	S1	PE	PE	
POTENTILLA PARADOXA	BUSHY CINQUEFOIL	G5	S1	PE	PE	
POTENTILLA TRIDENTATA	THREE-TOOTHED CINQUEFOIL	G5	S1	PE	PE	
PRENANTHES RACEMOSA	GLAUCOUS RATTLESNAKE-ROOT	G5	SR	PX	PX	
PRENANTHES SERPENTARIA	LION'S-FOOT	G5	S3	N	TU	
PROSERPINACA PECTINATA	COMB-LEAVED MERMAID-WEED	G5	SX	PX	PX	
PRUNUS ALLEGHANIENSIS	ALLEGHANY PLUM	G4	S2S3	N	PT	
PRUNUS MARITIMA	BEACH PLUM	G4	S1	PE	PE	
PRUNUS PUMILA VAR DEPRESSA		G5T5	S1		PE	
PRUNUS PUMILA VAR PUMILA		G5T4	SX		PX	
PRUNUS PUMILA VAR SUSQUEHANAE		G5T4	S2		PT	
PTELEA TRIFOLIATA	COMMON HOP-TREE	G5	S2	PT	PT	
PTILIMNIUM CAPILLACEUM	MOCK BISHOP-WEED	G5	SX	PE	PX	
PYCNANTHEMUM CLINOPODIOIDES	MOUNTAIN-MINT	G2	S1S2	N	TUEF	
PYCNANTHEMUM TORREI	TORREY'S MOUNTAIN-MINT	G2	SU	PE	PE	
PYCNANTHEMUM VERTICILLATUM VAR PILOSUM	HAIRY MOUNTAIN-MINT	G5T5	SU	TU	PX	
PYROLA CHLORANTHA		G5	S1	N	TU	
PYRULARIA PUBERA	BUFFALO-NUT	G5	S3	PR	PR	
QUERCUS FALCATA	SOUTHERN RED OAK	G5	S1	PE	PE	
QUERCUS PHELLOS	WILLOW OAK	G5	S2	PE	PE	
QUERCUS SHUMARDII	SHUMARD'S OAK	G5	S1	PE	PE	
RANUNCULUS AMBIGENS		G4	S3	N	TURF	
RANUNCULUS AQUATILIS VAR DIFFUSUS	WHITE WATER-CROWFOOT	G5T5	S3		PR	
RANUNCULUS FASCICULARIS	TUFTED BUTTERCUP	G5	S1S2	PE	PE	

RANUNCULUS FLABELLARIS	YELLOW WATER-CROWFOOT	G5	S2	N	PT	
RANUNCULUS FLAMMULA	LESSER SPEARWORT	G5	SH	TU	PX	
RANUNCULUS HEDERACEUS	LONG-STALKED CROWFOOT	G5	SX	PX	PX	
RANUNCULUS PUSILLUS	SPEARWORT	G5	S1	N	PE	
RATIBIDA PINNATA	GRAY-HEADED PRAIRIE CONEFLOWER	G5	SA?	TU	PX	
RHAMNUS LANCEOLATA	LANCE-LEAVED BUCKTHORN	G5	S1	PE	PE	
RHEXIA MARIANA	MARYLAND MEADOW-BEAUTY	G5	S1	PE	PE	
RHODODENDRON ATLANTICUM	DWARF AZALEA	G4G5	S1	PE	PE	
RHODODENDRON CALENDULACEUM	FLAME AZALEA	G5	SX	PX	PX	
RHYNCHOSPORA CAPILLACEA	CAPILLARY BEAKED-RUSH	G5	S1	PE	PE	
RHYNCHOSPORA FUSCA	BROWN BEAKED-RUSH	G4G5	SX	PX	PX	
RHYNCHOSPORA GLOBULARIS	GLOBE BEAK SEDGE	G5?	SU	N	TUXH	
RHYNCHOSPORA GRACILENTA	BEAKED-RUSH	G5	SX	PX	PX	
RHYNCHOSPORA RECOGNITA	SMALL GLOBE BEAKED-RUSH	G5?	S1	TU	PE	
RIBES LACUSTRE	SWAMP CURRANT	G5	S1	TU	PE	
RIBES MISSOURIENSE	MISSOURI GOOSEBERRY	G5	S1	PE	PE	
RIBES TRISTE	RED CURRANT	G5	S2	PT	PT	
ROSA BLANDA		G5	SU	N	TUTFN	
ROSA SETIGERA		G5	SU	N	TUEN	
ROSA VIRGINIANA	VIRGINIA ROSE	G5	S1	TU	TU	
ROTALA RAMOSIOR	TOOTH-CUP	G5	S3	PR	PR	
RUBUS CUNEIFOLIUS	SAND BLACKBERRY	G5	S1	TU	PE	
RUBUS SETOSUS	SMALL BRISTLEBERRY	G5	SH	TU	TU	
RUDBECKIA FULGIDA	EASTERN CONEFLOWER	G5	S3	N	TU	
RUELLIA CAROLINIENSIS	CAROLINA PETUNIA	G5	SX	PX	PX	
RUELLIA HUMILIS	FRINGED-LEAVED PETUNIA	G5	S1	PE	PE	
RUELLIA PEDUNCULATA	STALKED WILD-PETUNIA	G5	S1	N	TU	
RUELLIA STREPENS	LIMESTONE PETUNIA	G4G5	S2	PT	PT	
RUMEX HASTATULUS	HEART-WINGED SORRELL	G5	SX	TU	PX	
SABATIA CAMPANULATA	SLENDER MARSH PINK	G5	SX	PX	PX	
SAGITTARIA CALYCINA VAR SPONGIOSA	LONG-LOBED ARROW-HEAD	G5T4	S1	PE	PE	
SAGITTARIA FILIFORMIS	AN ARROW-HEAD	G4G5	SX	PX	PX	
SAGITTARIA SUBULATA	SUBULATE ARROWHEAD	G4	S3	PR	PR	
SALIX CANDIDA	HOARY WILLOW	G5	S1	PT	PE	
SALIX CAROLINIANA	CAROLINA WILLOW	G5	S1	N	PE	
SALIX MYRICOIDES	BROAD-LEAVED WILLOW	G4	S2	N	TU	
SALIX PEDICELLARIS	BOG WILLOW	G5	S1	N	PE	
SALIX SERISSIMA	AUTUMN WILLOW	G4	S2	PT	PT	
SALIX X SUBSERICEA	MEADOW WILLOW	G5	S1	TU	PE	
SAMOLUS PARVIFLORUS	PINELAND PIMPERNEL	G5	S2	TU	PE	
SCHEUCHZERIA PALUSTRIS	POD-GRASS	G5	S1	PE	PE	
SCHIZACHYRIUM SCOPARIUM VAR LITTORALE	SEASIDE BLUESTEM	G5T?	S3	PR	PR	
SCHOENOPLECTUS ACUTUS	HARD-STEMMED BULRUSH	G5	S2	PE	PE	
SCHOENOPLECTUS FLUVIATILIS	RIVER BULRUSH	G5	S3	PR	PR	
SCHOENOPLECTUS HETEROCHAETUS	SLENDER BULRUSH	G5	SX	PX	PX	
SCHOENOPLECTUS SMITHII	SMITH'S BULRUSH	G5?	S1	PE	PE	
SCHOENOPLECTUS SUBTERMINALIS	WATER BULRUSH	G4G5	S3	N	PT	
SCHOENOPLECTUS TORREYI	TORREY'S BULRUSH	G5?	S1	PE	PE	
SCIRPUS ANCISTROCHAETUS	NORTHEASTERN BULRUSH	G3	S3	PE	PT	LE
SCIRPUS PEDICELLATUS	STALKED BULRUSH	G4	S1	PT	PT	
SCLERIA MINOR	MINOR NUTRUSH	G4	SH	PE	PE	
SCLERIA MUEHLENBERGII	RETICULATED NUTRUSH	G5	S1	PE	PE	
SCLERIA PAUCIFLORA	FEW FLOWERED NUTRUSH	G5	S2	PT	PT	
SCLERIA TRIGLOMERATA	WHIP NUTRUSH	G5	SH	TU	TU	
SCLERIA VERTICILLATA	WHORLED NUTRUSH	G5	S1	PE	PE	
SCUTELLARIA SAXATILIS	ROCK SKULLCAP	G3	S1	TU	PE	
SCUTELLARIA SERRATA	SHOWY SKULLCAP	G4G5	S1	PX	PE	
SEDUM ROSEA	ROSEROOT STONECROP	G5	S1	PE	PE	
SEDUM TELEPHIOIDES	ALLEGHENY STONECROP	G4	S3	PR	PR	
SENECIO ANONYMUS	PLAIN RAGWORT	G5	S2	PR	PR	
SENECIO ANTENNARIIFOLIUS	CAT'S-PAW RAGWORT	G4	S1	PE	PE	
SENECIO PLATTENSIS	PRAIRIE RAGWORT	G5	SH	TU	PX	
SENNA MARILANDICA	WILD SENNA	G5	S1	TU	PE	
SHEPHERDIA CANADENSIS	CANADA BUFFALO-BERRY	G5	S1	PE	PE	
SIDA HERMAPHRODITA	SIDA	G2	S2	PE	PE	
SISYRINCHIUM ALBIDUM	BLUE-EYED GRASS	G5?	SH	TU	PX	
SISYRINCHIUM ATLANTICUM	EASTERN BLUE-EYED GRASS	G5	S1	PE	PE	
SISYRINCHIUM FUSCATUM	SAND BLUE-EYED GRASS	G5?	SH	PX	PX	
SMILAX PSEUDOCHINA	LONG-STALKED GREENBRIER	G4G5	SH	PX	PX	
SOLIDAGO ARGUTA VAR HARRISII	HARRIS' GOLDEN-ROD	G5T4	S1	PE	PE	
SOLIDAGO CURTISII	CURTIS' GOLDEN-ROD	G4G5	S1	PE	PE	
SOLIDAGO PURSHII	PURSH'S GOLDEN-ROD	G5	SH	TU	TU	
SOLIDAGO RIGIDA	HARD-LEAVED GOLDENROD	G5	S1	TU	PE	
SOLIDAGO ROANENSIS	TENESSEE GOLDEN-ROD	G4G5	S2	PR	PR	

