ENVIRONMENTAL ASSESSMENT

Reducing Pigeon, European Starling, Common Grackle, Brown-headed Cowbird and House Sparrow Damage through an Integrated Wildlife Damage Management Program in Pennsylvania

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

September 2003

TABLE OF CONTENTS

Acronyms

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION
1.1 AUTHORITY AND COMPLIANCE
    1.1.1 Wildlife Services Legislative Authority
    1.1.2 Pennsylvania Department of Agriculture (PDA)
    1.1.3 Pennsylvania Department of Agriculture (PGC)
    1.1.4 U.S. Fish and Wildlife Service (USFWS)
    1.1.5 Compliance with Federal and State Statutes
1.2 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS
    1.2.1 ADC Programmatic Environmental Impact Statement
1.3 NEED FOR ACTION
    1.3.1 Need for Bird Damage Management to Protect Human Health and Safety
    1.3.2 Need for Bird Damage Management at Airports
    1.3.3 Need for Bird Damage Management at Cattle Feeding and Dairy Cattle Facilities
    1.3.4 Need for Bird Damage Management Related to Agricultural Crops
    1.3.5 Need for Bird Damage Management to Protect Property
1.4 SCOPE AND PURPOSE OF THIS EA
1.5 WS RECORD KEEPING REGARDING REQUESTS FOR BIRD DAMAGE MANAGEMENT ASSISTANCE
1.6 PROPOSED ACTION
1.7 DECISION TO BE MADE
1.8 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS
    1.8.1 Actions Analyzed
    1.8.2 American Indian Lands and Tribes
    1.8.3 Period for which this EA is Valid
    1.8.4 Site Specificity
    1.8.5 Summary of Public Involvement
1.9 PREVIEW OF THE REMAINDER OF THIS EA

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.0 INTRODUCTION
2.1 AFFECTED ENVIRONMENT
2.2 ISSUES ANALYZED IN DETAIL IN CHAPTER 4
    2.2.1 Effects on Target Bird Species
    2.2.2 Effects on Other Wildlife Species, including T&E Species
    2.2.3 Effects on Public Health and Safety
    2.2.4 Impacts to Stakeholders, including Aesthetics
    2.2.5 Humaneness and Animal Welfare Concerns of Methods Used

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE
2.3.1 No Wildlife Damage Management at Taxpayer Expense; Wildlife Damage Management should be Fee Based
2.3.2 Bird Damage should be Managed by Private Nuisance Wildlife Control Agents
2.3.3 Appropriateness of Preparing an EA (Instead of an EIS) for Such a Large Area

CHAPTER 3: ALTERNATIVES

3.0 INTRODUCTION
3.1 DESCRIPTION OF THE ALTERNATIVES
3.1.1 Alternative 1: Technical Assistance Only
3.1.2 Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)
3.1.3 Alternative 3: Non-lethal Bird Damage Management Only by WS
3.1.4 Alternative 4: No Federal WS Bird Damage Management
3.2 BDM STRATEGIES AND METHODOLOGIES AVAILABLE TO WS IN PENNSYLVANIA
3.2.1 Integrated Wildlife Damage Management (IWDM)
3.2.2 The IWDM Strategies Employed by WS
3.2.3 WS Decision Making
3.2.4 Bird Damage Management Methods Available for Use
3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE
3.3.1 Lethal Bird Damage Management Only by WS
3.3.2 Compensation for Bird Damage Losses
3.3.3 Use of Bird-proof Feeders in Lieu of Lethal Control at Dairies and Cattle Feeding Facilities
3.4 MITIGATION AND STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT TECHNIQUES
3.4.1 Mitigation in Standard Operating Procedures (SOPs)
3.4.2 Additional Mitigation Specific to the Issues

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION
4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL
4.1.1 Effects on Target Bird Species Populations
4.1.2 Effects on Other Wildlife Species, including T&E Species
4.1.3 Effects on Human Health and Safety
4.1.4 Impacts to Stakeholders, including Aesthetics
4.1.5 Humaneness and Animal Welfare Concerns of Methods Used
4.2 CUMULATIVE IMPACTS

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

5.1 LIST OF PREPARERS
5.2 LIST OF PERSONS CONSULTED

LISTING OF TABLES AND FIGURES

Table 1. Diseases transmissible to humans and livestock that are associated with feral domestic pigeons, European starlings, and English sparrows. Information from Weber (1979).

Table 2. Diseases of livestock that have been linked to feral domestic pigeons, European starlings, and/or English sparrows. Information from Weber (1979).

Table 3. Number of incidents for direct control and technical assistance for Pennsylvania Wildlife Services by year.

Table 4. Number of pigeons, starlings, grackles, cowbirds, and sparrows lethally removed by USDA APHIS Wildlife Services in Pennsylvania during Federal Fiscal Years 2001 and 2002.

Table 5. Summary of Potential Impacts

Figure 3-1. WS Decision Model

APPENDICES

Appendix A: Literature Cited
Appendix B: BDM Methods Available for Use or Recommendation by the Pennsylvania Wildlife Services Program
Appendix C: Federally and State Listed Threatened and Endangered Species in Pennsylvania

ACRONYMS

ADC	Animal Damage Control
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
BDM	Bird Damage Management
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FY	Fiscal Year
PDA	Pennsylvania Department of Agriculture
DCNR	Department of Conservation of Natural Resources
IWDM	Integrated Wildlife Damage Management
MBTA	Migratory Bird Treaty Act
MIS	Management Information System
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
SOP	Standard Operating Procedure
T&E	Threatened and Endangered
TGE	Transmissible Gastroenteritis
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
WS	Wildlife Services

NOTE: On August 1, 1997, the Animal Damage Control program was officially renamed to Wildlife Services. The terms Animal Damage Control, ADC, Wildlife Services, and WS are used synonymously throughout this Environmental Assessment.

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION

Across the United States, wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with wildlife which increases the potential for conflicting human/wildlife interactions. In addition, segments of the public desire protection for all wildlife; this protection can create localized conflicts between human and wildlife activities. The *Animal Damage Control Programmatic Final Environmental Impact Statement* (EIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way {United States Department of Agriculture (USDA) 1997}:

> "*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 value is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well*."

Wildlife damage management is the science of reducing damage or other problems caused by wildlife and is recognized as an integral part of wildlife management (The Wildlife Society 1990). The USDA, Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) program (formerly known as Animal Damage Control) uses an Integrated Wildlife Damage Management (IWDM) approach, known as Integrated Pest Management (WS Directive 2.105[1]), in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1:1-7 of USDA (1997). These methods may include alteration of cultural practices and habitat and behavioral modification to prevent or reduce damage. The reduction of wildlife damage may also require that local populations be reduced through lethal means.

This environmental assessment (EA) documents the analysis of the potential environmental effects of proposed rock dove (pigeon) (*Columbia livia*), European starling (*Sturnus vulgaris*), brown-headed cowbird (*Molothrus ater*), common grackle(*Quiscalus quiscula*), and house sparrow (*Passer domesticus)* bird damage management (BDM) program. This analysis relies mainly on existing data contained in published documents (Appendix A), including the *Animal Damage Control Program Final Environmental Impact Statement* (USDA 1997). The final environmental impact statement (USDA 1997) may be obtained by contacting the USDA, APHIS, WS Operational Support Staff at 4700 River Road, Unit 87, Riverdale, MD 20737-1234.

---

[1] WS Policy Manual - Provides guidance for WS personnel to conduct wildlife damage management activities through Program Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Appendix.

WS is a federal agency authorized to protect American resources from damage associated with wildlife (Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1486; 7 U.S.C. 426-426c) and the Rural Development, Agriculture, 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). To fulfill this Congressional direction, WS activities are conducted to prevent or reduce wildlife damage caused to agricultural, industrial and natural resources; property; livestock; and threats to public health and safety on private and public lands in cooperation with federal, state and local agencies, private organizations, and individuals. Therefore, wildlife damage management is not based on punishing offending animals but as one means of reducing damage and is used as part of the WS Decision Model (Slate et al. 1992). The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated. The need for action is derived from the specific threats to resources or the public.

Normally, according to the APHIS procedures implementing the National Environmental Policy Act (NEPA), individual wildlife damage management actions could be categorically excluded {7 CFR 372.5(c), 60 Fed. Reg. 6,000 -6,003, (1995)}. WS has decided in this case to prepare this EA to facilitate planning, interagency coordination, and the streamlining of program management, and to clearly communicate with the public the analysis of individual and cumulative impacts. In addition, this EA has been prepared to evaluate and determine if there are any potentially significant or cumulative impacts from the proposed and planned damage management program. All wildlife damage management that would take place in Pennsylvania would be undertaken according to relevant laws, regulations, policies, orders and procedures, including the Endangered Species Act (ESA). Notice of the availability of this document will be published in newspapers, consistent with the agency's NEPA procedures.

WS is a cooperatively funded, service-oriented program that receives requests for assistance from private and public entities, including other governmental agencies. Before any wildlife damage management is conducted, Cooperative Agreements, Agreements for Control or other comparable documents are in place. As requested, WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently according to applicable federal, state and local laws and Memorandums of Understanding (MOUs) between WS and other agencies. WS' mission, developed through its strategic planning process, is

> 1) *"to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and*
>
> *2) to safeguard public health and safety."*

WS' Policy Manual reflects this mission and provides guidance for engaging in wildlife damage management through:

- Training of wildlife damage management professionals;
- Development and improvement of strategies to reduce losses and threats to humans from wildlife;

- Collection, evaluation, and dissemination of management information;
- Informing and educating the public on how to reduce wildlife damage;
- Providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1989)

1.1 AUTHORITY AND COMPLIANCE

1.1.1 Wildlife Services Legislative Authority

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 Animal Damage Control Act of March 2, 1931, as amended (46 Stat. 1486; 7 U.S.C. 426-426c) and the Rural Development, Agriculture, 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), 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 its 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 directive and 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 urban rodent 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 mammals and birds 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.*"

1.1.2 Pennsylvania Department of Agriculture (PDA)

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 the Commonwealth of 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.

1.1.3 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."

1.1.4 U.S. Fish and Wildlife Service (USFWS)
The USFWS is responsible for managing and regulating take of bird species that are listed as migratory under the Migratory Bird Treaty Act (MBTA) and those that are listed as threatened or endangered under the ESA.

The USFWS authority for action is based on the MBTA 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.

1.1.5 Compliance with Federal and State Statutes
Several federal laws, state laws, and state regulations regulate WS wildlife damage management. WS complies with these laws and regulations, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act: Environmental documents pursuant to NEPA must be completed before operational activities consistent with the NEPA decision can be implemented. This EA meets the NEPA requirement for the proposed action in Pennsylvania. When WS direct management 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. WS also coordinates specific projects and programs with other agencies. The purpose of these contacts is to coordinate any wildlife damage management that may affect resources managed by these agencies or affect other areas of mutual concern.

Endangered Species Act: It is federal policy, under the ESA, that all federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the Act (Sec. 2(c)). WS conducts Section 7 consultations with the United States Fish and Wildlife Service (USFWS) to use the expertise of the USFWS to ensure that "any action authorized, funded or carried out by such an agency... is not likely to jeopardize the continued existence of any endangered or threatened species . . . each agency shall use the best scientific and commercial data available" (Sec. 7(a)(2)). WS obtained a Biological Opinion (B.O.) from the U.S. Fish and Wildlife Service describing potential effects on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F).

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-711; 40 Stat. 755), as Amended: The MBTA provides the USFWS regulatory authority to protect families of birds that contain species which migrate outside the United States. The law prohibits any "*take*" of these species by any entities, except as permitted by the USFWS; therefore, the USFWS issues permits to requesters for reducing bird damage. European starlings, rock doves, and house sparrows are not federally protected species; brown-headed cowbirds and common grackles are classified as protected migratory birds. Depredation order (50 CFR 21, section 21.43) for blackbirds, cowbirds, grackles, crows, and magpies reads as follows:

> "*A Federal permit shall not be required to control yellow-headed, red-winged, rusty, and Brewer's blackbirds, cowbirds, all grackles, crows, and magpies, when found committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance…"*

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

Investigational New Animal Drug (INAD): The drug alpha-chloralose (AC) has been used as a sedative for animals and is registered with the Food and Drug Administration (FDA) to capture

waterfowl, coots, and pigeons. FDA approval for use under INAD (21 CFR, Part 511) authorized WS to use the drug as a non-lethal form of capture.

Executive Order 13112 of February 3, 1999: This Order prevents the introduction of invasive species and provides for their control to minimize the economic, ecological, and human health impacts that invasive species cause. Pigeons, starlings, and house sparrows are recognized as invasive species that have adverse economic, ecological, and human health impacts.

Executive Order 13186 of January 10, 2001 "Responsibilities of Federal Agencies to Protect Migratory Birds." This Order states that each federal agency, taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations, is directed to develop and implement, a MOU with the USFWS that shall promote the conservation of migratory bird populations. WS has developed a draft MOU with the USFWS as required by this Order and is currently waiting for USFWS approval. WS will abide by the MOU once it is finalized and signed by both parties.

Occupational Safety and Health Act of 1970: The Occupational Safety and Health Act of 1970 and its implementing regulations (29CFR1910) on sanitation standards states that, "Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected." This standard includes birds that may cause safety and health concerns at workplaces.

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

National Historic Preservation Act (NHPA) of 1966 as amended: The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that can result in changes in the character or use of historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian Tribes to determine whether they have concerns for traditional cultural properties in areas of these federal undertakings. WS actions on tribal lands are only conducted at the tribes request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties. WS activities as described under the proposed action do not cause ground disturbances nor do they otherwise have the potential to significantly affect visual, audible, or atmospheric elements of historic properties and are thus not undertakings as defined by the NHPA. Bird damage management could benefit historic properties if such properties were being damaged by starling, pigeons, grackles, cowbirds, or sparrows. In those cases, the officials responsible for management of such properties would make the request and would select the methods to be used in their bird damage management program. Harassment techniques that involve noise making could conceivably disturb users of

historic properties if they were used at or in close proximity to such properties; however, it would be an exceedingly rare event for noise producing devices to be used in closeproximity to such a property unless the resource being protected from bird damage was the property itself, in which case the primary effect would be beneficial. Also, the use of such devices is generally short term and could be discontinued if any conflicts with historic properties arose. WS has determined BDM actions are not undertakings as defined by the NHPA because such actions do not have the potential to result in changes in the character or use of historic properties.