SOLIDAGO SIMPLEX SSP RANDII VAR RACEMOSA	STICKY GOLDEN-ROD	G5T4?	S1	PE	PE	
SOLIDAGO SPECIOSA VAR ERECTA	SLENDER GOLDEN-ROD	G5	S1	PE	PE	
SOLIDAGO SPECIOSA VAR SPECIOSA	SHOWY GOLDENROD	G5T5?	SR	N	PT	
SOLIDAGO ULIGINOSA		G4G5	S3	N	TU	
SORBUS DECORA	SHOWY MOUNTAIN-ASH	G4G5	S1	PE	PE	
SPARGANIUM ANDROCLADUM	BRANCHING BUR-REED	G4G5	SH	PE	PE	
SPARGANIUM ANGUSTIFOLIUM	BUR-REED	G5	S2	N	TU	
SPARGANIUM MINIMUM	SMALL BUR-REED	G5	SX	PX	PX	
SPIRAEA BETULIFOLIA	DWARF SPIRAEA	G4G5	S1	PT	PE	
SPIRAEA VIRGINIANA	VIRGINIA SPIRAEA	G2	SX	PX	PX	LT
SPIRANTHES CASEI	CASE'S LADIES'-TRESSES	G4	S1	PE	PE	
SPIRANTHES LUCIDA	SHINING LADIES'-TRESSES	G5	S3	N	TU	
SPIRANTHES MAGNICAMPORUM	LADIES'-TRESSES	G4	SX	PX	PX	
SPIRANTHES OVALIS	OCTOBER LADIES'-TRESSES	G5?	S1	PE	PE	
SPIRANTHES ROMANZOFFIANA	HOODED LADIES'-TRESSES	G5	S1	PE	PE	
SPIRANTHES TUBEROSA	LITTLE LADIES'-TRESSES	G5	S1	TU	PE	
SPIRANTHES VERNALIS	SPRING LADIES'-TRESSES	G5	S1	PE	PE	
SPOROBOLUS CLANDESTINUS	ROUGH DROPSEED	G5	S1	PE	PE	
SPOROBOLUS HETEROLEPIS	PRAIRIE DROPSEED	G5	S1	PE	PE	
STACHYS HYSSOPIFOLIA	HYSSOP HEDGE-NETTLE	G5	SH	TU	PX	
STACHYS NUTTALLII	NUTTALL'S HEDGE-NETTLE	G5?	S1	PE	PE	
STELLARIA BOREALIS	MOUNTAIN STARWORT	G5	S1S2	N	TU	
STENANTHIUM GRAMINEUM	FEATHERBELLS	G4G5	S1S2	N	TU	
STIPA SPARTEA	NEEDLE-GRASS	G5	SH	N	TU	
STREPTOPUS AMPLEXIFOLIUS	WHITE TWISTED-STALK	G5	S1	PE	PE	
STROPHOSTYLES UMBELLATA	WILD BEAN	G5	S2	N	PE	
STYLOSANTHES BIFLORA	PENCILFLOWER	G5	S2	TU	PE	
SWERTIA CAROLINIENSIS	AMERICAN COLUMBO	G5	S1	PE	PE	
SYMPHYOTRICHUM FIRMUM	FIRM ASTER	G5	S2	TU	PT	
TAENIDIA MONTANA	MOUNTAIN PIMPERNEL	G4	S1	PE	PE	
THALICTRUM CORIACEUM	THICK-LEAVED MEADOW-RUE	G4	S2	PE	PT	
THALICTRUM DASYCARPUM	PURPLE MEADOW-RUE	G5	S1	N	TU	
TIPULARIA DISCOLOR	CRANEFLY ORCHID	G4G5	S3	PR	PR	
TOXICODENDRON RYDBERGII	GIANT POISON-IVY	G5	S1	N	PE	
TRAUTVETTERIA CAROLINIENSIS	CAROLINA TASSEL-RUE	G5	S3	PR	PR	
TRICHOSTEMA SETACEUM	BLUE-CURLS	G5	S1	PE	PE	
TRIFOLIUM REFLEXUM	BUFFALO CLOVER	G5	SX	PX	PX	
TRIFOLIUM VIRGINICUM	KATE'S MOUNTAIN CLOVER	G3	S1	PE	PE	
TRIGLOCHIN PALUSTRIS	MARSH ARROWGRASS	G5	SX	PX	PX	
TRILLIUM CERNUUM		G5	S3	N	TU	
TRILLIUM FLEXIPES	DECLINED TRILLIUM	G5	S2	TU	TU	
TRILLIUM NIVALE	SNOW TRILLIUM	G4	S3	PR	PR	
TRIOSTEUM ANGUSTIFOLIUM	HORSE-GENTIAN	G5	S1	TU	PE	
TRIPHORA TRIANTHOPHORA	NODDING POGONIA	G3G4	SH	PE	PE	
TRIPLASIS PURPUREA	PURPLE SANDGRASS	G4G5	S1	PE	PE	
TRIPSACUM DACTYLOIDES	EASTERN GAMMA-GRASS	G5	S1	TU	PE	
TRISETUM SPICATUM	NARROW FALSE OATS	G5	S1	N	PE	
TROLLIUS LAXUS SENSU STRICTO		G3Q	S1	PE	PE	
UTRICULARIA CORNUTA	HORNED BLADDERWORT	G5	S2	N	PT	
UTRICULARIA INFLATA	FLOATING BLADDERWORT	G5	S1S2	N	TU	
UTRICULARIA INTERMEDIA	FLAT-LEAVED BLADDERWORT	G5	S2	PT	PT	
UTRICULARIA RADIATA	SMALL SWOLLEN BLADDERWORT	G4	SX	PE	PX	
UTRICULARIA RESUPINATA	NORTHEASTERN BLADDERWORT	G4	SX	PX	PX	
UTRICULARIA SUBULATA		G5	SX	N	PX	
UVULARIA PUDICA	MOUNTAIN BELLWORT	G5	SH	TU	PR	
VERNONIA GLAUCA	TAWNY IRONWEED	G5	S1	PE	PE	
VERONICA CATENATA	PENNELL'S SPEEDWELL	G5	S1	TU	TU	
VIBURNUM NUDUM	POSSUM-HAW	G5	S1	PE	PE	
VIBURNUM TRILOBUM	HIGHBUSH-CRANBERRY	G5T5	S3S4	TU	PR	
VIOLA APPALACHIENSIS	APPALACHIAN BLUE VIOLET	G3	S2	PT	TU	
VIOLA BRITTONIANA	COAST VIOLET	G4G5	S1	PE	PE	
VIOLA RENIFOLIA	KIDNEY-LEAVED WHITE VIOLET	G5	SH	TU	PX	
VIOLA SELKIRKII	GREAT-SPURRED VIOLET	G5?	S1	N	TU	
VIOLA TRIPARTITA	THREE-PARTED VIOLET	G5	SH	TU	PX	
VITIS CINEREA VAR BAILEYANA	A PIGEON GRAPE	G4G5T?	SH	TU	PE	
VITIS NOVAE-ANGLIAE	NEW ENGLAND GRAPE	G4G5Q	S1	PE	PE	
VITIS RUPESTRIS	SAND GRAPE	G3	S1	PX	PE	
VITTARIA APPALACHIANA	APPALACHIAN GAMETOPHYTE FERN	G4	S2	PT	PT	
WOLFFIELLA GLADIATA	BOG-MAT	G5	S2	PR	PR	
WOODWARDIA AREOLATA	NETTED CHAINFERN	G5	S2	N	PT	
XYRIS TORTA	TWISTED YELLOW-EYED GRASS	G5	S1	N	PT	
ZIGADENUS GLAUCUS	WHITE CAMAS	G4G5	S1	N	PE	
ZIZANIA AQUATICA	INDIAN WILD RICE	G5	S3	PR	PR	

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Vertebrates

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Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
ACANTHARCHUS POMOTIS	MUD SUNFISH	G5	SX		PX	
ACCIPITER GENTILIS	NORTHERN GOSHAWK	G5	S2S3B,S3N		CR	
ACIPENSER BREVIROSTRUM	SHORTNOSE STURGEON	G3	S1	PE	PE	LE
ACIPENSER FULVESCENS	LAKE STURGEON	G3	S1	PE	PE	
ACIPENSER OXYRINCHUS	ATLANTIC STURGEON	G3	S1	PE	PE	(LT,C)
AEGOLIUS ACADICUS	NORTHERN SAW-WHET OWL	G5	S3B,S3N		CU	
AIMOPHILA AESTIVALIS	BACHMAN'S SPARROW	G3	SX		PX	
ALCES ALCES	MOOSE	G5	SX		PX	
ALOSA CHRYSOCHLORIS	SKIPJACK HERRING	G5	SH?	PT	PT	
ALOSA MEDIOCRIS	HICKORY SHAD	G5	SH?	PE	PE	
AMBYSTOMA TIGRINUM	TIGER SALAMANDER	G5	SX		PX	(PS)
AMEIURUS MELAS	BLACK BULLHEAD	G5	S1?	PE	PE	
AMIA CALVA	BOWFIN	G5	S2S3	PC	CR	
AMMOCRYPTA PELLUCIDA	EASTERN SAND DARTER	G3	S1	PE	PE	
ANAS CRECCA	GREEN-WINGED TEAL	G5	S1S2B,S3N		CR	
ANEIDES AENEUS	GREEN SALAMANDER	G3G4	S1	PT	PT	
APALONE MUTICA	SMOOTH SOFTSHELL	G5	SX		PX	
APHREDODERUS SAYANUS	PIRATE PERCH	G5	SX		PX	
ARDEA HERODIAS	GREAT BLUE HERON	G5	S3S4B,S4N			
ASIO FLAMMEUS	SHORT-EARED OWL	G5	S1B,S3N	PE	PE	
ASIO OTUS	LONG-EARED OWL	G5	S2B,S2S3N		CU	
BARTRAMIA LONGICAUDA	UPLAND SANDPIPER	G5	S1S2B	PT	PT	
BISON BISON	AMERICAN BISON	G4	SX		PX	(PS)
BOTAURUS LENTIGINOSUS	AMERICAN BITTERN	G4	S1B	PE	PE	
CANIS LUPUS	GRAY WOLF	G4	SX		PX	(PS:LE,LT,XN)
CARPIODES CARPIO	RIVER CARPSUCKER	G5	SR			
CARPIODES VELIFER	HIGHFIN CARPSUCKER	G4G5	SX?			
CASMERODIUS ALBUS	GREAT EGRET	G5	S1B	PE	PE	
CATHARUS USTULATUS	SWAINSON'S THRUSH	G5	S2S3B,S5N		CR	
CATOSTOMUS CATOSTOMUS	LONGNOSE SUCKER	G5	S1	PE	PE	
CERVUS ELAPHUS	WAPITI OR ELK	G5	SXSC		PX	(PS)
CHARADRIUS MELODUS	PIPING PLOVER	G3	SX		PX	(LE,LT)
CHLIDONIAS NIGER	BLACK TERN	G4	S1B	PE	PE	
CIRCUS CYANEUS	NORTHERN HARRIER	G5	S3B,S4N		CA	
CISTOTHORUS PALUSTRIS	MARSH WREN	G5	S2S3B		CR	
CISTOTHORUS PLATENSIS	SEDGE WREN	G5	S1B	PT	PT	
CLEMMYS MUHLENBERGII	BOG TURTLE	G3	S2	PE	PE	(LT,T (S/A))
CLONOPHIS KIRTLANDII	KIRTLAND'S SNAKE	G2	SH	PE	PE	
COLINUS VIRGINIANUS	NORTHERN BOBWHITE	G5	SZS3		CA	(PS)
CONTOPUS COOPERI	OLIVE-SIDED FLYCATCHER	G5	SXB		PX	
CONUROPSIS CAROLINENSIS	CAROLINA PARAKEET	GX	SX			
COREGONUS ARTEDI	CISCO	G5	SH?	PE	PE	
COREGONUS CLUPEAFORMIS	LAKE WHITEFISH	G5	SX		PX	
COREGONUS ZENITHICUS	SHORTJAW CISCO	G2	SX		PX	
COTTUS RICEI	SPOONHEAD SCULPIN	G5	SR		PX	
CROTALUS HORRIDUS	TIMBER RATTLESNAKE	G4	S3S4	PC	CA	
CRYPTOTIS PARVA	LEAST SHREW	G5	S1	PE	PE	
CULAEA INCONSTANS	BROOK STICKLEBACK	G5	S3	PC	C	
CYCLEPTUS ELONGATUS	BLUE SUCKER	G3G4	SR?	PC	CU	
CYSTOPHORA CRISTATA	HOODED SEAL	G4G5	SA			
ECTOPISTES MIGRATORIUS	PASSENGER PIGEON	GX	SX		PX	
EMPIDONAX FLAVIVENTRIS	YELLOW-BELLIED FLYCATCHER	G5	S1S2B	PT	PT	
EMYDOIDEA BLANDINGII	BLANDING'S TURTLE	G4	S1	PC	PX	
ENNEACANTHUS CHAETODON	BLACKBANDED SUNFISH	G4	SX		PX	
ENNEACANTHUS OBESUS	BANDED SUNFISH	G5	S2S3	PE	PE	
ERIMYSTAX X-PUNCTATUS	GRAVEL CHUB	G4	S1	PE	PE	
ERIMYZON SUCETTA	LAKE CHUBSUCKER	G5	SX		PX	
ETHEOSTOMA CAMURUM	BLUEBREAST DARTER	G4	S2	PT	PT	
ETHEOSTOMA EXILE	IOWA DARTER	G5	S1	PE	PE	
ETHEOSTOMA FUSIFORME	SWAMP DARTER	G5	SX		PX	
ETHEOSTOMA MACULATUM	SPOTTED DARTER	G2	S2	PT	PT	
ETHEOSTOMA TIPPECANOE	TIPPECANOE DARTER	G3	S2	PT	PT	
EUMECES ANTHRACINUS	COAL SKINK	G5	S3			
EUMECES LATICEPS	BROADHEAD SKINK	G5	S1	PC	CR	
FALCO PEREGRINUS	PEREGRINE FALCON	G4	S1B,S1N	PE	PE	
FELIS LYNX	LYNX	G5	SX		PX	(PS:LT)