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

WS personnel use only legal, effective, and environmentally safe wildlife damage management methods, tools, and approaches. All chemicals used by WS are regulated by the EPA through FIFRA, the Pennsylvania Department of Agriculture, by MOUs with land managing agencies, and by WS Directives. Based on a thorough Risk Assessment, APHIS concluded that when WS program chemicals are used according to label directions, they are selective to target individuals or populations, and such use has negligible impacts on the environment (USDA 1997, Appendix P). The WS operational program properly disposes of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations. In contrast, the proposed action may benefit minority or low-income populations by reducing bird damage such as threats to public health and safety.

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

1.2 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS

1.2.1 ADC Programmatic Environmental Impact Statement.

WS, previously called Animal Damage Control (ADC), has issued a Final EIS on the national APHIS/WS program (USDA 1997). Pertinent and current information available in the EIS has been incorporated by reference into this EA.

1.3 NEED FOR ACTION

Conflicts between humans and wildlife are common in Pennsylvania. The need for action in Pennsylvania is based on the necessity for a program to protect agricultural resources, property, livestock, and human health and safety from pigeon, starling, grackle, cowbird, and sparrow damage. Pigeon, starling, grackle, cowbird, and sparrow populations can have a negative economic impact in Pennsylvania. Comprehensive surveys of pigeon, starling, grackle, cowbird, and sparrow damage in Pennsylvania have not been conducted. Requests for WS assistance for FY 2000 through FY 2002 are summarized (Table 3). These data represent only a portion of the total damage caused by pigeons, starlings, grackles, cowbirds, and sparrows, because not all people who experience damage request assistance from WS.

1.3.1 Need for Bird Damage Management to Protect Human Health and Safety

Pigeons, house sparrows, and European starlings have been suspected in the transmission of 29 different diseases to humans (Davis et al. 1971, Stickley and Weeks 1985, and Weber 1979). These include viral diseases such as meningitis and seven different forms of encephalitis; bacterial diseases such as erysipeloid, salmonellosis, paratyphoid, Pasteurellosis, and Listeriosis; mycotic (fungal) diseases such as aspergillosis, blastomycosis, candidiasis, cryptococcosis, histoplasmosis, and sarcosporidiosis; protozoal diseases such as American trypansomiasis and toxoplasmosis; and rickettsial/chlamydial diseases such as chlamydiosis and Q fever. As many as 65 different diseases transmittable to humans or domestic animals have been associated with pigeons, European starlings, and house sparrows (Weber 1979). Table 1 shows the more typical diseases affecting humans that can be transmitted by pigeons, house sparrows, and European starlings. In most cases, in which human health concerns are a major reason for requesting BDM, no actual cases of bird transmission of disease to humans have been proven to occur. Thus, it is the risk of disease transmission that is the primary reason for requesting and conducting BDM. Situations in Pennsylvania where the threat of disease associated with European starling, pigeon, common grackle, brown-headed cowbird, or house sparrow populations might occur could be:

- exposure by residents to a roost which has been in a residential area for more than three years;
- disturbance of a large deposit of droppings in an attic where a flock of birds routinely roosts or nests;
- accumulated droppings from roosting birds on structures at an industrial site where employees must work in areas of accumulation
- Birds nesting or loafing around a food court area of a recreational facility or other site where humans eat in close proximity to concentrated numbers of these birds.

Individuals or property owners, requesting assistance with pigeon, house sparrow, common grackle, brown-headed cowbirds, or European starling roost problems, are often concerned about potential disease risks, but may be unaware of the types of diseases that can be associated with these birds. In most such situations, BDM is requested because the mess associated with droppings left by concentrations of birds is aesthetically displeasing and can result in continual clean-up costs. Under the proposed action, WS could agree to assist in resolving these types of problems.

Table 1. Diseases transmissible to humans and livestock that are associated wit pigeons, European starlings, brown-headed cowbirds, and house sparrows. Information from Weber (1979).

Disease	Human Symptoms	Potential for Human Fatality	Effects on Domestic Animals
Bacterial:			
Erysipeloid	skin eruption with pain, itching; headaches, chills, joint pain, prostration, fever, vomiting	sometimes - particularly to young children, old or infirm people	serious hazard for the swine industry
Salmonellosis	gastroenteritis, septicaemia, persistent infection	possible, especially in individuals weakened by other disease or old age	causes abortions in mature cattle, possible mortality in calves, decrease in milk production in dairy cattle
Pasteurellosis	respiratory infection, nasal discharge, conjunctivitis, bronchitis, pneumonia, appendicitis, urinary bladder inflammation, abscessed wound infections	rarely	may fatally affect chickens, turkeys and other fowl
Listeriosis	conjunctivitis, skin infections, meningitis in newborns, abortions, premature delivery, stillbirth	sometimes - particularly with newborns	In cattle, sheep, and goats, difficulty swallowing, nasal discharge,

			paralysis of throat and facial muscles
Viral:			
Meningitis	inflammation of membranes covering the brain , dizziness, and nervous movements	possible — can also result as a secondary infection with listeriosis, salmonellosis, cryptococcosis	causes middle ear infection in swine, dogs, and cats
Encephalitis (7 forms)	headache, fever, stiff neck, vomiting, nausea, drowsiness, disorientation	mortality rate for eastern equine encephalomyelitis may be around 60%	may cause mental retardation, convulsions and paralysis
Mycotic (fungal):			
Aspergillosis	affects lungs and broken skin, toxins poison blood, nerves, and body cells	not usually	causes abortions in cattle
Blastomycosis	weight loss, fever, cough, bloody sputum and chest pains.	rarely	affects horses, dogs and cats
Candidiasis	infection of skin, fingernails, mouth, respiratory system, intestines, and urogenital tract	rarely	causes mastitis, diarrhea, vaginal discharge and aborted fetuses in cattle
Cryptococcosis	lung infection, cough, chest pain, weight loss, fever or dizziness, also causes meningitis	possible especially with meningitis	chronic mastitis in cattle, decreased milk flow and appetite loss
Histoplasmosis	pulmonary or respiratory disease. May affect vision	possible, especially in infants and young children or if disease disseminates to the blood and bone marrow	actively grows and multiplies in soil and remains active long after birds have departed
Protozoal:			
American Trypanosomiasis	infection of mucous membranes of eyes or nose, swelling	possible death in 2-4 weeks	caused by the conenose bug found on pigeons
Toxoplasmosis	inflammation of the retina, headaches,	possible	may cause abortion or still

	fever, drowsiness, pneumonia, strabismus, blindness, hydrocephalus, epilepsy, and deafness		birth in humans, mental retardation
Rickettsial /Chlamydial:			
Chlamydiosis	pneumonia, flu-like respiratory infection, high fever, chills, loss of appetite, cough, severe headaches, generalized aches and pains, vomiting, diarrhea, hepatitis, insomnia, restlessness, low pulse rate	occasionally, restricted to old, weak or those with concurrent diseases	in cattle, may result in abortion, arthritis, conjunctivitis, and enteritis
Q Fever	sudden pneumonitis, chills, fever, weakness, severe sweating, chest pain, severe headaches and sore eyes	possible	may cause abortions in sheep and goats

1.3.2 Need for Bird Damage Management at Airports

The risk that birds pose to aircraft is well documented with the worst case reported in Boston in 1960 when 62 people were killed in the crash of an airliner which collided with a flock of European starlings (Terres 1980). Other examples of bird/aircraft strikes are as follows:

- In 1999, when a Boeing 757 struck a flock of European starlings at the Cincinnati / Northern Kentucky International Airport and was forced to abort the flight (NTSB 1999). Damages were assessed at more than $500,000 by airport officials (D.T. Little, WS Pers. Comm. 1999).

- In 1990, a Bae-3200 ingested doves in both engines during takeoff from Michigan Regional Airport in Indiana. The engines were destroyed, and the repair cost was about $1 million (GAO 2001).

- In 1997, a McDonnell Douglas 80 struck over 400 blackbirds just after takeoff from Dallas-Fort Worth Airport. Nearly every part of the plane was hit. The pilot declared an emergency and returned to land. The number 1 engine had to be replaced, and damage to the plane was substantial. The cost of repairs was about $219,000 (GAO 2001).

Flocks of birds may intersect aircraft flight lines upon entering or exiting a roost at or near airports and present a safety threat to aviation. Starlings are a particularly dangerous bird to aircraft operations because of their high body density and tendency to travel in large flocks of hundreds to thousands of birds (Seamans et al. 1995). Generally, bird collisions occur when aircraft are near the ground. From 1990-1999, approximately 55% of reported bird strikes occurred when the aircraft was at an altitude of 100 feet above ground level or less. Additionally, 78% occurred under 900 feet above ground level and about 87% occurred under 2,000 feet above ground level (Cleary et al. 2000). From 1990-1999, birds were involved in more than 97% of the reported wildlife strikes to civil aircraft in the USA (Cleary et al. 2000). From 1990-2001, reported losses from bird strikes totaled 193,624 hours of aircraft down time and $125.5 million in monetary losses (Cleary et al. 2000).

According to the Federal Aviation Administration's National Wildlife Strike Database, of the bird species identified in wildlife strikes, rock doves, starlings, sparrows, cowbirds, and grackles accounted for 4%, 5%, 7%, <1%, <1% of the strikes, respectively (Cleary et al. 2000). During a 2-year period (1990-2001), aircraft strikes involving rock doves, starlings, sparrows, cowbirds, and grackles caused an estimated $4million in monetary losses (Cleary et al. 2000). From 1990-2001, a total of 39,177 bird strikes were reported to the FAA in the United States with 1,611 of these strikes occurring in Pennsylvania. This number is likely to be much greater since an estimated 80% of civil bird strikes go unreported (Cleary et al. 2000).

WS receives requests for assistance regarding bird damage management at airports in Pennsylvania. These requests are considered serious because of the potential for loss of human life and because damage to aircraft can be extremely expensive. With the implementation of an Integrated BDM program in Pennsylvania, WS could provide direct management and technical assistance at the request of any aviation facility in the Commonwealth.

1.3.3 Need for Bird Damage Management at Cattle Feeding and Dairy Cattle Facilities

European starlings, house sparrows, brown-headed cowbirds, pigeons, and, to a lesser extent, common grackles often cause damage at cattle feeding facilities and dairies by congregating in large numbers to feed on the grain component of cattle feed. Such feeding strategies present disease threats to livestock at such sites. The birds also cause damage by defecating on fences, shade canopies, and other structures, which can accelerate corrosion of metal components and which generally is considered an unsightly nuisance and potential health hazard for the feedlot/dairy operators and their personnel.

<u>Scope of Livestock Feed Losses</u>: The problem of starling damage to livestock feed has been documented in France and Great Britain (Feare 1984), and in the United States (Besser et al. 1968). The concentration of larger numbers of cattle eating huge quantities of feed in confined pens results in a tremendous attraction to European starlings, house sparrows, cowbirds and pigeons. Diet rations for cattle contain all of the nutrients and fiber that cattle need, and are so

thoroughly mixed that cattle are unable to select any single component over others. The basic constituent of most rations is silage and the high energy portion is usually provided as barley, which may be incorporated as whole grain or crushed or ground cereal. While cattle cannot select individual ingredients from that ration, birds can and do select the barley, thereby altering the energetic value of the complete diet. The removal of this high energy fraction by birds, is believed to reduce milk yields, weight gains, and is economically critical (Feare 1984). Glahn and Otis (1986) reported that starling damage was also associated with proximity to roosts, snow, and freezing temperatures and the number of livestock on feed.

The economic significance of feed losses to European starlings has been demonstrated by Besser et al. (1968) who concluded that the value of losses in feedlots near Denver, Colorado was $84 per 1,000 birds in 1967. Forbes (1995) reported European starlings consume up to 50% of their body weight in feed each day. Glahn and Otis (1981) reported losses of 4.8 kg of pelletized feed consumed per 1,000 bird minutes. Glahn (1983) reported that 25.8% of farms in Tennessee experienced starling depredation problems of which 6.3% experienced considerable economic loss. Williams (1983) estimated seasonal feed losses to five species of blackbirds (primarily brown-headed cowbirds) at one feedlot in south Texas at nearly 140 tons valued at $18,000.

Scope of Livestock Health Problems: A number of diseases that affect livestock have been associated with pigeons, European starlings, and house sparrows (Weber 1979). Transmission of diseases such as Transmissible Gastroenteritis Virus (TGE), Tuberculosis (TB), and Coccidiosis to livestock has been linked to migratory flocks of European starlings. Estimates of the dollar value of this type of damage are not available. A consulting veterinarian for a large cattle feeding facility in Texas indicated problems associated with coccidiosis declined following reduction of starling numbers using the facility (R. Smith, WS, Canyon District, TX, Pers. Comm.).

Table 2. Diseases of livestock that have been linked to pigeons, European starlings, and/or house sparrows. Information from Weber (1979).