FELIS RUFUS	BOBCAT	G5	S3S4		CA	
FULICA AMERICANA	AMERICAN COOT	G5	S3B,S3N		CR	
GALLINAGO GALLINAGO	COMMON SNIPE	G5	S3B,S3N		CR	
GALLINULA CHLOROPUS	COMMON MOORHEN	G5	S3B			(PS)
GASTEROSTEUS ACULEATUS	THREESPINE STICKLEBACK	G5	SA?	PE	PE	(PS)
GLAUCOMYS SABRINUS	NORTHERN FLYING SQUIRREL	G5	SU			(PS)
GULO GULO	WOLVERINE	G4	SX		PX	
HALIAEETUS LEUCOCEPHALUS	BALD EAGLE	G4	S2B	PE	PE	(PS:LT,PDL)
HETERODON PLATIRHINOS	EASTERN HOGNOSE SNAKE	G5	S3S4			
HIODON ALOSOIDES	GOLDEYE	G5	S2?	PT	PT	
HIODON TERGISUS	MOONEYE	G5	S2?	PT	PT	
ICHTHYOMYZON BDELLIUM	OHIO LAMPREY	G3G4	S2S3	PC	C	
ICHTHYOMYZON FOSSOR	NORTHERN BROOK LAMPREY	G4	S1	PE	PE	
ICHTHYOMYZON GREELEYI	MOUNTAIN BROOK LAMPREY	G3G4	S2	PT	PT	
ICHTHYOMYZON UNICUSPIS	SILVER LAMPREY	G5	SH		PX	
ICTIOBUS BUBALUS	SMALLMOUTH BUFFALO	G5	S2	PT	PT	
ICTIOBUS CYPRINELLUS	BIGMOUTH BUFFALO	G5	SX	PE	PE	
IXOBRYCHUS EXILIS	LEAST BITTERN	G5	S1B	PE	PE	
KINOSTERNON SUBRUBRUM	EASTERN MUD TURTLE	G5	SH		PX	
LABIDESTHES SICCULUS	BROOK SILVERSIDE	G5	S3	PC	C	
LAMPETRA AEPYPTERA	LEAST BROOK LAMPREY	G5	S3	CR	CR	
LAMPETRA APPENDIX	AMERICAN BROOK LAMPREY	G4	S3	CR	CR	
LAMPROPELTIS GETULA	COMMON KINGSNAKE	G5	SX			
LANIUS LUDOVICIANUS MIGRANS	MIGRANT LOGGERHEAD SHRIKE	G5T3Q	S1B	PE	PE	
LASIONYCTERIS NOCTIVAGANS	SILVER-HAIRED BAT	G5	SUB		CR	
LEPISOSTEUS OCULATUS	SPOTTED GAR	G5	S1	PE	PE	
LEPISOSTEUS OSSEUS	LONGNOSE GAR	G5	S2S3	PC	CR	
LEPOMIS GULOSUS	WARMOUTH	G5	S1S2	PE	PE	
LEPOMIS MEGALOTIS	LONGEAR SUNFISH	G5	S1	PE	PE	
LONTRA CANADENSIS	NORTHERN RIVER OTTER	G5	S3		CA	
LOTA LOTA	BURBOT	G5	S1S2	PE	PE	
LYTHRURUS UMBRATILIS	REDFIN SHINER	G5	S2	PE	PE	
MACRHYBOPSIS STORERIANA	SILVER CHUB	G5	S1	PE	PE	
MARTES AMERICANA	AMERICAN MARTEN	G5	SX		PX	
MARTES PENNANTI	FISHER	G5	SC		PX	
MICROTUS CHROTORRHINUS	ROCK VOLE	G4	S2		CA	
MINYTREMA MELANOPS	SPOTTED SUCKER	G5	S2	PT	PT	
MOXOSTOMA CARINATUM	RIVER REDHORSE	G4	S3	PC	CU	
MUSTELA NIVALIS	LEAST WEASEL	G5	S3		CU	
MYOTIS LEIBII	EASTERN SMALL-FOOTED MYOTIS	G3	S1B,S1N	PT	PT	
MYOTIS SEPTENTRIONALIS	NORTHERN MYOTIS	G4	S3B,S3N		CR	
MYOTIS SODALIS	INDIANA OR SOCIAL MYOTIS	G2	SUB,S1N	PE	PE	LE
MYOXOCEPHALUS THOMPSONI	DEEPWATER SCULPIN	G5	SU		PX	
NEOTOMA MAGISTER	ALLEGHENY WOODRAT	G3G4	S3	PT	PT	
NOCOMIS BIGUTTATUS	HORNYHEAD CHUB	G5	S2	PC	CR	
NOTROPIS ARIOMMUS	POPEYE SHINER	G3	S1		PX	
NOTROPIS BIFRENATUS	BRIDLE SHINER	G5	S1S2	PE	PE	
NOTROPIS BLENNIUS	RIVER SHINER	G5	S1?	PE	PE	
NOTROPIS BUCHANANI	GHOST SHINER	G5	S1	PE	PE	
NOTROPIS CHALYBAEUS	IRONCOLOR SHINER	G4	S1	PE	PE	
NOTROPIS DORSALIS	BIGMOUTH SHINER	G5	S2	PT	PT	
NOTROPIS HETERODON	BLACKCHIN SHINER	G5	S1	PE	PE	
NOTROPIS HETEROLEPIS	BLACKNOSE SHINER	G5	SX		PX	
NOTURUS ELEUTHERUS	MOUNTAIN MADTOM	G4	S1S2	PE	PE	
NOTURUS GYRINUS	TADPOLE MADTOM	G5	S1	PE	PE	
NOTURUS MIURUS	BRINDLED MADTOM	G5	S2	PT	PT	
NOTURUS STIGMOSUS	NORTHERN MADTOM	G3	S2	PE	PE	
NYCTANASSA VIOLACEA	YELLOW-CROWNED NIGHT-HERON	G5	S1B	PE	PE	
NYCTICEIUS HUMERALIS	EVENING BAT	G5	SUB,SUN		CR	
NYCTICORAX NYCTICORAX	BLACK-CROWNED NIGHT-HERON	G5	S2S3B		CA	
OPHEODRYS AESTIVUS	ROUGH GREEN SNAKE	G5	S1	PT	PT	
OPSOPOEODUS EMILIAE	PUGNOSE MINNOW	G5	S1SE?			
ORYZOMYS PALUSTRIS	MARSH RICE RAT	G5	SX		PX	(PS)
PANDION HALIAETUS	OSPREY	G5	S2B	PT	PT	
PARARHINICHTHYS BOWERSI	CHEAT MINNOW	G1G2Q	S1?		CU	
PERCINA COPELANDI	CHANNEL DARTER	G4	S1S2	PT	PT	
PERCINA EVIDES	GILT DARTER	G4	S1S2	PT	PT	
PERCINA MACROCEPHALA	LONGHEAD DARTER	G3	S2	PT	PT	
PERCINA OXYRHYNCHUS	SHARPNOSE DARTER	G4	SX		PX	
PHOCA VITULINA	HARBOR SEAL	G5	SA			
PHOCOENA PHOCOENA	HARBOR PORPOISE	G4G5	SA			(PS:C)

PHOXINUS EOS	NORTHERN REDBELLY DACE	G5	SX		PX	
PHOXINUS ERYTHROGASTER	SOUTHERN REDBELLY DACE	G5	S2S3	PT	PT	
PIMEPHALES VIGILAX	BULLHEAD MINNOW	G5	SU		CU	
PIRANGA RUBRA	SUMMER TANAGER	G5	S3B		CR	
PLEGADIS FALCINELLUS	GLOSSY IBIS	G5	SAB			
PODILYMBUS PODICEPS	PIED-BILLED GREBE	G5	S3B,S4N		CR	
POLYODON SPATHULA	PADDLEFISH	G4	SXSC		PX	
PORZANA CAROLINA	SORA	G5	S3B			
PROTONOTARIA CITREA	PROTHONOTARY WARBLER	G5	S2S3B		CR	
PSEUDACRIS TRISERIATA KALMI	NEW JERSEY CHORUS FROG	G5T4	S1	PE	PE	
PSEUDEMYS RUBRIVENTRIS	REDBELLY TURTLE	G5	S2	PT	CA	(PS)
PSEUDOTRITON MONTANUS	MUD SALAMANDER	G5	S1	PE	CR	
PUMA CONCOLOR COUGUAR	EASTERN COUGAR	G5TH	SX		PX	LE
RALLUS ELEGANS	KING RAIL	G4G5	S1B	PE	PE	
RALLUS LIMICOLA	VIRGINIA RAIL	G5	S3B			
RANA SPHENOCEPHALA	COASTAL PLAIN LEOPARD FROG	G5	S2	PE	PE	
SALVELINUS NAMAYCUSH	LAKE TROUT	G5	S?			
SCAPHIOPUS HOLBROOKII	EASTERN SPADEFOOT	G5	S1S2			
SCAPHIRHYNCHUS PLATORYNCHUS	SHOVELNOSE STURGEON	G4	SX			
SCIURUS NIGER CINEREUS	DELMARVA FOX SQUIRREL	G5T3	SX	PE	PX	(LE,XN)
SCIURUS NIGER VULPINUS	EASTERN FOX SQUIRREL	G5T4T5	SU		CR	
SISTRURUS CATENATUS CATENATUS	EASTERN MASSASAUGA	G3G4T3T4	S1S2	PE	PE	C
SOREX DISPAR	LONG-TAILED OR ROCK SHREW	G4	S3			
SOREX PALUSTRIS ALBIBARBIS	WATER SHREW	G5T5	S3		CR	
SOREX PALUSTRIS PUNCTULATUS	SOUTHERN WATER SHREW	G5T3	S1	PT	PT	
SPILOGALE PUTORIUS	EASTERN SPOTTED SKUNK	G5	SH		PE	
SPIZA AMERICANA	DICKCISSEL	G5	S2B		PT	
STERNA HIRUNDO	COMMON TERN	G5	SXB	PE	PE	
STIZOSTEDION VITREUM GLAUCUM	BLUE PIKE	G5TX	SX		PX	
SYLVILAGUS OBSCURUS	APPALACHIAN COTTONTAIL	G4	SU			
TAXIDEA TAXUS	AMERICAN BADGER	G5	SA	N		
THRYOMANES BEWICKII ALTUS	APPALACHIAN BEWICK'S WREN	G5T2Q	SH		PX	
TYMPANUCHUS CUPIDO	GREATER PRAIRIE-CHICKEN	G4	SX		PX	(PS)
TYTO ALBA	BARN-OWL	G5	S3B,S3N		CA	
UMBRA LIMI	CENTRAL MUDMINNOW	G5	S3	PC	C	
UMBRA PYGMAEA	EASTERN MUDMINNOW	G5	S3	PC	C	