Disease	Livestock affected	Symptoms	Comments
Bacterial:			
Erysipeloid	cattle, swine, horses, sheep, goats, chickens, turkeys, ducks	Pigs - arthritis, skin lesions, necrosis, septicemia Sheep - lameness	serious hazard for the swine industry, rejection of swine meat at slaughter due to speticemia, also affects dogs
Salmonellosis	all domestic animals	abortions in mature cattle, mortality in calves, decrease in milk production in dairy cattle Colitis in pigs,	over 1700 serotypes

Pasteurellosis	cattle, swine, horses, rabbits, chickens, turkeys	Chickens and turkeys die suddenly without illness pneumonia, bovine mastitis, abortions in swine, septicemia, abscesses	also affects cats and dogs
Avian Tuberculosis	chickens, turkeys, swine, cattle, horses, sheep	Emaciation, decrease in egg production, and death in poultry. Mastitis in cattle	also affects dogs and cats
Streptococcosis	cattle, swine, sheep, horses, chickens, turkeys, geese, ducks, rabbits	Emaciation and death in poultry. Mastitis in cattle, abscesses and inflamation of the heart , and death in swine	feral pigeons are susceptible and aid in transmission
Yersinosis	cattle, sheep, goats, horses, turkeys, chickens, ducks	abortion in sheep and cattle	also affects dogs and cats
Vibriosis	cattle and sheep	In cattle, often a cause of infertility or early embryonic death. In sheep, the only known cause of infectious abortion in late pregnancy	of great economic importance
Listeriosis	Chickens, ducks, geese, cattle, horses, swine, sheep, goats	In cattle, sheep, and goats, difficulty swallowing, nasal discharge, paralysis of throat and facial muscles	also affects cats and dogs
Viral:			
Meningitis	cattle, sheep, swine, poultry	inflamation of the brain, newborn calves unable to suckle	associated with listeriosis, salmonellosis, cryptococcosis

Encephalitis (7 forms)	horses, turkeys, ducks	drowsiness, inflamation of the brain	mosquitoes serve as vectors
Mycotic (fungal):			
Aspergillosis	cattle, chickens, turkeys, and ducks	abortions in cattle	common in turkey poults
Blastomycosis	weight loss, fever, cough, bloody sputum and chest pains.	Rarely	affects horses, dogs and cats
Candidiasis	cattle, swine, sheep, horses, chickens, turkeys	In cattle, mastitis, diarrhea, vaginal discharge, and aborted fetuses	causes unsatisfactory growth in chickens
Cryptococcosis	cattle, swine, horses	chronic mastitis in cattle, decreased milk flow and appetite loss	also affects dogs and cats
Histoplasmosis	horses cattle and swine	(in dogs) chronic cough, loss of appetite, weakness, depression, diarrhea, extreme weight loss	also affects dogs; actively grows and multiplies in soil and remains active long after birds have departed
Coccidiosis	poultry, cattle, and sheep	bloody diarrhea in chickens, dehydration, retardation of growth	almost always present in English sparrows; also found in pigeons and European starlings
Protozoal:			
American Trypanosomiasis	infection of mucous membranes of eyes or nose, swelling	possible death in 2-4 weeks	caused by the conenose bug found on pigeons
Toxoplasmosis	cattle, swine, horses, sheep, chickens, turkeys	In cattle, muscular tremors, coughing, sneezing, nasal discharge, frothing at the mouth,	also affects dogs and cats

		prostration and abortion	
Rickettsial/ Chlamydial:			
Chlamydiosis	cattle, horses, swine, sheep, goats, chickens, turkeys, ducks, geese	In cattle, abortion, arthritis, conjunctivitis, enteritis	also affects dogs and cats and many wild birds and mammals
Q Fever	affects cattle, sheep, goats, and poultry	may cause abortions in sheep and goats	can be transmitted by infected ticks

1.3.4 Need for Bird Damage Management at Staging-Areas

Flocking bird species, such as starlings, grackles and cowbirds, often congregate in large numbers prior to entering feeding or night roosting sites. This type of behavior is often referred to as "staging." The goal of staging-area baiting is to locate or create staging areas which will attract large numbers of blackbirds (starlings, grackles, cowbirds) from flightlines onto bait sites and to maintain bird use of the bait sites for as long as possible. By reducing numbers of blackbirds in flightlines, often times by using DRC-1339, it is possible to disperse roosting birds and to lessen crop damage by blackbirds in areas surrounding associated roosts (USDA 1997). Staging areas are also dispersed through the use of nonlethal harassment techniques to reduce the number of birds night roosting in undesirable locations (Booth 1994).

Natural staging areas are by far the best sites for baiting and dispersal. Natural staging areas, when they exist, are usually located within 2-3 miles of roost sites but can be farther away. Some roosts have no associated natural staging areas. Other roosts have staging areas that are inaccessible and cannot be baited or dispersed. Staging areas can sometimes be artificially created using techniques designed to attract birds from flightlines onto bait sites (USDA 1997).

1.3.5 Need for Bird Damage Management Related to Agricultural Crops

Common grackles will feed on mature field corn in the dent stage, removing entire kernels from the cob. Also, grackles will pull up sprouting corn (Dolbeer 1994). Sparrows consume grains in fields and in storage facilities. Sparrows damage crops by pecking seeds, seedlings, buds, flowers, vegetables, and maturing fruits (Fitzwater 1994). Several studies have shown that European starlings can pose a great economic threat to agricultural producers (Besser et. al. 1968, Dolbeer et al. 1978, and Feare 1984). Bird damage to crops has occasionally been identified as a problem in Pennsylvania.

1.3.6 Need for Bird Damage Management to Protect Property

Birds frequently damage structures on private property, or public facilities, with fecal contamination. Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Corrosion damage to metal structures and painted finishes, including those on automobiles, can occur because of uric acid from bird droppings. Electrical utility companies frequently have problems with birds causing power outages by shorting out transformers and substations. Pigeon droppings deface and accelerate the deterioration of buildings and increase the cost of maintenance. Large amounts of droppings may kill vegetation

and produce an objectionable odor. Pigeon manure deposited on park benches, statues, cars, and unwary pedestrians is aesthetically displeasing (Williams 1994).

Pigeons, starlings, cowbirds, grackles, and sparrows cause economic damage to aircraft in hangars. Accumulation of fecal droppings on planes, helicopters, maintenance equipment, and hangar floors results in unscheduled maintenance to clean planes and buildings to protect painted surfaces from acidic fecal droppings and maintain a sanitary work environment. Furthermore, birds may build nests in engines of idle aircraft which may cause engine damage or cause a fire.

1.4 SCOPE AND PURPOSE OF THIS EA

The scope and purpose of this EA is to address and evaluate the potential impact to the human environment from the implementation of a WS BDM program to protect agricultural resources, property, livestock, and public health and safety in Pennsylvania. Damage problems can occur throughout the Commonwealth, resulting in requests for WS assistance. Under the Proposed Action, BDM could be conducted on private, federal, state, tribal, county, and municipal lands in Pennsylvania upon request.

1.5 WS RECORD KEEPING REGARDING REQUESTS FOR BIRD DAMAGE MANAGEMENT ASSISTANCE

WS maintains a Management Information System (MIS) database to document assistance that the agency provides in addressing wildlife damage conflicts. 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 exists.

The database includes, but not limited to, the following information: species of wildlife involved, the number of individuals involved in a damage situation; tools and methods used or recommended to alleviate the conflict; and the resource that is in need of protection. Table 3 provides a summary of Technical Assistance projects completed by the Pennsylvania WS program for Fiscal Year 2000-2002. A description of the WS Direct Control and Technical Assistance programs are described in Chapter 3 of this EA.

Table 3*. Number of incidents for technical assistance for Pennsylvania Wildlife Services by year.

Fiscal Year	Species	Agriculture	Property	Health & Safety	Total
2000	Pigeon	0	0	0	0
	Starling	2	2	0	4
	Sparrow	0	0	1	1
	Grackle	0	0	0	0
	Cowbird	0	0	0	0
2001	Pigeon	0	0	0	0
	Starling	6	2	2	10

	Sparrow	0	0	0	0
	Grackle	0	0	0	0
	Cowbird	0	0	0	0
2002	Pigeon	0	2	0	2
	Starling	25	77	1	102
	Sparrow	0	1	0	1
	Grackle	1	0	0	1
	Cowbird	0	0	0	0
Total		34	84	4	121

*data presented in this table were taken from PA WS Annual Program Reports and represent the number of technical assistance projects conducted by the PA WS program and do not include data from operational projects conducted during the time period covered

1.6 PROPOSED ACTION

Wildlife Services proposes to continue the current bird damage management program that responds to pigeon, European starling, common grackle, brown-headed cowbird, and house sparrow damage requests in the Commonwealth of Pennsylvania. An IWDM approach would be implemented to reduce damage activities to property, agricultural resources, livestock, and public health and safety. Damage management would be conducted on public and private property in Pennsylvania when the resource owner (property owner) or manager requests assistance. 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 could provide technical assistance and direct operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion, habitat modification or harassment would be recommended and utilized to reduce damage. In other situations, birds would be removed as humanely as possible using: shooting, trapping, and registered pesticides. 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.

1.7 DECISION TO BE MADE

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

- Should WS implement an integrated bird damage management strategy, including technical assistance and direct control, to meet the need for starling, cowbird, grackle, sparrow and pigeon damage management in Pennsylvania?

- Should WS attempt to implement one of the alternatives to an integrated bird damage management strategy as described in the EA?

- Would the proposed action have significant impacts on the quality of the human environment, requiring preparation of an EIS?

1.8 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT ANALYSIS

1.8.1 Actions Analyzed

This EA evaluates bird damage management by WS to protect: 1) property, 2) agricultural resources, 3) livestock and dairies, and 4) public health and safety in Pennsylvania. Protection of other resources or other program activities would be addressed in other NEPA analysis, as appropriate.

1.8.2 American Indian Lands and Tribes

Currently, Pennsylvania WS does not have any MOUs with any American Indian tribes. If WS enters into an agreement with a tribe for BDM, this EA would be reviewed and supplemented, if appropriate, to insure compliance with NEPA. MOUs, agreements and NEPA documentation would be prepared as appropriate before conducting BDM on tribal lands.

1.8.3 Period for which this EA is Valid

This EA would remain valid until the WS program in Pennsylvania and other appropriate agencies determine that new needs for action, changed conditions or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document would be supplemented pursuant to NEPA. Review of the EA will be conducted each year to ensure that the EA is sufficient.

1.8.4 Site Specificity

This EA analyzes the potential impacts of BDM and addresses activities on all public and private lands in Pennsylvania under MOUs, Cooperative Agreements, and in cooperation with the appropriate public land management agencies. It also addresses the impacts of BDM in 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 BDM efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program.

Planning for the management of bird 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 bird 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 bird 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 Pennsylvania. In this way, APHIS-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.

1.8.5 Summary of Public Involvement

Issues related to the proposed action were initially developed by WS. Issues were defined and preliminary alternatives were identified. 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 newspapers 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.

1.9 PREVIEW OF THE REMAINDER OF THIS EA

The remainder of this EA is composed of four (4) chapters and three (3) appendices. Chapter 2 discusses and analyzes the issues and affected environment. Chapter 3 contains a description of each alternative, alternatives not considered in detail, mitigation, and standard operating procedures (SOP). Chapter 4 analyzes environmental consequences and the environmental impacts associated with each alternative considered in detail. Chapter 5 contains the list of preparers of this EA. Appendix A comprises a list of the literature cited during the preparation of the EA and Appendix B is a detailed description of the methods used for BDM in Pennsylvania. Appendix C is a comprehensive list of federally and State listed T&E species in the Commonwealth of Pennsylvania.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.0 INTRODUCTION

Chapter 2 contains a discussion of the issues, including issues that received detailed environmental impact analysis in Chapter 4 (Environmental Consequences), issues used to develop mitigation measures and SOPs, and issues not considered in detail, with the rationale. Pertinent portions of the affected environment are included in this chapter and in the discussion of issues used to develop mitigation measures. Additional affected environments are incorporated into the discussion of the environmental impacts in Chapter 4 and the description of the proposed program in Chapter 3.

2.1 AFFECTED ENVIRONMENT

The areas of the proposed action could include areas in and around buildings and parks, bridges, industrial sites, urban/suburban woodlots, or at any other sites where birds may feed, roost, loaf, or nest. Damage management activities could be conducted at agricultural fields, vineyards, orchards, farmyards, dairies, ranches, livestock operations, grain mills, and grain handling areas (e.g., railroad yards) where birds destroy crops, feed on spilled grains, or contaminate food products for human or livestock consumption. Additionally, the area of the proposed action could include airports, landfills, and surrounding property where birds represent a threat to aviation safety and human health and safety.

2.2 ISSUES ANALYZED IN DETAIL IN CHAPTER 4

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

- Effects on target bird species
- Effects on other wildlife species, including T&E species
- Effects on human health and safety
- Impacts to stakeholders, including aesthetics
- Humaneness and animal welfare concerns of methods used

2.2.1 Effects on Target Bird Species

A common concern among members of the public is whether wildlife damage management actions adversely affect the viability of target species populations. The target species selected for analysis in this EA are pigeons, European starlings, common grackles, brown-headed cowbirds, and house sparrows.

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

A common concern among members of the public and wildlife professionals, including WS personnel, is whether the proposed action or any of the alternatives might result in adverse impacts to populations of other wildlife, particularly T&E species. WS' mitigation measures and SOPs are designed to reduce the effects on non-target species' populations and are presented in Chapter 3. To reduce the risks of adverse affects to non-target species, WS would select damage management methods that are target-selective or apply such methods in ways to reduce the likelihood of capturing or killing non-target species.

Threatened and Endangered species lists for the USFWS and Commonwealth of Pennsylvania were reviewed to identify potential effects on federal and state listed T&E species. Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has consulted with the USFWS under Section 7 of the ESA concerning potential effects of BDM methods on T&E species and has obtained a Biological Opinion (B.O.) on the APHIS ADC Program. For the full context of the B.O., see Appendix F of the ADC FEIS (USDA 1997). WS is also in the process of reinitiating Section 7 consultation at the program level to assure that potential effects on T&E species have been adequately addressed.

Some members of the public are concerned that the use of registered toxicants to reduce bird damage would have adverse impacts on other wildlife species, including T&E species. Under the alternatives proposed in this EA, the primary toxicant proposed for use by WS is DRC-1339 (WS may also recommend the use of Starlicide, a similar product), which would be used to remove European starlings or brown-headed cowbirds in damage situations. Another chemical method that could be used is Avitrol. Avitrol is classified as an avian distressing agent and is normally used to deter target bird species from using certain problem areas. Other chemicals available for use include the tranquilizer Alpha-chloralose (for live-capturing pigeons), anthraquinone (Flight Control®), and methyl and di-methyl anthranilate (artificial grape flavoring, which also has bird repellent capabilities). See Appendix B for detailed description of these chemicals and their potential effects.

2.2.3 Effects on Public Health and Safety

Safety and efficacy of chemical control methods

Some individuals may have concerns that chemicals used for animal control should not be used because of potential adverse effects on people from being exposed to the chemicals directly or to the animals that have died as a result of the chemical use. Under the alternatives proposed in this EA, one of the toxicants proposed for use by WS is DRC-1339 (Starlicide), which would be primarily used to remove starlings and cowbirds in damage situations. The use of DRC-1339 is regulated by the EPA through FIFRA, the PA Department of Agriculture, and by WS Directives. The chemical bird repellents methyl anthranilate (Rejex-it®) or anthraquinone (Flight Control®) could be used to reduce feeding activity on airfields and other turf areas. Both methyl anthranilate and anthraquinone are non-lethal and work by causing a negative response to feeding in the treated area. Another chemical method that could be used is Avitrol, which is classified as a chemical frightening agent and is normally used to avert certain bird species from using certain problem areas. The avian tranquilizer Alpha-Chloralose could be used for live-capturing pigeons.