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Invertebrates

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Scientific Name	Common Name	Global Rank	State Rank	State Status	Proposed State Status	Federal Status
ACRONICTA ALBARUFA	BARRENS DAGGER MOTH	G3G4	SX			
ACRONICTA LANCEOLARIA	A NOCTUID MOTH	G4	SU			
AESHNA CLEPSYDRA	SPOTTED BLUE DARNER	G4	S2S3			
AESHNA MUTATA	SPRING BLUE DARNER	G3G4	S1			
ALASMIDONTA HETERODON	DWARF WEDGEMUSSEL	G1G2	S1		PX	LE
ALASMIDONTA VARICOSA	BROOK FLOATER	G3	S2		PE	
AMBLEMA PLICATA	THREE-RIDGE	G5	S2S3		PT	
AMBLYSCIRTES VIALIS	ROADSIDE SKIPPER	G5	S?			
AMELETUS BROWNI		G3	S?			
ANAX LONGIPES	LONG-LEGGED GREEN DARNER	G5	S1S2			
ANISOTA STIGMA	SPINY OAKWORM MOTH	G5	S?			
ANODONTA IMPLICATA	ALEWIFE FLOATER	G5	SH		CU	
ANODONTOIDES FERUSSACIANUS	CYLINDRICAL PAPERSHELL	G5	S2S3		PE	
ANOMOGYNA ELIMATA	SOUTHERN VARIABLE DART MOTH	G5	SU			
APAMEA BURGESSI	A CUTWORM MOTH	G4	SH			
APAMEA CRISTATA	A NOCTUID MOTH	G4	SU			
APHARETRA PURPUREA	A NOCTUID MOTH	G4	S2			
APLECTOIDES CONDITA	A NOCTUID MOTH	G4	S2S3			
APODREPANULATRIX LIBERARIA	A GEOMETER MOTH	G4	S3			
ARCTOSA LITTORALIS	A SAND SPIDER	G?	S?	N		
ARGIA BIPUNCTULATA	TWO-SPOTTED DANCER	G4	SU			
ARGIA FUMIPENNIS	VARIABLE DANCER	G5	S?			
ARGIA TIBIALIS	EASTERN DANCER	G5	SH			
ARIGOMPHUS FURCIFER	FORKED CLUBTAIL DRAGONFLY	G5	S2			
ARTACE CRIBRARIA	DOT-LINED WHITE MOTH	G5	S1			
ATRYTONE AROGOS AROGOS	AROGOS SKIPPER	G3G4T1T2	SX			
ATRYTONOPSIS HIANNA	DUSTED SKIPPER	G4G5	S3			
AUTOCHTON CELLUS	GOLDEN-BANDED SKIPPER	G4	SH			
BAGISARA GULNARE	A NOCTUID MOTH	G4	SU			
BAGISARA RECTIFASCIA	STRAIGHT LINED MALLOW MOTH	G4	SU			
BOYERIA GRAFIANA	OCELLATED DARNER	G5	S3			
BRACHIONYCHA BOREALIS	BOREAL FAN MOTH	G4	SH			
CAECIDOTEA FRANZI	FRANZ'S CAVE ISOPOD	G2G3	S1			
CAECIDOTEA KENKI	AN ISOPOD	G3	S1			
CAECIDOTEA PRICEI	PRICE'S CAVE ISOPOD	G3G4	S2S3			
CALEPHELIS BOREALIS	NORTHERN METALMARK	G3G4	S2			
CALOPTERYX AEQUABILIS	BLACK-BANDED BANDWING	G5	S2			
CALOPTERYX AMATA	SUPERB JEWELWING	G4	S2S3			
CALOPTERYX ANGUSTIPENNIS	APPALACHIAN JEWELWING	G4	SU			
CALYCOPIS CECROPS	RED-BANDED HAIRSTREAK	G5	S2S3			
CARIPETA ARETARIA	SOUTHERN PINE LOOPER MOTH	G4	S1			
CARTEROCEPHALUS PALAEMON MANDAN	ARCTIC SKIPPER	G5T5	S2			
CATOCALA MARMORATA	MARBLED UNDERWING MOTH	G3G4	SX			
CATOCALA MIRANDA	A NOCTUID MOTH	G4	SU			
CATOCALA PRETIOSA PRETIOSA	PRECIOUS UNDERWING MOTH	G4T2T3	SX			
CATOCALA SP 1	PINE WOODS UNDERWING	G5	S1			
CELASTRINA EBENINA	SOOTY AZURE	G4	SH			
CELASTRINA NEGLECTAMAJOR	APPALACHIAN BLUE	G4	S3S4			
CERMA CORA	A BIRD-DROPPING MOTH	G3G4	S?			
CHAETAGLAEA CERATA	A SALLOW MOTH	G3G4	S1			
CHAETAGLAEA TREMULA	BARRENS CHAETAGLAEA	G5	S1			
CHEUMATOPSYCHE HELMA	HELMA'S CHEUMATOPSYCHE CADDISFLY	G1G3	S1			
CHEUMATOPSYCHE VANNOTEI	VANNOTE'S CHEUMATOPSYCHE CADDISFLY	GH	SH			
CHLOSYNE GORGONE	GORGONE CHECKERSPOT	G5	SH			
CHLOSYNE HARRISII	HARRIS' CHECKERSPOT	G4	S3			
CHYTONIX SENSILIS	MARVEL MOTH	G4	S1			
CICINDELA ANCOCISCONENSIS	A TIGER BEETLE	G3	S1			
CICINDELA FORMOSA	A TIGER BEETLE	G5	S1			
CICINDELA HIRTICOLLIS	BEACH-DUNE TIGER BEETLE	G5	S2S3			
CICINDELA LEPIDA	LITTLE WHITE TIGER BEETLE	G4	SH			
CICINDELA LIMBALIS	A TIGER BEETLE	G5	S3			
CICINDELA MARGINIPENNIS	COBBLESTONE TIGER BEETLE	G2G3	SX			