The use of registered chemical toxicants and repellants for bird damage management poses no risk to public health and safety. WS personnel who apply pesticides are certified restricted use pesticide applicators and apply pesticides according to label instructions. Certification is obtained after passing written tests administered by the Pennsylvania Department of Agriculture. See Appendix B for a detailed description of these chemicals and their potential effects.

Impacts on human safety of non-chemical BDM methods

Some people may be concerned that WS's use of firearms, traps, and pyrotechnic scaring devices could cause injuries to people. WS personnel occasionally use traps, rifles, and shotguns to remove birds that are causing damage. There is some potential fire hazard to agricultural sites and private property from pyrotechnic use.

Firearm use is a very sensitive public concern because of safety relating to the public and the threat of misuse. 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 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.

Impacts on human health and safety from birds

The concern stated here is that the absence of adequate BDM would result in adverse effects on human health and safety, because bird damage would not be curtailed or reduced to the minimum levels possible and practical. The potential impacts of not conducting such work could lead to increased incidence of injuries, illness, or loss of human lives.

2.2.4 Impacts to Stakeholders, including Aesthetics

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception and today a large percentage of households have pets. 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 reduce conflicts/problems between humans and wildlife.

There may be some concern that the proposed action or alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. Wildlife 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 a philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature and is dependent on what an observer regards as beautiful.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the 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 up the animal or intending to) 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 come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Many people, directly affected by problems and threats to public health or safety caused by birds, insist upon their removal from the property or public location when they cause damage. Some members of the public have an idealistic view and believe that all wildlife should be captured and relocated to another area to alleviate damage or threats to public health or safety. Others, directly affected by the problems caused by wildlife, strongly support removal. Individuals not directly affected by the harm or damage caused by wildlife may be supportive, neutral, or totally opposed to any removal of wildlife from specific locations or sites. Those totally opposed to bird damage management want WS to teach tolerance for damage and threats to public health or safety, and that wildlife should never be killed. Some people would strongly oppose removal of birds regardless of the amount of damage. Some members of the public who oppose removal of wildlife do so because of human-affectionate bonds with individual wildlife. These human-affectionate bonds are similar to attitudes of a pet owner and result in aesthetic enjoyment.

The WS program in Pennsylvania only conducts wildlife damage management at the request of the affected property owner or resource manager. If WS received requests from an individual or official for BDM, WS would address the issues/concerns and consideration would be made to explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a caring, humane, and professional manner.

2.2.5 Humaneness and Animal Welfare Concerns of Methods Used

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns, if *". . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."*

Suffering is described as a *". . . highly unpleasant emotional response usually associated with pain and distress."* However, suffering *". . . can occur without pain . . . ,"* and *". . . pain can occur without suffering . . . "* (AVMA 1987). Because suffering carries with it the implication of a time frame, a case could be made for *". . . little or no suffering where death comes immediately . . . "* (CDFG 1991), such as shooting.

Defining pain as a component in humaneness of WS methods appears to be a greater challenge than that of suffering. 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 1987). However, pain experienced by individual animals probably ranges from little or no pain to considerable 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 nor 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.

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 BDM methods are used in situations where non-lethal damage management methods are not practical or effective.

Pennsylvania WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology, workforce and funding. Mitigation measures/SOPs used to maximize humaneness are listed in Chapter 4.

2.3 ISSUES NOT CONSIDERED IN DETAIL WITH RATIONALE

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

Funding for WS comes from a variety of sources in addition to federal appropriations. Pennsylvania state agency funds, county funds, city funds, private funds, and other federal agency funds are applied to the program under Cooperative Agreements. Federal, state, and local officials have decided that wildlife damage management should be conducted by appropriating funds. WS was established by Congress as the agency responsible for providing wildlife damage management to the people of the United States. Wildlife damage management is an appropriate sphere of activity for government programs, since aspects of wildlife damage management are a government responsibility and authorized and authorized by law.

2.3.2 Bird Damage should be Managed by Private Nuisance Wildlife Control Agents

Private nuisance wildlife control agents could be contacted to reduce bird damage for property owners or property owners could attempt to reduce their own damage problems. Some property owners would prefer to use a private nuisance wildlife control agent because the nuisance wildlife agent is located in closer proximity and thus could provide the service at less expense, or because they prefer to use a private business rather than a government agency. However, some property owners would prefer to contract with a government agency. In particular, large industrial businesses and cities and towns may prefer to use WS because of security and safety issues and reduced administrative burden. Additionally, use of the pesticide DRC-1339 may be the most effective damage management method in some situations, either used alone or as part of an IWDM program. This avicide is registered only for use by USDA personnel trained in bird control techniques and is not available to private nuisance wildlife control agents or property

owners. However, the restricted use pesticide, Starlicide, is similar to DRC-1339 and may be used by certified applicators.

2.3.3 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 the Commonwealth of Pennsylvania would meet the NEPA requirements for site specificity. If in fact 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 EAs covering smaller zones. In addition, the WS program in Pennsylvania only conducts BDM in a very small area of the Commonwealth where damage is occurring or likely to occur.

CHAPTER 3: ALTERNATIVES

3.0 INTRODUCTION

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

Alternatives analyzed in detail are:

- Alternative 1: Technical Assistance Only
- Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)
- Alternative 3: Non-lethal Bird Damage Management Only By WS
- Alternative 4: No federal WS Bird Damage Management

3.1 DESCRIPTION OF THE ALTERNATIVES

3.1.1 Alternative 1: Technical Assistance Only

This alternative would not allow for WS operational BDM in Pennsylvania. WS would only provide technical assistance and make recommendations when requested. Producers, property owners, agency personnel, or others could conduct BDM using any legal lethal or non-lethal method available to them. Currently, DRC-1339 and alpha-chloralose are only available for use by WS employees. Therefore, use of these chemicals by others would be illegal. However, the restricted use pesticide, Starlicide, is similar to DRC-1339 and may be used by certified applicators. Avitrol could also be used by state certified restricted-use pesticide applicators.

3.1.2 Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)

Wildlife Services proposes to continue the current bird damage management program that responds to pigeon, European starling, common grackle, brown-headed cowbird, and house sparrow damage requests in the Commonwealth of Pennsylvania. An IWDM approach would be implemented to reduce damage activities to property, agricultural resources, livestock, and public health and safety. Damage management would be conducted on public and private property in Pennsylvania when the resource owner (property owner) or manager requests assistance. 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 could provide technical assistance and direct operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion, habitat modification or harassment would be recommended and utilized to reduce damage. In other situations, birds would be removed as humanely as possible using: shooting, trapping, and registered pesticides.

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.

3.1.3 Alternative 3: Non-lethal Bird Damage Management Only by WS

This alternative would require WS to use non-lethal methods only to resolve bird damage problems. Individuals 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, or take no action. Persons receiving WS' non-lethal technical and direct control assistance could still resort to lethal methods that were available to them. Currently, DRC-1339 and alpha-chloralose are only available for use by WS employees. Therefore, use of these chemicals by others would be illegal. However, the restricted use pesticide, Starlicide, is similar to DRC-1339 and may be used by certified applicators. Avitrol could also be used by state certified restricted-use pesticide applicators.

3.1.4 Alternative 4: No Federal WS Bird Damage Management

This alternative would eliminate federal involvement in BDM in Pennsylvania. WS would not provide direct operational or technical assistance and requesters of WS' assistance would have to conduct their own BDM without WS input. Information on BDM methods would still be available to producers and property owners through other sources such as USDA Agricultural Extension Service offices, universities, or pest control organizations. Individuals might choose to conduct BDM themselves, use contractual services of private businesses, or take no action. DRC-1339 and alpha-chloralose are only available for use by WS employees. Therefore, use of these chemicals by private individuals would be illegal. However, the restricted use pesticide, Starlicide, is similar to DRC-1339 and may be used by certified applicators. Avitrol could also be used by state certified restricted-use pesticide applicators.

3.2 BDM STRATEGIES AND METHODOLOGIES AVAILABLE TO WS IN PENNSYLVANIA

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

3.2.1 Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in the most cost-effective[2] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. IWDM may incorporate cultural practices (e.g., animal husbandry), habitat modification (e.g., exclusion), animal behavior modification (e.g., scaring), removal of individual offending animals, local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

---

[2] The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

3.2.2 The IWDM Strategies Employed by WS

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

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 bird damage problems.

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

Educational Efforts
Education is an important element of WS program activities because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations 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.

Research and Development
The National Wildlife Research Center (NWRC) functions as the research arm of WS by providing scientific information and development of methods for wildlife damage management that are effective and environmentally responsible. NWRC scientists work closely with wildlife managers, researchers, field specialists and others to develop and evaluate wildlife damage management techniques. NWRC research was instrumental in the development of Methyl Anthranilate. In addition, NWRC is currently testing new experimental drugs that inhibit bird

reproduction. NWRC scientists have authored hundreds of scientific publications and reports, and are respected world-wide for their expertise in wildlife damage management.

3.2.2.1 Examples of Current and Future WS Direct Operational Activities in BDM in Pennsylvania

- WS conducts BDM activities using canon nets at several different facilities to capture birds such as starlings and pigeons.

- WS conducts BDM activities using pyrotechnics and other harassment techniques at areas that include but are not limited to airports and landfills.

- WS conducts BDM activities using DRC-1339 to reduce European starling damage at dairy facilites (feedlots) and at staging areas.

- WS conducts BDM activities using Methyl Anthranilate and pyrotechnics to disperse European starling roosting sites.

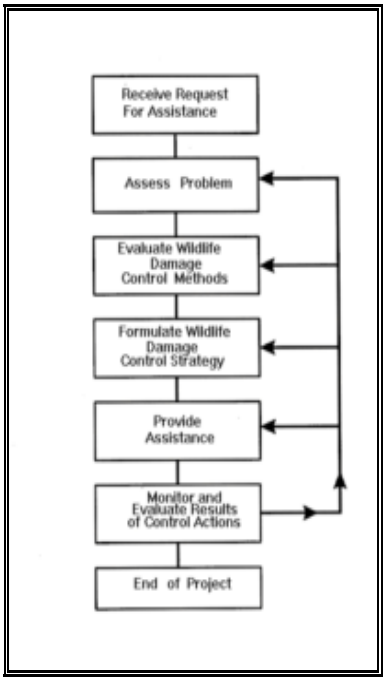
- WS conducts BDM activities using starling V-top traps at areas that include but are not limited to airports and landfills.

- WS assists in bird disease monitoring activities. In June of 2003, WS assisted the National Wildlife Research Center with West Nile Virus surveillance. Mist netting was conducted in three counties in Pennsylvania (Bucks, Montgomery, and Philadelphia). Blood samples and oral swabs were taken from every bird caught and tested for West Nile Virus. All of the birds were fitted with leg bands and released.

3.2.3 WS Decision Making

WS personnel use a thought process for evaluating and responding to damage complaints which is depicted by the WS Decision Model and described by Slate et al. in 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 effectively reducing damage. WS personnel assess the problem then evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy. The Decision Model is not a written documented process, but a mental problem-solving process common to most, if not all, professions.

Figure 3-1
WS Decision Model



3.2.4 Bird Damage Management Methods Available for Use (See Appendix B)

3.2.4.1 Non-chemical, Non-lethal Methods

Agricultural producer and property owner practices consist primarily of non-lethal preventive methods such as cultural methods[3] and habitat modification.

Animal behavior modification refers to tactics that alter the behavior of birds to reduce damages. Some but not all of these tactics include the following:

- Exclusions, such as netting
- Propane exploders (to scare birds)
- Pyrotechnics (to scare birds)
- Distress calls and sound producing devices (to scare birds)
- Visual repellents and other scaring tactics
- Lasers (to scare birds)

Nest destruction of the target species before eggs or young are in the nest.

Egg addling/oiling/destruction is the practice of destroying the embryo in the egg prior to hatching; physically breaking eggs; or directly removing eggs from a nest and destroying them.

Habitat/environmental modification to attract or repel certain bird species.

Live traps are various types of traps designed to capture birds alive. Some examples are clover traps, decoy traps, nest box traps, mist nets, cannon nets, etc. Captured target birds can then be euthanized.

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

3.2.4.2 Chemical, Non-lethal Methods (See Appendix B for detailed descriptions)

Avitrol is a chemical frightening agent registered for use on pigeons, European starlings, and house sparrows in various situations. This chemical works by causing distress behavior in the birds that consume treated baits from a mixture of treated and untreated bait. These distress calls then generally frighten the other birds from the site. In most cases, those birds that consume the treated bait will die (Johnson and Glahn 1994).

Alpha-chloralose is used as an immobilizing agent, which is a central nervous system depressant, and used to capture pigeons or other birds. It is generally used in recreational and

[3] Generally involves modifications to the management of protected resources to reduce their vulnerability to wildlife damage.

residential areas, such as near swimming pools, shoreline residential areas, golf courses, or resorts. Alpha- chloralose is typically delivered as a well-contained bait in small quantities with minimal hazards to pets and humans; single baits consisting of bread or corn are fed directly to the target birds.

Tactile repellents reportedly deter birds from roosting, perching, or nesting on certain structural surfaces by creating a tacky or sticky surface that the birds avoid.

Methyl Anthranilate (MA) and **Di-methyl Anthranilate** (artificial grape flavoring food additive) has been shown to be an effective repellent for many bird species. It can be applied as a fog to repel birds from small areas. It may also become available for use as a livestock feed additive that has bird repellent value.

Anthraquinone is a chemical bird repellent that could be used to reduce feeding activity on the airfield and other turf areas. Antraquinone is a bio-pesticide that is non-lethal and works by causing a negative response to feeding in the treated area (Avery et al. 1997).

3.2.4.3 Mechanical, Lethal Methods

Snap traps are considered quick-kill traps. They are modified rat traps that are used to remove individual birds causing damage to buildings.

Shooting is more effective as a dispersal technique than as a way to reduce bird numbers. The number that can be killed by shooting is generally very small in relation to the number involved in damage situations. Usually only a few dozen birds can be shot from individual flocks that can number anywhere from a few hundred to many thousands or hundreds of thousands of birds before the rest of the birds become gun shy. Shooting, however, can be helpful in some situations to supplement and reinforce other dispersal techniques. It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with rifles, shotguns, or pellet guns (rifles or pistols) is sometimes used to manage bird damage problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible.

Cervical dislocation is approved by the American Veterinary Medical Association (AVMA) and may be used to euthanize birds which are captured in live traps.

3.2.4.4 Chemical, Lethal Methods

DRC-1339 is a slow-acting avicide for reducing damage from several species of birds, including European starlings and brown-headed cowbirds. DRC-1339 is highly toxic to sensitive species, but only slightly toxic to non-sensitive birds, predatory birds and mammals. This chemical would be the primary lethal chemical method used for European starling and brown-headed cowbird damage management under the proposed program.

Starlicide (3-chloro-p-toluidine hydrochloride) is a restricted use pesticide that is formulated as a 0.1% ready-to-use product and is commercially available to certified applicators or persons

under their supervision. This avicide may be recommended or used by WS to control European starlings, cowbirds and pigeons. Starlicide may be used in feedlots, around buildings and fenced non-crop areas, bird staging and roosting areas, federal and state wildlife refuges, and other sites (EPA 1995). Starlicide is similar to DRC-1339 used in feedlots; however, it contains 0.1% DRC-1339 (USDA 1997, Appendix P). Therefore, the properties of this product are similar to DRC-1339.

Carbon dioxide (CO_2) gas is an AVMA-approved euthanasia method which is sometimes used to euthanize birds that have been chemically immobilized or captured in live traps. Live birds are placed in a container or chamber into which CO_2 gas is released. The birds quickly expire after inhaling the gas.

3.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

Several alternatives were considered, but not analyzed in detail. These were:

3.3.1 Lethal Bird Damage Management Only By WS

Under this alternative, WS would not conduct any non-lethal control of birds for BDM purposes in the Commonwealth, but would only conduct lethal BDM. This alternative was eliminated from further analysis because some bird damage problems can be resolved effectively through non-lethal means. Additionally, lethal methods may not always be available for use due to safety concerns or local ordinances prohibiting the use of some lethal methods, such as the discharge of firearms. For example, a number of damage problems involving the encroachment of injurious birds into buildings can be resolved by installing barriers or repairing of structural damage to the buildings, thus excluding the birds. Further, damage situations such as large flocks of injurious birds on/near airport runways could not be removed immediately by lethal means, while scaring them away through various harassment devices might resolve the threat to passenger safety at once.

3.3.2 Compensation for Bird Damage Losses

The compensation alternative would require the establishment of a system to reimburse persons impacted by bird damage. This alternative was eliminated from further analysis because no federal or state laws currently exist to authorize such action. Under such an alternative, WS would not provide any direct control or technical assistance. Aside from lack of legal authority, analysis of this alternative in the ADC Final EIS indicated that the concept has many drawbacks (USDA 1997):

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

- Compensation would most likely be less than full market value. Responding in a timely fashion to all requests to assess and confirm damage would be difficult and certain types of damage could not be conclusively verified. For example, proving conclusively in individual situations that birds were responsible for disease outbreaks would be impossible, even though they may actually have been responsible. Thus, a compensation program that requires verification would not meet its objective for mitigating such losses.

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

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

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

3.3.3 Use of Bird-proof Feeders in Lieu of Lethal Control at Dairies and Cattle Feeding Facilities

Bird-proof feeders were proposed by Animal Protection of New Mexico (APNM), Inc. as a method for excluding birds at dairies and cattle feeding facilities in that State. This method would involve the installation of 1/8" thick steel panel feed troughs, covered by parallel 4-6 inch spaced steel cables or wires running from the outer top edge of the trough up at a 30-45 degree angle to the top of the head chutes that cattle use to access the feed. Vertical canvas strips would be hung from the cables. The feeder was reportedly designed for use with horses. A copy of a diagram of this system was sent to Mr. Jim Glahn, Bird Control Research Biologist at the WS-National Wildlife Research Center (NWRC), who has nearly 12 years of experience researching problems caused by European starlings at livestock feeding operations. He found the following:

- A major flaw in the design is the spacing of the cables at 4-6" which would allow European starlings to drop through. Reducing the spacing to 2" as recommended by Johnson and Glahn (1994) would likely interfere with the delivery of feed to the troughs. Interference would occur because the feed mixture currently used by most dairies is a mixture of chopped alfalfa hay and corn silage with a grain component. The alfalfa/corn silage portion would likely hang up on the cable or wire strands of the troughs and much would fall outside the troughs, with increased feed waste a result (Twedt and Glahn 1982).

- the spacing of the canvas strips is not specified, and canvas would deteriorate quickly from cattle licking and weather (Twedt and Glahn 1982).

Mr. Glahn expressed the opinion, based on Twedt and Glahn (1982) and Feare (1984), that exclusion methods to reduce starling depredations at livestock feeding operations are usually the least cost-effective solution. Despite the above concerns about the bird-proof feeder system recommended by APNM, Inc., similar types of systems could be recommended by WS under the current program should any become available that are effective, practical, and economically feasible for producers to implement.

3.4 MITIGATION AND STANDARD OPERATING PROCEDURES FOR BIRD DAMAGE MANAGEMENT TECHNIQUES

3.4.1 Mitigation in Standard Operating Procedures (SOPs)

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for effects that otherwise might result from that action. The current WS program, nationwide

and in Pennsylvania, uses such mitigation measures and these are discussed in detail in Chapter 5 of the ADC Final EIS (USDA 1997). Some key mitigating measures pertinent to the proposed action and alternatives of this EA that are also incorporated into WS' SOPs include:

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

- Reasonable and prudent measures or alternatives are identified through consultation with the USFWS and are implemented to avoid effects to T&E species.

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

- All WS Specialists in the Commonwealth using restricted chemicals are trained and certified by, or operate under the direct supervision of, program personnel or others who are experts in the safe and effective use of chemical BDM materials.

- The presence of non-target species is monitored before using DRC-1339 (or Starlicide) to control European starlings and cowbirds at feedlots to reduce the risk of mortality of non-target species populations.

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

Some additional mitigating factors specific to the current program include:

- Management actions would be directed toward localized populations or groups of target species and/or individual offending members of those species. Generalized population suppression across the Commonwealth, or even across major portions of the Commonwealth, would not be conducted.

- WS uses BDM 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 1997, Appendix P). Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazards to the public is even further reduced.

3.4.2 Additional Mitigation 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.

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

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

- Observations of birds feeding at feedlots, dairies, or European starling staging areas or observations of birds that are associated with feral domestic pigeon concentrations are made to determine if non-target or T&E species would be at risk from BDM activities.

- WS has consulted with the USFWS regarding potential effects of control methods on T&E species and abides by reasonable and prudent alternatives (RPAs) and/or reasonable and prudent measures (RPMs) established as a result of that consultation. For the full context of the Biological Opinion, see the ADC Final EIS, Appendix F (USDA 1997).

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

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

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

The following resource values within the Commonwealth are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

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

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

Effects on sites or resources protected under the National Historic Preservation Act: WS BDM actions are not undertakings that could adversely affect historic resources (See Section 1.1.5).

4.1 ENVIRONMENTAL CONSEQUENCES FOR ISSUES ANALYZED IN DETAIL

4.1.1 Effects on Target Bird Species Populations

4.1.1.1 Alternative 1: Technical Assistance Only

Under this alternative, WS would have no impact on house sparrow, feral domestic pigeon, brown-headed cowbird, common grackle, and European starling populations in the Commonwealth because the program would not provide any operational BDM activities. The program would be limited to providing advice only. Private efforts to reduce or prevent bird damage and perceived disease transmission risks could increase, which could result in similar or even greater effects on those populations than the Proposed Action. However, for the same reasons shown below in the population effects analysis in section 4.1.1.2, it is unlikely that target bird populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of other chemicals which could lead to real but unknown effects on target bird populations. DRC-1339 and the tranquilizer alpha-chloralose are currently only available for use by WS employees in Pennsylvania and would not be available for use under this alternative.

4.1.1.2 Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)

Analysis of this issue is limited to those species killed during WS BDM. The analysis for magnitude of impact generally follows the process described in Chapter 4 of USDA (1997). Magnitude is described in USDA (1997) 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 only conducts damage management on species whose population densities are high and usually only after they have caused damage.

Table 4. Number of pigeons, starlings, grackles, cowbirds, and sparrows lethally removed by USDA APHIS Wildlife Services in Pennsylvania during Federal Fiscal Years 2001 and 2002.

Fiscal Year	Number of Pigeons	Number of European Starlings	Number of English Sparrows	Number of Common Grackles	Number of Cowbirds
2001	38	49	88	7	9
2002	71	503	18	14	111
Total	109	552	106	21	120

<u>Impacts of West Nile virus on bird populations</u>

West Nile (WN) virus has emerged in recent years in temperate regions of North America, with the first appearance of the virus in North America occurring in New York City in 1999 (MMWR 2002, Rappole et al. 2000). Since 1999 the virus has spread across the United States and was reported to occur in 44 states and the District of Columbia in 2002 (MMWR 2002). West Nile virus is typically transmitted between birds and mosquitoes. Mammals can become infected if bitten by an infected mosquito, but individuals in most species of mammals do not become ill from the virus. The most serious manifestation of the WN virus is fatal encephalitis in humans, horses, and birds. West Nile virus has been detected in dead bird species of at least 138 species (CDC 2003). Although birds infected with WN virus can die or become ill, most infected birds do survive and may subsequently develop immunity to the virus (CDC 2003, Cornell University 2003). In some bird species, particularly Corvids (crows, blue jays, ravens, magpies), the virus causes disease (often fatal) in a large percentage of infected birds (Audubon 2003, CDC 2003, Cornell University 2003, MMWR 2002). In 2002, WN virus surveillance/monitoring programs revealed that Corvids accounted for 90% of the dead birds reported with crows representing the highest rate of infection (MMWR 2002). Large birds that live and die near humans (i.e. crows) have a greater likelihood of being discovered, therefore the reporting rates tend to be higher for these bird species and are a "good indicator" species for the presence of WV virus in a specific area (Cornell University 2003, Audubon 2003). According to US Geological Survey (USGS), National Wildlife Health Center (2003), information is not currently available to know whether or not WN virus is having an impact on bird populations in North America. USGS states that it

is not unusual for a new disease to cause high rates of infection or death because birds do not have the natural immunity to the infection. Furthermore, it is not known how long it will take for specific bird population to develop sufficient immunity to the virus. Surveys of wild birds completed in the last three years have shown that some birds have already acquired antibodies to the virus (USGS-WHC 2003). Based upon available Christmas Bird Counts and Breeding Bird Surveys, USGS-WHC (2003) states that there have been declines in observations of many local bird populations, however they do not know if the decline can be attributed to WN virus or to some other cause. A review of available crow population data by Audubon (2003) reveals that at least some local crow populations are suffering high WN virus related mortality, but crow numbers do not appear to be declining drastically across broad geographic areas. USGS does not anticipate that the commonly seen species, such as crows and blue jays, will be adversely affected by the virus to the point that these bird species will disappear from the U.S. (USGS-WHC 2003).

European Starling Population Effects

Colonization of North America by the European Starling began on March 6, 1890 when a Mr. Eugene Scheifflin, a member of the Acclimatization Society, released 80 starlings into New York's Central Park. The birds thrived and exploited their new habitat. By 1918, the advance line of migrant juveniles extended from Ohio to Alabama; by 1926 from Illinois to Texas; by 1941 from Idaho to New Mexico; and by 1946 to California and Canadian coasts (Miller 1975). In just 50 short years the starling had colonized the United States and expanded into Canada and Mexico and 80 years after the initial introduction had become one of the most common birds in North America (Feare 1984).

The starling is found in virtually all Pennsylvania habitats. It forages in open areas, often near human dwellings, and dislikes only extensive woodlands. Starlings eat both animal and plant matter, including beetles, grains, cherries, and mulberries. The bird has an excellent memory for locating food and its digestive system adapts quickly to major dietary changes (Brauning 1992). Starlings nest in cavities and will readily evict most native hole-nesting species. In the absence of natural cavitites, they will nest in almost any enclosed area such as a street light, a mail box, or an attic (Brauning 1992).

Precise counts of starling populations do not exist but one estimate placed the nationwide starling population at an estimated at 140 million birds (Johnson and Glahn 1994). Natural mortality in starling populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997). Therefore the estimated natural mortality of starlings in the U.S should be between 70 and 91 million birds annually. Based upon an anticipated increase in requests for services, WS' lethal management of starlings in Pennsylvania would be expected to be no more than approximately 1 million starlings in any one year under the Proposed Action.

Breeding Bird Survey trend data from 1980-2002 indicate that European starling populations have decreased at annual rate of -0.2%, -0.3% and -0.5% throughout the United States, the eastern region, and Pennsylvania, respectively (Sauer et al. 2003). It is estimated that the total population of European starlings in Pennsylvania is approximately 4 million birds (Per. Comm. Dan Brauning, PGC, 2003).

Starlings are non-indigenous and often have negative impacts on and competition with native birds. Therefore, starlings are considered by many wildlife biologists and ornithologists to be an undesirable component of North American wild and native ecosystems. Any reduction in starling populations in North America, even to the extent of complete eradication, could be considered a beneficial impact to native bird species.

Based on the above described population trends, population estimates, and WS limited lethal take of starlings in Pennsylvania, WS should have minimal effects on local, statewide, regional or continental starling populations.

Rock Dove (feral/domestic Pigeon) Population Effects

Domestic pigeons, or rock doves, are a non-indigenous species that were first introduced into the United States by European settlers as a domestic bird to be used for sport, carrying messages, and as a source of food (USFWS 1981). Many of these birds escaped and eventually formed the feral pigeon populations that are now found throughout the United States, southern Canada, and Mexico (Williams and Corrigan 1994). However, because pigeons are an introduced rather than a native species, they are not protected by federal law or Pennsylvania state law.

Pigeons are highly dependent on humans to provide them with food and sites for roosting, loafing, and nesting (Williams and Corrigan 1994). Thus, they are commonly found around city buildings, bridges, parks, farm yards, grain elevators, feed mills, and other manmade structures (Williams and Corrigan 1994). Additionally, although pigeons are primarily grain and seed eaters, they will readily feed on garbage, livestock manure, spilled grains, insects, and any other available bits of food (Williams and Corrigan 1994).

Breeding Bird Survey trend data from 1980-2002 indicate that pigeon populations have decreased at annual rate of -1.3%, -1.2% and -0.3% throughout the United States, the eastern region, and Pennsylvania, respectively (Sauer et al. 2003). It is estimated that the total population of rock doves in Pennsylvania is approximately 850,000 birds (Per. Comm. Dan Brauning, PGC, 2003).