CICINDELA PATRUELA	A TIGER BEETLE	G3	S2S3			
CICINDELA SCUTELLARIS	A TIGER BEETLE	G5	SH			
CICINDELA SPLENDIDA	A TIGER BEETLE	G5	SH			
CICINDELA UNIPUNCTATA	A TIGER BEETLE	G4	SH			
CICINNUS MELSHEIMERI	MELSHEIMER'S SACK BEARER	G4	S1			
CISTHENE PACKARDII	PACKARD'S LICHEN MOTH	G5	S1S3			
CISTHENE PLUMBEA	LEAD COLORED LICHEN MOTH	G5	S1			
CITHERONIA REGALIS	REGAL MOTH	G5	SU			
CITHERONIA SEPULCRALIS	PINE DEVIL	G5	SH			
CLOEON COGNATUM		G3	S?			
COENAGRION RESOLUTUM	RESOLUTE DAMSEL	G5	S1			
COLEOPHORA LEUCOCHRYSELLA	CHESTNUT CASE-BEARER MOTH	G?	SX			
COLIAS INTERIOR	PINK-EDGED SULPHUR	G5	SH			
CRAMBIDIA CEPHALICA	LICHEN MOTH	G4	S1S2			
CRAMBIDIA PURA	PURE LICHEN MOTH	G4	SU			
CRANGONYX DEAROLFI	PENNSYLVANIA CAVE AMPHIPOD	G2G3	S1			
CYCLONAIAS TUBERCULATA	PURPLE WARTYBACK	G5	SX		PX	
CYCLOPHORA NANARIA	A GEOMETRID MOTH	G5	S1S2			
CYPROGENIA STEGARIA	FANSHELL	G1	SX		PX	LE
DACTYLOCYTHERE SUTERI	AN OSTRACOD	GU	SU			
DATANA RANAECEPS	A HAND-MAID MOTH	G3G4	S1			
DERRIMA STELLATA	PINK STAR MOTH	G4	SH			
DIARSIA RUBIFERA		G5	SU			
DOROCORDULIA LEPIDA	ELEGANT SKIMMER	G5	S2			
DRYOBIUS SEXNOTATUS	SIX-BANDED LONGHORN BEETLE	G?	SH			
ELAPHRIA FESTIVOIDES	A NOCTUID MOTH	G5	S5			
ELAPHRIA GEORGEI	A MIDGET MOTH	G4	S?			
ELAPHRIA SP 1 NR FESTIVOIDES		G5	SU			
ELLIPSARIA LINEOLATA	BUTTERFLY MUSSEL	G4	SX		PX	
ELLIPTIO CRASSIDENS	ELEPHANT EAR	G5	SX		PX	
ELLIPTIO FISHERIANA	NORTHERN LANCE	G4	SH		CU	
ELLIPTIO PRODUCTA	ATLANTIC SPIKE	G4Q	S2		N	
ENALLAGMA BOREALE	BOREAL BLUET	G5	S2			
ENALLAGMA LATERALE	LATERAL BLUET	G3	S1			
EPIGLAEA APIATA	POINTED SALLOW	G5	S3S4			
EPIOBLASMA TORULOSA RANGIANA	NORTHERN RIFFLESHELL	G2T2	S2	PE	PE	LE
EPIOBLASMA TRIQUETRA	SNUFFBOX	G3	S1		PE	
EPIRRITA AUTUMNATA HENSHAWI	NOVEMBER MOTH	G5T5	SU			
ERASTRIA COLORARIA	BROAD-LINED ERASTRIA MOTH	G4	S1			
ERYNNIS LUCILIUS	COLUMBINE DUSKYWING	G4	S1S2			
ERYNNIS MARTIALIS	MOTTLED DUSKYWING	G3G4	S1S2			
ERYNNIS PERSIUS PERSIUS	PERSIUS DUSKYWING	G5T2T3	S1S2			
EUCHLOE OLYMPIA	OLYMPIA MARBLE	G4G5	S1			
EUPHYES CONSPICUUS	BLACK DASH	G4	S3			
EUPHYES DION	SEDGE SKIPPER	G4	S1			
EURYLOPHELLA BICOLOROIDES		G3	S?			
EURYLOPHELLA POCONOENSIS		G1	S?			
EUXOA VIOLARIS	VIOLET DART MOTH	G4	SH			
FAGITANA LITTERA	A NOCTUID MOTH	G4	SH			
FIXSENIA FAVONIUS ONTARIO	NORTHERN HAIRSTREAK	G4T4	S1S3			
FUSCONAIA FLAVA	WABASH PIGTOE	G5	S2		PE	
FUSCONAIA SUBROTUNDA	LONG-SOLID	G3	S1		PE	
GLAUCOPSYCHE LYGDAMUS LYGDAMUS	SILVERY BLUE	G5T4	S2			
GLENA COGNATARIA	BLUEBERRY GRAY	G4	S1			
GOMPHAESCHNA ANTILOPE	SOUTHERN BOG DARNER	G4	SH			
GOMPHUS ABBREVIATUS	ABBREVIATED CLUBTAIL DRAGONFLY	G3G4	S2			
GOMPHUS ADELPHUS	MOUSTACHED CLUBTAIL	G4	S?			
GOMPHUS DESCRIPTUS	HARPOON CLUBTAIL	G4	S1S2			
GOMPHUS FRATERNUS	BROTHERLY CLUBTAIL	G5	S2S3			
GOMPHUS LINEATIFRONS	LINED CLUBTAIL	G4	SX			
GOMPHUS QUADRICOLOR	RAPIDS CLUBTAIL	G3G4	S1S2			
GOMPHUS ROGERSI	ROGER'S CLUBTAIL	G4	S1			
GOMPHUS VENTRICOSUS	WIDE-TAILED CLUBTAIL	G3	SX			
GOMPHUS VIRIDIFRONS	GREEN-FACED CLUBTAIL	G3	S1			
GRAMMIA PHYLLIRA	PHYLLIRA TIGER MOTH	G4	SH			
HELOCORDULIA UHLERI	UHLER'S SUNFLY	G5	S3			
HEMARIS GRACILIS	GRACEFUL CLEARWING	G3G4	SH			
HEMILEUCA MAIA	BARRENS BUCKMOTH	G5	S1S2			
HEMILEUCA SP 3	MIDWESTERN FEN BUCKMOTH	G3G4Q	S1			
HEMIPACHNOBIA MONOCHROMATEA	SUNDEW CUTWORM MOTH	G4	S2S3			
HEMISTENA LATA	CRACKING PEARLYMUSSEL	G1	SX		PX	LE
HEPTAGENIA CULACANTHA		G3	S?			

HESPERIA ATTALUS SLOSSONAE	DOTTED SKIPPER	G3G4T3	SX			
HESPERIA LEONARDUS	LEONARD'S SKIPPER	G4	S3S4			(PS)
HESPERIA METEA	COBWEB SKIPPER	G4G5	S2S3			
HETAERINA TITIA	TITIAN RUBY-SPOT	G5	S2			
HOLOMELINA LAETA	JOYFUL HOLOMELINA MOTH	G5	SU			
HOLOMELINA NIGRICANS		GHQ	S?			
HYDRAECIA IMMANIS	A NOCTUID MOTH	G4	SU			
HYDRAECIA STRAMENTOSA	A MOTH	G4	SU			
HYPAGYRTIS ESTHER	ESTHER MOTH	G5	S2S3			
IDAEA EREMIATA		G4	S1			
IDAEA VIOLACEARIA	A WAVE MOTH	G4	S1			
INCISALIA HENRICI	HENRY'S ELFIN	G5	S2S3			
INCISALIA IRUS	FROSTED ELFIN	G3	S2			
INCISALIA POLIA	HOARY ELFIN	G5	S1			
ISONYCHIA HOFFMANI		G1	S?			
ITAME SP 1	BARRENS ITAME (cf I. INEXTRICATA)	G3	S1			
LAGOA CRISPATA	BLACK-WAVED FLANNEL MOTH	G5	S1			
LAMPSILIS ABRUPTA	PINK MUCKET	G2	SX		PX	LE
LAMPSILIS CARIOSA	YELLOW LAMPMUSSEL	G3G4	S3S4		CU	
LAMPSILIS RADIATA	EASTERN LAMPMUSSEL	G5	S2		CU	
LANTHUS PARVULUS	ZORRO CLUBTAIL	G4	S3S4			
LASIUS MINUTIS	AN ANT	G?	S?	N		
LASMIGONA COMPLANATA	WHITE HEELSPLITTER	G5	S1		PE	
LASMIGONA COMPRESSA	CREEK HEELSPLITTER	G5	S2S3		PE	
LASMIGONA SUBVIRIDIS	GREEN FLOATER	G3	S2		CU	
LEMMERIA DIGITALIS	A NOCTUID MOTH	G4G5	SH			
LEPTODEA FRAGILIS	FRAGILE PAPERSHELL	G5	S2		PT	
LEPTODEA OCHRACEA	TIDEWATER MUCKET	G4	SX		PX	
LEUCORRHINIA PROXIMA	CANADIAN WHITE-FACED SKIMMER	G5	S2			
LIGUMIA NASUTA	EASTERN PONDMUSSEL	G4G5	S1			
LITHOMOIA SOLIDAGINIS GERMANA	A MOTH	G5T5	S3S4			
LITHOPHANE FRANCLEMONTI		GU	SH			
LITHOPHANE THAXTERI	THAXTER'S PINION MOTH	G4	SH			
LORDITHON NIGER	BLACK LORDITHON ROVE BEETLE	G1	SX			
LYCAEIDES MELISSA	MELISSA BLUE	G5	SX			(PS)
LYCAEIDES MELISSA SAMUELIS	KARNER BLUE BUTTERFLY	G5T2	SX			LE
LYCAENA EPIXANTHE	BOG COPPER	G4G5	S2			
LYCAENA HYLLUS	BRONZE COPPER	G5	S2			
LYCIA RACHELAE	TWILIGHT MOTH	G4	S1			
MACROMIA ALLEGHANIENSIS	ALLEGHENY RIVER SKIMMER	G4	SH			
MARGARITIFERA MARGARITIFERA	EASTERN PEARLSHELL	G4	S1		PE	
MEGACEPHALA VIRGINICA	VIRGINIA BIG-HEADED TIGER BEETLE	G5	SH			
MEROLONCHE DOLLI	DOLL'S MEROLONCHE	G3G4	S1			
MEROPE TUBER	EARWIG SCORPIONFLY	G3G5	SU			
METARRANTHIS APICIARIA	BARRENS METARRANTHIS MOTH	GU	SH			
METAXAGLAEA SEMITARIA	FOOTPATH SALLOW MOTH	G5	S2			
MITOURA GRYNEA	OLIVE HAIRSTREAK	G5	S3			
NANNOTHEMIS BELLA	DWARF SKIMMER	G4	SH			
NASIAESCHNA PENTACANTHA	BLUE-NOSED DARNER	G5	S2			
NICROPHORUS AMERICANUS	AMERICAN BURYING BEETLE	G2G3	SH			LE
NICROPHORUS MARGINATUS	A BURYING BEETLE	G?	SX			
OBLIQUARIA REFLEXA	THREEHORN WARTYBACK	G5	SX		PX	
OBOVARIA OLIVARIA	HICKORYNUT	G4	SX		PX	
OBOVARIA RETUSA	RING PINK	G1	SX		PX	LE
OBOVARIA SUBROTUNDA	ROUND HICKORYNUT	G4	S1		PE	
OLIGIA HAUSTA	NORTHERN BROCADE MOTH	G4	S1			
OPHIOGOMPHUS ANOMALUS	IRREGULAR SNAKETAIL	G3	S1			
OPHIOGOMPHUS EDMUNDO	EDMUND'S SNAKETAIL	G1G2	SX			
OPHIOGOMPHUS HOWEI	MIDGET SNAKETAIL DRAGONFLY	G3	S1			
OPHIOGOMPHUS MAINENSIS	TWIN-HORNED SNAKETAIL	G4	S3			
ORCONECTES PROPINQUUS	NORTHERN CLEARWATER CRAYFISH	G5	S3S4			
OXYSOMA CUBANA	A SAC-SPIDER	G?	S?	N		
PALAEMONETES KADIAKENSIS	MISSISSIPPI GRASS SHRIMP	G4	SU			
PANOQUINA PANOQUIN	SALT-MARSH SKIPPER	G5	SH			
PAPAIPEMA AERATA	A BORER MOTH	GH	SH			
PAPAIPEMA LEUCOSTIGMA	COLUMBINE BORER	G4	SU			
PAPAIPEMA MARGINIDENS	A BORER MOTH	G4	SU			
PAPAIPEMA SP 1	FLYPOISON BORER MOTH	G2G3	S2			
PAPAIPEMA SP 2		G3G4	S?			
PAPILIO CRESPHONTES	GIANT SWALLOWTAIL	G5	S2			
PARAHYPENODES QUADRALIS		G4	SU			