Federal or state law does not protect this species. Any WDM involving lethal control actions by WS for this species would be restricted to isolated, individual sites, or communities. In those cases where feral domestic pigeons are causing damage or are a nuisance, complete removal of the local population could be achieved. This would be considered to be a beneficial impact on the human environment since the affected property owner or administrator would request it. Although regional population impacts would be minor, even if significant regional or nationwide reductions could be achieved, this would not be considered an adverse impact on the human environment because the species is not part of native ecosystems. However, some individuals who experience aesthetic enjoyment of pigeons may consider major population reduction in some localities a negative impact.

Based upon an anticipated increase in requests for services, WS' lethal management of pigeons in Pennsylvania would be expected to be no more than approximately 5,000 pigeons in any one year under the Proposed Action. Based on the above described population trends, population

estimates, and WS limited lethal take of pigeons in Pennsylvania, WS should have minimal effects on local, statewide, regional or continental pigeon populations.

House Sparrow Population Effects

House sparrows, or English sparrows, were introduced to North America from England in 1850 and have spread throughout the continent (Fitzwater 1994). The species is not protected by Federal or Pennsylvania state laws. Like European starlings and pigeons, because of their negative effects on and competition with native bird species, house sparrows are considered by many wildlife biologists, ornithologists, and naturalists to be an undesirable component of North American native ecosystems. House sparrows are found in nearly every habitat except dense forest, alpine, and desert environments. They prefer human-altered habitats, and are abundant on farms and in cities and suburbs (Robbins et al. 1973).

Breeding Bird Survey trend data from 1980-2002 indicate that house sparrow populations have decreased at annual rate of -3.8%, -4.1% and -2.7% throughout the United States, the eastern region, and Pennsylvania, respectively (Sauer et al. 2003). It is estimated that the total population of house sparrows in Pennsylvania is approximately 2 million birds (Per. Comm. Dan Brauning, PGC, 2003).

The change in farming practices may have been a factor for their recent population decline. The considerable decline in small farms and associated disappearance of a multitude of small feed lots, stables and barns, may have reduced English sparrow populations, as these sites were a primary source of food in the early part of the 20th century. Ehrlich et al. (1988) suggested that English sparrow population declines might be linked to the dramatic decrease during the 20th century in the presence of horses as transport animals. Grain rich horse droppings were apparently a major food source for this species.

Based upon an anticipated increase in requests for services, WS' lethal management of house sparrows in Pennsylvania would be expected to be no more than approximately 1,000 sparrows in any one year under the Proposed Action. Based on the above described population trends, population estimates, and WS limited lethal take of house sparrows in Pennsylvania, WS should have minimal effects on local, statewide, regional or continental sparrow populations.

Brown-headed Cowbird Population Effects

Brown-headed cowbirds are considered to be part of the blackbird species group described in USDA (1997) and is estimated to represent 18% of this group (Meanley and Royall 1976). The brown-headed cowbird is the smallest member of the blackbird group. It is common throughout the United States and often is found near livestock, and in flocks of mixed blackbird species. This bird inhabits agricultural land, fields, woodland edges, and suburban areas (Bull and Farrand 1977). The preferred food of brown-headed cowbird includes: insects, small fruits, wild seeds, grain, and small aquatic life (Peterson 1980).

The brown-headed cowbird is one of few bird species in the U.S. that never incubates its own eggs or raises its own young. Cowbirds accomplish this by laying their eggs in the nests of other birds. It is the only species in Pennsylvania known to rely solely on this means of reproduction, brood parasitism (Brauning 1992). Many Great Plains species respond to cowbirds by removing

eggs from their nests, but eastern woodland species generally show no response to this intrusion. The cowbird is a parasitic generalist, depositing eggs in almost any appropriate nest it encounters. Almost all of Pennsylvania's altricial passerine birds have been listed as hosts (Brauning 1992). The impact on host breeding populations has been debated at some length. Clearly, host species raise fewer of their own young. The reduced reproductive output, added to habitat loss and other environmental pressures, is widely believed to be a significant component of some species' downward population trend (Brauning 1992).

Precise counts of blackbird populations do not exist, but one estimate placed the United States summer population of the blackbird group at over 1 billion (USDA 1997) and the winter population at 500 million (Royall 1977). Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997). The annual population of blackbirds in the eastern U.S. is at least 232 million (Meanley and Royall 1976, Johnson and Glahn 1994). Therefore the estimated natural mortality of the blackbird group in the eastern U.S should be between 116 and 140 million birds annually with cowbirds representing 20 to 25 million of these birds.

Dolbeer et al. (1995) showed that WS kills of 3.6% of the wintering population had no effect on breeding populations the following spring. Dolbeer et al. (1976) constructed a population model which indicated that a reduction of 14.8% of the wintering blackbird population would reduce the spring breeding population by 20% and that a 56.2% reduction in the wintering blackbird population would reduce spring breeding populations by only 33%. Given the density-dependent relationships in a blackbird population (i.e. decreased mortality and increased fecundity of surviving birds) a much higher number would likely have to be killed in order to impact the regional breeding population.

Breeding Bird Survey trend data from 1980-2002 indicate that brown-headed cowbird populations have decreased at annual rate of -0.7%, -1.5% and -2.6% throughout the United States, the eastern region, and Pennsylvania, respectively (Sauer et al. 2003). It is estimated that the total population of brown-headed cowbirds in Pennsylvania is approximately 400,000 birds (Per. Comm. Dan Brauning, PGC, 2003).

The USFWS has established a Depredation Order (50 CFR 21.43) for blackbirds, whereby no Federal permit is required to remove blackbirds if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on blackbird populations would have no significant adverse impact on the quality of the human environment.

Based upon an anticipated increase in requests for services, WS' lethal management of brown-headed cowbirds in Pennsylvania would be expected to be no more than approximately 20,000 cowbirds in any one year under the Proposed Action. Based on the above described population trends, population estimates, and WS limited lethal take of brown-headed cowbirds in

Pennsylvania, WS should have minimal effects on local, statewide, regional or continental cowbird populations.

Common Grackle Population Effects

Common grackles are considered to be part of the blackbird species group described in USDA (1997) and is estimated to represent 22% of this group (Meanley and Royall 1976). The common grackle occupies a range that includes Canada and the United States east of the Rockies (Peterson 1980). This bird inhabits croplands, fields, parks, lawns, and open woodland (Bull and Farrand 1977). The grackle has an extremely varied diet, which includes insects, crayfish, frogs, other small aquatic life, mice, nestling birds, eggs, sprouting and ripened grains, seeds, and fruits (Bull and Farrand 1977; Peterson 1980). These birds form large flocks during migration and in winter roosts and often form breeding colonies. Common grackles usually nest in tall evergreens and have clutch size of five eggs.

The common grackle is one of Pennsylvania's most abundant breeding birds, although not the most widespread species (Brauning 1992). The common grackle uses a wide range of nesting habitats. They seem to prefer conifers for nest sites, especially red cedar groves, white pine rows, and spruce plantings. Atypical but not infrequent nesting locations include shrubs and cattails in marshes, artificial duck nests, artificial and natural cavities, and niches and ledges of buildings, bridges, and other man-made structures (Brauning 1992). Nest building can occur as early as the first week of April. Winter roosts, may contain hundreds of thousands of individuals (Brauning 1992).

Precise counts of blackbird populations do not exist, but one estimate placed the United States summer population of the blackbird group at over 1 billion (USDA 1997) and the winter population at 500 million (Royall 1977). Natural mortality in blackbird populations is between 50% and 65% of the population each year, regardless of human-caused control operations (USDA 1997). The annual population of blackbirds in the Eastern U.S. is at least 232 million (Meanley and Royall 1976, Johnson and Glahn 1994). Therefore the estimated natural mortality of the blackbird group in the eastern U.S should be between 116 and 140 million birds annually with common grackles representing 25 to 30 million of these birds.

Dolbeer et al. (1995) showed that WS kills of 3.6% of the wintering population had no effect on breeding populations the following spring. Dolbeer et al. (1976) constructed a population model which indicated that a reduction of 14.8% of the wintering blackbird population would reduce the spring breeding population by 20% and that a 56.2% reduction in the wintering blackbird population would reduce spring breeding populations by only 33%. Given the density-dependent relationships in a blackbird population (i.e. decreased mortality and increased fecundity of surviving birds) a much higher number would likely have to be killed in order to impact the regional breeding population.

Breeding Bird Survey trend data from 1980-2002 indicate that common grackle populations have decreased at annual rate of -1.5%, -1.3% and -2.0% throughout the United States, the eastern region, and Pennsylvania, respectively (Sauer et al. 2003). It is estimated that the total population of common grackles in Pennsylvania is approximately 3 million birds (Per. Comm. Dan Brauning, PGC, 2003).

The USFWS has established a Depredation Order (50 CFR 21.43) for blackbirds, whereby no Federal permit is required to remove blackbirds if they are committing or about to commit depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when concentrated in such numbers and manner as to constitute a health hazard or other nuisance. The USFWS, as the agency with management responsibility, could impose restrictions on depredation harvest as needed to assure cumulative take does not adversely affect the continued viability of populations. This should assure that cumulative impacts on blackbird populations would have no significant adverse impact on the quality of the human environment.

Based upon an anticipated increase in requests for services, WS' lethal management of common grackles in Pennsylvania would be expected to be no more than approximately 1,000 grackles in any one year under the Proposed Action. Based on the above described population trends, population estimates, and WS limited lethal take of common grackles in Pennsylvania, WS should have minimal effects on local, statewide, regional or continental grackle populations.

4.1.1.3 Alternative 3: Non-lethal Bird Damage Management Only by WS

Under this alternative, WS would not take any target species because no lethal methods would be used. Although WS lethal take of house sparrows, pigeons, grackles, cowbirds, and European starlings would not occur, it is likely that without WS conducting some level of lethal BDM activities for these species; private BDM efforts would increase, leading to potentially similar or even greater effects on target species populations than those of the current program alternative. For the same reasons shown in the population effects analysis in section 4.1.1.2, however, it is unlikely that target bird populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of other chemicals which could lead to real but unknown effects on target bird populations. DRC-1339 is currently only available for use by WS employees and would not be available for use under this alternative. Effects and hypothetical risks of illegal chemical toxicant use under this alternative would probably be about the same as those under Alternative 1, but less than Alternative 4.

4.1.1.4 Alternative 4: No Federal WS Bird Damage Management

Under this alternative, WS would have no impact on house sparrow, pigeon, grackle, cowbird, and European starling populations in the Commonwealth. Private efforts to reduce or prevent depredations could increase which could result in effects on target species populations to an unknown degree. Effects on target species under this alternative could be the same, less, or more than those of the proposed action depending on the level of effort expended by private persons. For the same reasons shown in the population effects analysis in section 4.1.1.2, it is unlikely that target bird populations would be adversely impacted by implementation of this alternative. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of other chemicals which could lead to real but unknown effects on target bird populations. DRC- 1339 and the tranquilizer alpha-chloralose are currently only available for use by WS employees and would not be available for use under this alternative.

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

4.1.2.1 Alternative 1: Technical Assistance Only

Alternative 1 would not allow any WS direct operational BDM in Pennsylvania. Non-target or T&E species would not be impacted by WS activities from this alternative. Technical assistance or self-help information would be provided at the request of producers and others. Although technical support might lead to more selective use of control methods by private parties than that which might occur under Alternative 4, private efforts to reduce or prevent depredations could still result in less experienced persons implementing control methods, leading to greater take of non-target wildlife than under the proposed action. It is hypothetically possible that, similar to Alternative 3 and 4, frustration caused by the inability to reduce damage and associated losses could lead to illegal use of chemical toxicants which could lead to unknown effects on local non-target species populations, including some T&E species. Hazards to raptors, including bald eagles, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

4.1.2.2 Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)

Adverse Effects on Non-target (non-T&E) Species: There has been no lethal take of non-target species by WS while conducting BDM activities in Pennsylvania. Although it is possible that some non-target birds may be unknowingly killed by use of DRC-1339 for cowbird or starling control, the method of application is designed to minimize or eliminate that risk. For example, DRC-1339 treated bait is only applied after a period of prebaiting with untreated bait material and when non-target birds are not observed at the feed site. WS take of non-target species during BDM 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 nontarget species. Shooting is virtually 100% selective for the target species; therefore no adverse impacts are anticipated from use of this method. Any non-target species captured in a live trap would be released unharmed on site. No adverse impacts from the use of registered pesticides and repellents 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).

While every precaution is taken to safeguard against taking non-target birds, changes in local flight patterns and other unanticipated events can result in the incidental take of unintended species. These occurrences are rare and should not affect the overall populations of any species under the current program.

Beneficial Effects on Non-target Species: Interspecific nest competition has been well documented in European starlings. Miller (1975) and Barnes (1991) reported European starlings were responsible for a severe depletion of the eastern bluebird (*Sialis sialis*) population due to nest competition. Nest competition by European starlings has also been known to adversely impact American kestrels (sparrow hawks) (Von Jarchow 1943, Nickell 1967, and Wilmer 1987), red-bellied woodpeckers (*Centurus carolinus*), Gila woodpeckers (Centurus uropygial is)

(Kerpez et.al. 1990 and Ingold 1994), and wood ducks (*Aix sponsa*) (Shake 1967, McGilvery et.al 1971, Heusmann et.al. 1977, and Grabill 1977). Weitzel (1988) reported nine native species of birds in Nevada had been displaced by starling nest competition, and Mason et al. (1972) reported European starlings evicting bats from nest holes. Control operations as proposed in this alternative could reduce starling populations on a local level. Reduction in nest site competition would be a beneficial impact on the species listed above.

Brood parasitism has been well documented in brown-headed cowbirds. The brown-headed cowbird may function most prominently in negatively impacting other bird species. Cowbirds are the only birds in Pennsylvania that rely solely on this type of reproduction. These birds successfully parasitize the nests of songbirds laying 1 or sometimes 2 eggs per host nest and up to 25 or more eggs per nesting season (Dolbeer 1994). Brown-headed cowbirds are known to parasitize the nests of at least 158 avian species (Friedman 1929) and are thought to be responsible for the decline in populations of many species of resident and migrant birds. Parasitized nests of songbirds are usually destroyed. Control operations as proposed in this alternative could reduce cowbird populations on a local level. Reduction in brood parasitism would be a beneficial impact on native bird species.

T&E Species Effects: The USFWS and the PGC have provided WS a list of Endangered, Threatened and Special Concern species in Pennsylvania (see Appendix C). WS will periodically consult with the USFWS and PGA to ensure that actions taken under this plan will not adversely affect PA listed species.

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential effects and the establishment of special restrictions or mitigation measures. WS has consulted with the USFWS under Section 7 of the ESA concerning potential impacts of wildlife damage management methods on T&E species and has obtained a Biological Opinion (USDI 1992). For the full context of the Biological Opinion, see Appendix F of the ADC Final EIS (USDA 1997, Appendix F). Based on the conclusions made by USFWS during their 1992 programmatic consultation of WSs activities and subsequent Biological Opinion, it was determined that management activities being utilized for bird damage management in Pennsylvania are not likely to adversely affect the T&E species listed in Pennsylvania. Furthermore, the Pennsylvania WS program has determined no effect on those T&E species considered extirpated from the state; and those T&E species (Bog turtle (*Clemmys muhlenbergii*), Clubshell mussel (*Pleurobema clava*), Dwarf wedgemussel (*Alasmidonta heterodon*), Northern riffleshell (*Epioblasma torulosa rangiana*), and Northeastern bulrush (*Scirpus ancistrochaetus*)) and methods not included in the 1992 B.O.

Mitigation measures to avoid T&E effects are described in Chapter 3 (Subsection 3.4.2) and are also described in Subsection 4.1.2 of this chapter. The inherent safety features of DRC-1339, Starlicide, and Avitrol use that preclude or minimize hazards to mammals and plants are described in Appendix B and in a formal risk assessment in the ADC Final EIS (USDA 1997, Appendix P). Those measures and characteristics should assure there would be no jeopardy to T&E species or adverse effects on mammalian or non-T&E bird scavengers from the proposed action.

As stated in the 1992 BO, the USFWS has determined that the only BDM method that might adversely affect the bald eagle was above ground use of strychnine treated bait for "nuisance birds." Strychnine is no longer registered for above ground use and would not be used by WS for BDM in Pennsylvania. DRC-1339/Starlicide poses no primary hazard to eagles because eagles do not eat grain or other bait materials on which this chemical might be applied during BDM, and further, because eagles are highly resistant to DRC-1339 - up to 100 mg doses were force fed to captive golden eagles with no mortality or adverse effects noted other than regurgitation and head-shaking (Larsen and Dietrich 1970). Secondary hazards to raptors from DRC-1339, Starlicide, and Avitrol are low to nonexistent (see Appendix B). Therefore, WS BDM in Pennsylvania is not likely to adversely affect bald eagles.

WS has reviewed the list of Pennsylvania State listed T&E species, species of concern, and species of special interest and has determined that the proposed WS BDM program will not adversely affect any of the species listed in Pennsylvania.

4.1.2.3 Alternative 3: Non-lethal Bird Damage Management Only by WS

Under this alternative, WS take of non-target animals would hypothetically be less than that of the proposed action because no lethal control actions would be taken by WS. However, if bird damage problems were not effectively resolved by non-lethal control methods, members of the public may resort to other means of lethal control such as the use of shooting or even illegal use of chemical toxicants. This could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than the proposed action. For example, shooting by persons not proficient at bird identification could lead to killing of non-target birds. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of chemical toxicants which could lead to unknown effects on local non-target species populations, including T&E species. Hazards to raptors, including bald eagles and falcons, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

4.1.2.4 Alternative 4: No Federal WS Bird Damage Management

Alternative 4 would not allow any WS BDM in the Commonwealth. There would be no impact on non-target or T&E species by WS BDM activities from this alternative. However, private efforts to reduce or prevent depredations could increase which could result in less experienced persons implementing control methods and could lead to greater take of non-target wildlife than under the proposed action. It is hypothetically possible that frustration caused by the inability to reduce damage and associated losses could lead to illegal use of chemical toxicants which could impact local non-target species populations, including some T&E species. Hazards to raptors, including bald eagles, could therefore be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used by frustrated private individuals.

4.1.3 Effects on Human Health and Safety

4.1.3.1 Effects of Chemical BDM Methods on Human Health

Alternative 1: Technical Assistance Only

Alternative 1 would not allow any direct operational BDM assistance by WS in the Commonwealth. Concerns about human health risks from WS' use of chemical BDM methods would be alleviated because no such use would occur. DRC-1339 and alpha-chloralose are only registered for use by WS personnel in Pennsylvania and would not be available for use by privateindividuals. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and leading to a greater risk than the Proposed Action alternative. However, because some of these private parties would be receiving advice and instruction from WS, concerns about human health risks from chemical BDM methods use should be less than under Alternative 4. Commercial pest control services would be able to use Avitrol and Starlicide and such use would likely occur to a greater extent in the absence of WS' assistance. Use of Avitrol and Starlicide in accordance with label requirements should preclude any hazard to members of the public. Hazards to humans and pets could be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used. It is hypothetically possible that frustration caused by the inability to alleviate bird damage could lead to illegal use of certain toxicants that, unlike WS' controlled use of DRC- 1339 and Avitrol, could pose secondary poisoning hazards to pets. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the Proposed Action alternative.

Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)

<u>DRC-1339:</u> DRC-1339 is the primary lethal chemical BDM method that would be used under the proposed program alternative. Some concern has been generated by a few members of the public that unknown, but significant, risks to human health may exist from DRC-1339 used for BDM.

This chemical is one of the most extensively researched and evaluated pesticides ever developed. Over 30 years of studies have demonstrated the safety and efficacy of this compound. Appendix B provides more detailed information on this chemical and its use in BDM. Factors that virtually eliminate any risk of public health problems from use of this chemical are:

- Its use is prohibited within 50 feet of standing water and cannot be applied directly to food or feed crops.

- DRC-1339 is highly unstable and degrades rapidly when exposed to sunlight, heat, or ultraviolet radiation. The half-life is about 25 hours, which means that treated bait material generally is nearly 100% broken down within a week.

- It is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people.

- Application rates are extremely low (less than 0.1 lb. of active ingredient per acre) (EPA 1995).

- A human would need to ingest the internal organs of birds found dead from DRC-1339 to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur.

- The EPA has concluded that, based on mutagenicity (the tendency to cause gene mutations in cells) studies, this chemical is not a mutagen or a carcinogen (i.e., cancer-causing agent) (EPA 1995). Notwithstanding, the extremely controlled and limited circumstances in which DRC-1339 is used would prevent any exposure of the public to this chemical.

The above analysis indicates that human health risks from DRC-1339 use would be virtually nonexistent under any alternative.

Avitrol (4-Aminopyridine): Avitrol is another chemical method that might be used by WS in BDM. Appendix B provides more detailed information on this chemical.

Avitrol is available as a prepared grain bait mixture or as a powder. It is formulated in such a way that ratios of treated baits to untreated baits are no greater than 1:9. Factors that virtually eliminate health risks to members of the public from use of this product as an avicide are:

- It is readily broken down or metabolized into removable compounds that are excreted in urine in the target species (ETOXNET 1996). Therefore, little of the chemical remains in killed birds to present a hazard to humans.

- A human would need to ingest the internal organs of birds found dead from Avitrol ingestion to have any chance of receiving even a minute amount of the chemical or its metabolites into his/her system. This is highly unlikely to occur. Furthermore, secondary hazard studies with mammals and birds have shown that there is virtually no hazard of secondary poisoning.

- Although Avitrol has not been specifically tested as a cancer-causing agent, the chemical was found not to be mutagenic in bacterial organisms (EPA 1997). Therefore, the best scientific information available indicates it is not a carcinogen. Notwithstanding, the extremely controlled and limited circumstances in which Avitrol is used would prevent exposure of members of the public to this chemical.

The above analysis indicates that human health risks from Avitrol use would be virtually nonexistent under any alternative.

Other BDM Chemicals: Other non-lethal BDM chemicals that might be used or recommended by WS would include repellents such as methyl or di-methyl anthranilate (artificial grape flavoring used in foods and soft drinks sold for human consumption), which has been used as an area repellent; anthraquinone which is presently marketed as Flight Control®; and the tranquilizer drug alpha-chloralose. Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by the EPA or Food and Drug Administration (FDA). Any operational use of chemical repellents

would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations which are established to avoid unreasonable adverse effects on the environment. Following labeling requirements and use restrictions are a built-in mitigation measure that would assure that use of registered chemical products would avoid significant adverse effects on human health.

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).

Alternative 3: Non-lethal Bird Damage Management Only by WS
Alternative 3 would not allow for any lethal methods use by WS in the Commonwealth. WS could only implement non-lethal methods such as harassment and exclusion devices and materials. Non-lethal methods could, however, include the tranquilizer drug alpha-chloralose and chemical repellents such as anthraquinone and methyl anthranilate which, although already considered safe for human consumption because it is artificial grape flavoring, which might nonetheless raise concerns about human health risks. Such chemicals must undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by the EPA or FDA. Any operational use of chemical repellents and tranquilizer drugs would be in accordance with labeling requirements under FIFRA and state pesticide laws and regulations and FDA rules which are established to avoid unreasonable adverse effects on the environment. 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.

Excessive cost or ineffectiveness of non-lethal techniques could result in some entities rejecting WS' assistance and resorting to other means of BDM. Such means could include illegal pesticide uses. Hazards to humans and pets could be greater under this alternative if chemicals that are less selective or that cause secondary poisoning are used. It is hypothetically possible that frustration caused by the inability to alleviate bird damage could lead to illegal use of certain toxicants that, unlike WS' controlled use of DRC-1339 and Avitrol, could pose secondary poisoning hazards to pets or other non-target animals. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the proposed alternative.

Alternative 4: No Federal WS Bird Damage Management
Alternative 4 would not allow any WS BDM in the Commonwealth. Concerns about human health risks from WS' use of chemical BDM methods would be alleviated because no such use would occur. DRC- 1339 and alpha-chloralose are only registered for use by WS personnel and would not be available for use by private individuals. Private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially leading to greater risk to human health and safety than the proposed action alternative. Commercial pest control services would be able to use Avitrol and Starlicide and such use would likely occur to a greater extent in the absence of WS' assistance. Use of Avitrol and Starlicide in accordance with label requirements should preclude any hazard to members of the public. However, hazards to humans and pets could be greater

under this alternative if other chemicals that are less selective or that cause secondary poisoning are used. It is hypothetically possible that frustration caused by the inability to alleviate bird damage could lead to illegal use of certain toxicants that, unlike WS' controlled use of DRC-1339 and Avitrol, could pose secondary poisoning hazards to pets or other non-target animals. Some chemicals that could be used illegally could present greater risks of adverse effects on humans than those used under the current program alternative.

4.1.3.2 Effects of Non-chemical BDM Methods on Human Safety

Alternative 1: Technical Assistance Only
Under this alternative, WS would not engage in direct operational use of any non-chemical BDM methods. Risks to human safety from WS' use of firearms, traps and pyrotechnics would hypothetically be lower than the Proposed Action alternative, since WS would not be conducting direct control activities. Hazards to humans and property could be greater under this alternative if personnel conducting BDM activities using non-chemical methods are poorly or improperly trained.

Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)
Non-chemical BDM methods that might raise safety concerns include shooting with firearms, traps and harassment with pyrotechnics. Firearms are only used by WS personnel who are experienced in handling and using them. WS personnel receive safety training on a periodic basis to keep them aware of safety concerns. The Pennsylvania WS program has had no accidents involving the use of firearms, traps or pyrotechnics in which a member of the public was harmed. A formal risk assessment of WS' operational management methods found that risks to human safety were low (USDA 1997, Appendix P). Therefore, no adverse affects on human safety from WS' use of these methods is expected.

Alternative 3: Non-lethal Bird Damage Management Only by WS
Under this alternative, non-chemical BDM methods that might raise safety concerns include shooting with firearms when used as a harassment technique, traps and harassment with pyrotechnics. Firearms are only used by WS personnel who are experienced in handling and using them. WS personnel receive safety training on a periodic basis to keep them aware of safety concerns. The Pennsylvania WS program has had no accidents involving the use of firearms, traps or pyrotechnics in which a member of the public was harmed. A formal risk assessment of WS' operational management methods found that risks to human safety were low (USDA 1997, Appendix P). Therefore, no adverse affects on human safety from WS' use of these methods is expected.

Alternative 4: No Federal WS Bird Damage Management
Alternative 4 would not allow any WS BDM in the Commonwealth. Concerns about human health risks from WS' use of non-chemical BDM methods would be alleviated because no such use would occur. The use of firearms, traps or pyrotechnics by WS would not occur in BDM activities in the Commonwealth. However, private efforts to reduce or prevent damage would be expected to increase, resulting in less experienced persons implementing damage management methods and potentially leading to greater risk to human health and safety than the proposed

action alternative. Commercial pest control services would be able to use pyrotechnics, traps or firearms in BDM programs and this activity would likely occur to a greater extent in the absence of WS' assistance. Hazards to humans and property could be greater under this alternative if personnel conducting BDM activities using non-chemical methods are poorly or improperly trained.

4.1.3.3 Effects on Human Health and Safety from Birds

Alternative 1: Technical Assistance Only
With WS technical assistance but no direct management, entities requesting BDM assistance for human health concerns would either take no action, which means the risk of human health problems would likely continue or increase in each situation as bird numbers are maintained or increased; or implement WS recommendations for non-lethal and lethal control methods. Potential impacts would be variable. Individuals or entities that implement management actions may or may not have the experience necessary to efficiently and effectively conduct an effective BDM program. In some situations the implementation of non-lethal controls such as electric or porcupine wires, netting barriers, and harassment could actually increase the risk of human health problems at other sites by causing the birds to move to other urban roosting sites not previously affected. This potential risk would be less likely under this alternative than Alternative 4 when people requesting assistance receive and accept WS technical assistance recommendations.

Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)
People are concerned with potential injury, illness, and loss of human life as a result of the potential impacts of injurious bird species. An Integrated BDM strategy, a combination of lethal and non-lethal means, has the greatest potential of successfully reducing this risk. All BDM methods could possibly be implemented and recommended by WS.

An IWDM approach reduces damage or threats to public health or safety for people who would have no relief from such damage or threats if non-lethal methods were ineffective or impractical. As discussed in Chapter 1, birds are a threat to aviation safety and can also carry or transmit diseases to humans. In most cases, it is difficult to conclusively prove that birds were responsible for transmission of individual human cases or outbreaks of bird-borne diseases. Nonetheless, certain requesters of BDM service may consider this risk to be unacceptable and may request such service primarily for that reason. In such cases, BDM, either by lethal or non-lethal means, would, if successful, reduce the risk of bird-borne disease transmission at the site for which BDM is requested.