PARALEPTOPHLEBIA ASSIMILIS		G2	S?			
PHOBERIA ORTHOSIOIDES	AN OAK MOTH	G4	S3			
PHYCIODES BATESII	TAWNY CRESCENT	G4	SH			
PHYCIODES SELENIS	PASCO CRESCENT	G5	S3S4			
PLATYPERIGEA MERALIS	A NOCTUID MOTH	G4	S1			
PLETHOBASUS COOPERIANUS	ORANGE-FOOT PIMPLEBACK	G1	SX		PX	LE
PLETHOBASUS CYPHYUS	SHEEPNOSE MUSSEL	G3	S1		PE	
PLEUROBEMA CLAVA	CLUBSHELL	G2	S1S2	PE	PE	LE
PLEUROBEMA CORDATUM	OHIO PIGTOE	G3	SX		PX	
PLEUROBEMA PLENUM	ROUGH PIGTOE	G1	SX		PX	LE
PLEUROBEMA PYRAMIDATUM	PYRAMID PIGTOE	G2	SX		PX	
PLEUROBEMA SINTOXIA	ROUND PIGTOE	G4	S2		PE	
POANES MASSASOIT	MULBERRY WING	G4	S2			
POANES VIATOR VIATOR	BROAD-WINGED SKIPPER	G5T4	SU			
POANES VIATOR ZIZANIAE	BROAD-WINGED SKIPPER	G5T5	S1			
POLYGONIA FAUNUS	FAUNUS ANGLEWING	G5	S3S4B,SZN			
POLYGONIA PROGNE	GRAY COMMA	G5	SU			
PONTIA PROTODICE	CHECKERED WHITE	G4	SH			
POTAMILUS ALATUS	PINK HEELSPLITTER	G5	S2		PT	
PROCAMBARUS ACUTUS	WHITE RIVER CRAWFISH	G5	SU			
PROGOMPHUS OBSCURUS	OBSCURE CLUBTAIL	G5	S2			
PROPERIGEA SP 1	A NOCTUID MOTH	G2G3Q	S1			
PSECTRAGLAEA CARNOSA	PINK SALLOW	G3	S1			
PYREFERRA CEROMATICA	ANOINTED SALLOW MOTH	GU	SX			
PYRGUS WYANDOT	SOUTHERN GRIZZLED SKIPPER	G2	S1			
QUADRULA CYLINDRICA	RABBITSFOOT	G3	S1		PE	(PS)
QUADRULA METANEVRA	MONKEYFACE	G4	SX		PX	
QUADRULA PUSTULOSA	PIMPLEBACK	G5	SX		PX	
QUADRULA QUADRULA	MAPLELEAF	G5	S1S2		PT	
RENIA SP 1 NR DISCOLORALIS		G4	S1?			
RHODOECIA AURANTIAGO	AUREOLARIA SEED BORER	G4	SH			
RICHIA GROTEI	A NOCTUID MOTH	G4	S1			
SEMIOTHISA PROMISCUATA	PROMISCUOUS ANGLE	G4	S1			
SIDERIDIS MARYX		G4	S1S3			
SIMPSONAIAS AMBIGUA	SALAMANDER MUSSEL	G3	S1?		CU	
SINGA EUGENIE	AN ORB-WEAVER SPIDER	G?	S?	N		
SOMATOCHLORA ELONGATA	SKI-TAILED EMERALD	G5	S2			
SOMATOCHLORA FORCIPATA	FORCIPATE BOG SKIMMER	G5	S2			
SOMATOCHLORA INCURVATA	MICHIGAN BOG SKIMMER	G4	S1			
SOMATOCHLORA LINEARIS	LINED BOG SKIMMER	G5	S1			
SOMATOCHLORA WALSHII	WALSH'S EMERALD	G5	S2			
SOMATOCHLORA WILLIAMSONI	WILLIAMSON'S BOG SKIMMER	G5	S1			
SPEYERIA DIANA	DIANA	G3	SAH			
SPEYERIA IDALIA	REGAL FRITILLARY	G3	S1			
SPHALLOPLANA PRICEI	REFTON CAVE PLANARIAN	G1G3	S1			
SPHINX FRANCKII	FRANCK'S SPHINX MOTH	G4	SH			
SPHINX GORDIUS		G4	S1S3			
SPONGILLA LACUSTRIS	A FRESHWATER SPONGE	G?	S1?			
STAMNODES GIBBICOSTATA	SHINY GRAY CARPET MOTH	G4	SU			
STAPHYLUS HAYHURSTII	SCALLOPED SOOTYWING	G5	S1			
STENACRON GILDERSLEEVEI		G3	S?			
STYGOBROMUS ALLEGHENIENSIS	ALLEGHENY CAVE AMPHIPOD	G4	S2S3			
STYGOBROMUS BIGGERSI	BIGGERS' CAVE AMPHIPOD	G2G4	S1			
STYGOBROMUS FRANZI	FRANZ'S CAVE AMPHIPOD	G2G3	S?			
STYGOBROMUS GRACILIPES	SHENANDOAH VALLEY CAVE AMPHIPOD	G2G4	S1			
STYGOBROMUS PIZZINII	PIZZINI'S CAVE AMPHIPOD	G2G4	S1			
STYGOBROMUS STELLMACKI	STELLMACK'S CAVE AMPHIPOD	G1G2	S1			
STYGOBROMUS TENUIS POTOMACUS	POTOMAC GROUNDWATER AMPHIPOD	G4T3T4Q	S1			
STYLURUS AMNICOLA	RIVER CLUBTAIL DRAGONFLY	G4	SX			
STYLURUS NOTATUS	MARKED CLUBTAIL	G3	SX			
STYLURUS PLAGIATUS	OBLIQUE CLUBTAIL	G5	SX			
STYLURUS SCUDDERI	ZEBRA CLUBTAIL	G4	S1			
SUTYNA PRIVATA TELTOWA		G5T4	S1			
SWAMMERDAMIA CASTANEAE	YPONOMEUTID MOTH	GHQ	SX			
SYMPETRUM COSTIFERUM	SAFFRON-BORDERED MEADOWFLY	G5	S1?			
SYNANTHEDON CASTANEAE	AMERICAN CHESTNUT CLEARWING MOTH	G3G5	SH			
TACHOPTERYX THOREYI	THOREY'S GRAYBACK DRAGONFLY	G4	S3			
THORYBES CONFUSIS	EASTERN CLOUDYWING	G4	SH			
TOLYPE NOTIALIS	TOLYPE MOTH	G?	S1			
TOXOLASMA PARVUM	LILLIPUT	G5	S1S2		PE	
TRITOGONIA VERRUCOSA	PISTOLGRIP MUSSEL	G4	S1		PE	
TRUNCILLA DONACIFORMIS	FAWNSFOOT	G5	S1		CU	
TRUNCILLA TRUNCATA	DEERTOE	G5	SX		PX	
VILLOSA FABALIS	RAYED BEAN MUSSEL	G1G2	S1S2		PE	
VILLOSA IRIS	RAINBOW MUSSEL	G5	S1		PE	

XYLOTYPE CAPAX	BROAD SALLOW MOTH	G4	S3
ZALE CUREMA	A ZALE MOTH	G3G4	S1
ZALE METATA	A ZALE MOTH	G5	S?
ZALE OBLIQUA	OBLIQUE ZALE MOTH	G5	S1
ZALE SP 1	PINE BARRENS ZALE	G3Q	S1
ZALE SQUAMULARIS		G4	S2S3
ZALE SUBMEDIANA	A ZALE MOTH	G4	S2
ZANCLOGNATHA MARTHA	PINE BARRENS ZANCLOGNATHA	G4	S1S2

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Global Rank Definitions

Global ranks (i.e. range-wide conservation status ranks) are assigned at NatureServe's Headquarters or by a designated lead office in the Heritage/Conservation Data Center Network.

Basic Global Rank Codes and Definitions

GX **Presumed Extinct** - Believed to be extinct throughout its range. Not located despite intensive searches of historic sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

GH **Possibly Extinct** - Known from only historical occurrences. Still some hope of rediscovery.

G1 **Critically Imperiled** - Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or stream miles (<10).

G2 **Imperiled** - Imperiled globally because of rarity or because of some factor (s) making it very vulnerable to extinction. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or stream miles (10 to 50).

G3 **Vulnerable** - Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

G4 **Apparently Secure** - Uncommon but not rare, and usually widespread. Possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.

G5 **Secure** - Common, typically widespread and abundant. Typically with considerably more than 100 occurrences and more than 10,000 individuals.

Variant Global Ranks

G#G# **Range Rank** - A numeric range rank (e.g., G2G3) is used to indicate uncertainty about the exact status of a taxon.

GU **Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

G? **Unranked** - Global rank not yet assessed.

HYB **Hybrid** - Element represents an interspecific hybrid.

Rank Qualifiers

? **Inexact Numeric Rank** - Denotes inexact numeric rank.

Q **Questionable Taxonomy** - Taxonomic status is questionable; numeric rank may change with taxonomy.

C **Captive or Cultivated Only** - Taxon at present is extant only in captivity or cultivation, or as a reintroduced population not yet established.

Infraspecific Taxon Ranks

T **Infraspecific Taxon** (trinomial) - The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank. Rules for assigning T ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T subrank cannot imply the subspecies or variety is more abundant than the species= basic rank (e.g.., a G1T2 subrank should not occur). A population (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an infraspecific taxon and given a T rank; in such cases a Q is used after the T rank to denote the taxon's questionable taxonomic status.

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State Rank Definitions

State Rank Codes and Definitions

SX **Extirpated** - Element is believed to be extirpated from the "state" (or province or other subnational unit).

SH **Historical** - Element occurred historically in the state (with expectation that it may be rediscovered), perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an Element would become SH without such a 20-year delay if the only known occurrences in a state were destroyed or if it had been extensively and unsuccessfully looked for. Upon verification of an extant occurrence, SH-ranked Elements would typically receive an S1 rank. The SH rank should be reserved for Elements for which some effort has been made to relocate occurrences, rather than simply ranking all Elements not known from verified extant occurrences with this rank.

S1 **Critically Imperiled** - Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically 5 or fewer

occurrences or very few remaining individuals or acres.

S2 **Imperiled** - Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state. Typically 6 to 20 occurrences or few remaining individuals or acres.

S3 **Vulnerable** - Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences.

S4 **Apparently Secure** - Uncommon but not rare, and usually widespread in the state. Usually more than 100 occurrences.

S5 **Secure** - Demonstrably widespread, abundant, and secure in the state, and essentially ineradicable under present conditions.

S? **Unranked** - State rank is not yet assessed.

SU **Unrankable** - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible, the most likely rank is assigned and a question mark added (e.g.., S2?) to express uncertainty, or a range rank (e.g.., S2S3) is used to delineate the limits (range) of uncertainty.

S#S# **Range Rank** - A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status of the Element. Ranges cannot skip more than one rank (e.g.., SU should be used rather than S1S4).

HYB **Hybrid** - Element represents an interspecific hybrid.

SE **Exotic** - An exotic established in the state; may be native in nearby regions (e.g.., house finch or catalpa in eastern U.S.).

SE# **Exotic Numeric** - An exotic established in the state that has been assigned a numeric rank to indicate its status, as with S1 through S5.

SA **Accidental** - Accidental or casual in the state (i.e., infrequent and outside usual range). Includes species (usually birds or butterflies) recorded once or only a few times. A few of these species may have bred on the one or two occasions they were recorded. Examples include European strays or western birds on the East Coast and vice-versa.

SZ **Zero Occurrences** - Not of practical conservation concern in the state because there are no definable occurrences, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long distance migrants whose occurrences during their migrations have little or no conservation value for the migrant as they are typically too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. In other words, the migrant regularly passes through the subnation, but enduring, mappable Element Occurrences cannot be defined. Typically, the SZ rank applies to a non-breeding population in the subnation -- for example, birds on migration. An SZ rank may in a few instances also apply to a breeding population, for example certain Lepidoptera which regularly die out every year with no significant

return migration. Although the SZ rank typically applies to migrants, it should not be used indiscriminately. Just because a species is on migration does not mean it receives an SZ rank. SZ only applies when the migrants occur in an irregular, transitory, and dispersed manner.

SP **Potential** - Potential that Element occurs in the state but no extant or historic occurrences reported.

SR **Reported** - Element reported in the state but without a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports.

SRF **Reported Falsely** - Element erroneously reported in the state (e.g., misidentified specimen) and the error has persisted in the literature.

SSYN **Synonym** - Element reported as occurring in the state, but state does not recognize the taxon; therefore the Element is not ranked by the state.

***** S rank has been assigned and is under review. Contact the individual state Natural Heritage program for assigned rank.

Not Provided Species is known to occur in this state. Contact the individual state Natural Heritage program for assigned rank.

Breeding Status Qualifiers

B **Breeding** - Basic rank refers to the breeding population of the Element in the state.

N **Non-breeding** - Basic rank refers to the non-breeding population of the Element in the state.

Note A breeding status subrank is only used for species that have distinct breeding and/or non-breeding populations in the state. A breeding-status SRANK can be coupled with its complementary non-breeding-status SRANK. The two are separated by a comma, with the higher-priority rank listed first in their pair (e.g.., AS2B,S3N@ or ASHN,S4S5B@).

Other Qualifiers

? **Inexact or Uncertain** - Denotes inexact or uncertain numeric rank. For SE denotes uncertainty of exotic status. (The ? qualifies the character immediately preceding it in the SRANK.)

C **Captive or Cultivated** - Element is presently extant in the state only in captivity or cultivation, or as a reintroduced population not yet established.

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Pennsylvania Status 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.

Native Plant Status Codes and Definitions

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 Legislative Authority: Title 34 Chapter 133, Game and Wildlife Code, revised Dec. 1, 1990, Pennsylvania Game Commission.

Wild Birds and Mammals Status Codes and Definitions

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".

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

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

Fish, Amphibians, Reptiles, and Aquatic Organisms Status Codes and Definitions

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.

Invertebrates Legislative Authority: No state agency has been assigned to develop regulations to protect terrestrial invertebrates although a federal status may exist for some species. Aquatic invertebrates are regulated by the Pennsylvania Fish Commission but have not been listed to date.

Invertebrates Status Codes and Definitions

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

Pennsylvania Biological Survey (PBS) Suggested Status Definitions

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Pennsylvania Biological Survey (PBS) Suggested Status Codes and Definitions

Note: the same PBS Status codes and definitions are used for all PNDI tracked species.

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".

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.

CP **Candidate Proposed** - Species comprising taxa for which the Pennsylvania Biological Survey (PBS) currently has substantial information on hand to support the biological appropriateness of proposing to list as Endangered or Threatened.

CA **Candidate at Risk** - Species that although relatively abundant now are particularly vulnerable to certain types of exploitation or environmental modification.

CR **Candidate Rare** - Species which exist only in one of a few restricted geographic areas or habitats within Pennsylvania, or they occur in low numbers over a relatively broad area of the Commonwealth.

CU **Condition Undetermined** - Species for which there is insufficient data available to provide an adequate basis for their assignment to other classes or categories.

PX **Pennsylvania Extirpated** - Species that have disappeared from Pennsylvania since 1600 but still exist elsewhere.

DL **Delisted** - Species which were once listed but are now cited for delisting.

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

Federal Status Definitions

Native Plant and Animal Species Legislative Authority: United States Endangered Species Act of 1973: Public Law 93-205. U.S. Fish and Wildlife Service.

Federal Status Codes and Definitions

LE	**Listed Endangered** - A species which is in danger of extinction throughout all or a significant portion of its range.
LT	**Listed Threatened** - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
LELT	Listed **Endangered** in part of range; listed **Threatened** in the remaining part.
PE	**Proposed Endangered** - Taxa proposed to be listed as endangered.
PT	**Proposed Threatened** - Taxa proposed to be listed as threatened.
PEPT	Proposed **Endangered** in part of range; proposed **Threatened** in the remaining part.
C	**Candidate** for listing.
E(S/A)	Treat as **Endangered** because of similarity of appearance.
T(S/A)	Treat as **Threatened** because of similarity of appearance.
XE	Essential **Experimental** population.
XN	Nonessential **Experimental** population.
"xy" (mixed status)	Status varies for different populations or parts of range.
"x" NL	Status varies for different populations or parts of range with at least one part not listed.