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

Alternative 3: Non-lethal Bird Damage Management Only by WS
Under this alternative, WS would be restricted to implementing and recommending only non-lethal methods in providing assistance with bird damage problems. The success or failure of the use of non-lethal methods can be quite variable. WS would not be able to implement lethal management actions in those situations where non-lethal methods are not effective at reducing damage to acceptable levels. In these situations bird damage would likely remain the same or possibly increase unless cooperators implemented their own BDM program. In some situations the implementation of non-lethal controls such as electric or porcupine wires, netting barriers, and harassment could actually increase the risk of human health problems at other sites by causing the birds to move to other urban roosting sites not previously affected. Some requesting entities, such as city government officials, would reject WS assistance for this reason and would likely seek to achieve bird control by other means. However, if WS is providing direct operational assistance in relocating birds, coordination with local authorities may be conducted to assure they do not re-establish in other undesirable locations.

Alternative 4: No Federal WS Bird Damage Management
With no WS assistance, cooperators would be responsible for developing and implementing their own BDM program. Cooperator efforts to reduce or prevent conflicts could result in less experienced persons implementing control methods, therefore leading to a greater potential of not reducing bird hazards, than under the proposed action. In some situations the implementation of non-lethal controls such as electric or porcupine wires, netting barriers, and harassment could actually increase the risk of human health problems at other sites by causing the birds to move to other urban roosting sites not previously affected. Under this alternative, human health problems could increase if private individuals were unable to find and implement effective means of controlling birds that cause damage problems.

4.1.4 Impacts to Stakeholders, including Aesthetics

4.1.4.1 Effects on Human Affectionate Bonds with Individual Birds and on Aesthetic Values of Wild Bird Species

Alternative 1: Technical Assistance Only
Under this alternative, WS would not conduct any direct operational BDM, but would still provide technical assistance or self-help advice to persons requesting assistance with bird damage. Additionally, WS would not conduct any harassment of birds that were causing damage. Those who oppose direct operational assistance in wildlife damage management by the government, but favor government technical assistance, would favor this alternative. Persons who have developed affectionate bonds with individual wild birds would not be affected by WS' activities under this alternative because the individual birds would not be killed by WS. However, other private entities would likely conduct BDM activities similar to those that would no longer be conducted by WS, which means the effects would then be similar to the Proposed Action alternative.

Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)

Those who routinely view or feed individual birds, such as pigeons, would likely be disturbed by removal of such birds under the current program. WS is aware of such concerns and takes these concerns into consideration to mitigate effects. WS may be able to mitigate such concerns by leaving certain birds that have been identified by interested individuals.

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

Lethal removal of birds from airports should not affect the public's enjoyment of the aesthetics of the environment since airport properties are closed to public access. The ability to view and interact with birds at these sites is usually either restricted to viewing from a location outside boundary fences or is forbidden.

Alternative 3: Non-lethal Bird Damage Management Only by WS
Under this alternative, WS would not conduct any lethal BDM, but may conduct harassment of birds that are causing damage. Some people who oppose lethal control of wildlife by the government, but are tolerant of government involvement in non-lethal wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild birds would not be affected by the death of individual birds under this alternative, but might oppose dispersal or translocation of certain birds. WS may be able to mitigate such concerns by leaving certain birds that have been identified by interested individuals. In addition, the abundant populations of target bird species in urban environments would enable people to continue to view them and to establish affectionate bonds with individual wild birds. Although WS would not perform any lethal activities under this alternative, other private entities would likely conduct BDM activities similar to those that would no longer be conducted by WS, which means the effects would then be similar to the proposed action alternative.

Alternative 4: No Federal WS Bird Damage Management
Under this alternative, WS would not conduct any lethal removal of birds nor would the program conduct any harassment of birds. Those in opposition of any government involvement in wildlife damage management would favor this alternative. Persons who have developed affectionate bonds with individual wild birds would not be affected by WS' activities under this alternative. However, other private entities would likely conduct BDM activities similar to those that would no longer be conducted by WS, which means the effects would then be similar to the proposed action alternative.

4.1.4.2 Effects On Aesthetic Values of Property Damaged by Birds

Alternative 1: Technical Assistance Only

Under this alternative, the lack of operational assistance in reducing bird problems could result in an increase of potential adverse affects on aesthetic values. However, potential adverse affects would likely be less than as those under Alternative 4, since WS would be providing technical assistance.

Relocation of nuisance roosting or nesting populations of birds (e.g., starling roosts) through harassment, barriers, or habitat alteration can sometimes result in the birds causing the same problems at the new location. If WS has only provided technical assistance to local residents or municipal authorities, coordination with local authorities to monitor the birds' movements to assure the birds do not reestablish in other undesirable locations might not be conducted, thereby increasing the potential of adverse effects to nearby property owners.

Alternative 2: Integrated Bird Damage Management Program (Proposed Action/No Action)

Under this alternative, operational assistance in reducing bird problems, in which droppings from the birds cause an unsightly mess, would improve aesthetic values of affected properties. In addition, individuals objecting to the presence of invasive nonnative species, such as European starlings, pigeons, and house sparrows and whose aesthetic enjoyment of other birds is diminished by the presence of such species, will be positively affected by programs which result in reductions in the presence of such birds.

Relocation or dispersal of nuisance roosting or nesting populations of birds (e.g., starling roosts) by harassment can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities may be conducted to assure they do not re-establish in other undesirable locations.

Alternative 3: Non-lethal Bird Damage Management Only by WS

Under this alternative, WS would be restricted to non-lethal methods only. Assuming property owners would choose to allow and pay for the implementation of these non-lethal methods, this alternative could result in birds relocating to other sites where they would likely cause or aggravate similar problems for other property owners. Thus, this alternative would likely result in more property owners experiencing adverse effects on the aesthetic values of their properties than the Proposed Action alternative.

Relocation or dispersal of nuisance roosting or nesting populations of birds (e.g., starling roosts) by harassment can sometimes result in the birds causing the same or similar problems at the new location. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities may be conducted to assure they do not re-establish in other undesirable locations.

Alternative 4: No Federal WS Bird Damage Management

Under this alternative, the lack of any operational or technical assistance in reducing bird problems would mean aesthetic values of some properties would continue to be adversely affected if the property owners were not able to achieve BDM some other way. In many cases,

this type of aesthetic damage would worsen because property owners would not be able to resolve their problems.

Relocation of nuisance roosting or nesting population of birds (e.g., starling roosts) through harassment, barriers, or habitat alteration can sometimes result in the birds causing the same problems at the new location. Coordination of dispersal activities by local residents with local authorities to monitor the birds' movements to assure the birds do not re-establish in other undesirable locations might not be conducted, thereby increasing the potential of adverse effects to nearby property owners.

4.1.5 Humaneness and Animal Welfare Concerns of Methods Used

4.1.5.1 Alternative 1: Technical Assistance Only

Under this alternative, WS would provide self-help advice only. Thus, lethal methods, viewed as inhumane by some persons, would not be used by WS. Without WS direct operational assistance, it is expected that many requesters of BDM would reject non-lethal recommendations or would not be willing to pay the extra cost of implementing and maintaining them and would seek alternative lethal means. Similar to Alternative 3, DRC-1339 would no longer be available as it is only registered for use by or under the direct supervision of USDA personnel. Thus, the only chemical BDM methods legally available would be Avitrol and Starlicide. The use of Avitrol may be viewed by many persons as less humane than DRC-1339 or Starlicide. Improper or illegal use of both chemicals would likely be viewed as inhumane by the public. Similar to the proposed action shooting; and live trapping/capture and euthanization by decapitation, cervical dislocation, or CO_2 gas could be used by these entities. Overall, BDM under this alternative would likely be somewhat less humane than the Proposed Action alternative, but slightly more humane than Alternative 4.

4.1.5.2 Alternative 2: Implement an Integrated Bird Damage Management Program (Proposed Action/No Action)

Under this alternative, methods viewed by some persons as inhumane would be used in BDM by WS. These methods would include shooting; live trapping/capture and euthanization; and toxicants/chemicals such as DRC-1339 and Avitrol.

Shooting, when performed by experienced professionals, usually results in a quick death for target birds. Occasionally, however, some birds are initially wounded and must be shot a second time or must be caught by hand and then dispatched or euthanized. Some persons would view shooting as inhumane.

The primary lethal chemical BDM method that would be used by WS under this alternative would be DRC-1339. This chemical causes a quiet and apparently painless death resulting from uremic poisoning and congestion of major organs (Decino et al. 1966). The birds become listless and lethargic, and a quiet death normally occurs in 24 to 72 hours following ingestion. However, the method appears to result in a less stressful death than that which probably occurs by most natural causes, such as by disease, starvation, or predation. For these reasons, WS considers DRC-1339 use to be a relatively humane method of lethal BDM. However, despite the apparent

painlessness of the effects of this chemical, some persons will view any method that takes a number of hours to cause death as inhumane and unacceptable.

The chemical Avitrol repels birds by poisoning a few members of a flock, causing them to become hyperactive. Their distress calls generally alarm the other birds and cause them to leave the site. Only a small number of birds need to be affected to cause alarm in the rest of the flock. The affected birds generally die. In most cases where Avitrol is used, only a small percentage of the birds are affected and killed by the chemical with the rest being merely dispersed. In experiments to determine suffering, stress, or pain in affected animals, Rowsell, et. al. (1979) tested Avitrol on pigeons and observed subjects for clinical, pathological, or neural changes indicative of pain or distress. None were observed. Conclusions of the study were that the chemical met the criteria for a humane pesticide. Notwithstanding, some persons would view Avitrol as inhumane treatment of the birds that are affected by it based on the birds' distress-like behavior.

Occasionally, birds captured alive by use of the tranquilizer Alpha-chloralose, cage traps, by hand, or with nets would be euthanized. The most common method of euthanization would be by decapitation, cervical dislocation, or CO_2 gas which are described and approved by AVMA as humane euthanasia methods (Beaver et al. 2001). Most people would view AVMA-approved euthanization methods as humane.

4.1.5.3 Alternative 3: Non-lethal Bird Damage Management Only by WS

Under this alternative, lethal methods, viewed as inhumane by some persons, would not be used by WS. However, it is expected that many requesters of BDM assistance would reject non-lethal methods recommended by WS and/or would not be willing to pay the extra cost of implementing and maintaining them and would seek alternative lethal means. DRC-1339 would not be available to non-USDA entities; however, Avitrol and Starlicide would be legal for use by certified pest control operators. Avitrol would most likely be viewed as less humane than DRC-1339 or Starlicide because of the distress behaviors that it causes. Shooting could be used by non-WS entities and, similar to the current program alternative, would be viewed by some persons as inhumane. Live trapping/capture and euthanization by decapitation, cervical dislocation, or CO_2 gas could also be used by these entities.

4.1.5.4 Alternative 4: No Federal WS Bird Damage Management

Under this alternative, methods viewed as inhumane by some persons would not be used by WS. Similar to Alternatives 1 and 3, DRC-1339 would no longer be available for use since it is only registered for use by or under the direct supervision of WS personnel. However, Avitrol and Starlicide would be legal for use by certified pest control operators. Avitrol would most likely be viewed as less humane than DRC-1339 or Starlicide because of the distress behaviors that it causes. Shooting could be used by non-WS entities and, similar to the proposed action alternative, would be viewed by some persons as inhumane. Live trapping/capture and euthanasia by decapitation, cervical dislocation, or CO_2 gas could also be used by these entities.

4.2 CUMULATIVE IMPACTS

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

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

Under Alternatives 1, 2 and 3, WS would address damage associated with birds in a number of situations throughout the Commonwealth. The WS BDM program would be the primary federal program with BDM responsibilities; however, some state and local government agencies may conduct BDM activities in Pennsylvania as well. Through ongoing coordination with these agencies, WS is aware of such BDM 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 BDM activities at adjacent sites within the same time frame. In addition, commercial pest control companies may conduct BDM activities in the same area. The potential cumulative impacts analyzed below could occur either as a result of WS BDM 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

Bird 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. Population trend data indicate that target bird populations have remained relatively stable or decreased slightly for Pennsylvania, the region and the U.S. 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

BDM programs which include the use of pesticides 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. The avicides, DRC-1339 and Starlicide are the only chemicals used or recommended by the Pennsylvania WS BDM program for the purpose of obtaining lethal effects on birds. These chemicals have been evaluated for possible residual effects which might occur from buildup of the chemicals in soil, water, or other environmental sites.

> ***DRC-1339*** exhibits a low persistence in soil or water, and bioaccumulation of the chemical is unlikely (USDA 1997). Additionally, the relatively small quantity of DRC-1339 that will be used in BDM programs in Pennsylvania, the chemical's instability which results in speedy degradation of the product, and application protocol used in WS programs further reduces the likelihood of any environmental accumulation. DRC-1339 is not used by any other entities in Pennsylvania.
>
> ***Starlicide*** is similar to DRC-1339 used in feedlots; however, it contains 0.1% DRC-1339 (USDA 1997, Appendix P). Therefore, the cumulative impact potential from Starlicide use should be similar to DRC-1339.
>
> ***Avitrol*** may be used or recommended by the Pennsylvania WS program. Most applications would not be in contact with soil, applications would not be in contact with

surface or ground water, and uneaten baits will be recovered and disposed of according to EPA label specifications. Avitrol exhibits a high persistence in soil and water but, according to literature, does not bioaccumulate (USDA 1997 and EXTOXNET 2000). Because of Avitrol's characteristic of binding to soils, it is not expected to be present in surface or ground water as a result of its use on land (EPA 1980). A combination of chemical characteristics and baiting procedures used by WS would reduce the likelihood of environmental accumulation of Avitrol. The EPA has not required studies on the fate of Avitrol in the soil because, based on use patterns of the avicide, soil residues are expected to be low (EPA 1980).

Based on use patterns, the chemical and physical characteristics of DRC-1339, Starlicide, and Avitrol, 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 BDM program in Pennsylvania.

Non-lethal chemicals may also be used or recommended by the WS BDM program in Pennsylvania. Characteristics of these chemicals and use patterns indicate that no significant cumulative impacts related to environmental fate are expected from their use in WS BDM programs in Pennsylvania.

Cumulative Impact Potential from Non-chemical Components

Non-chemical methods used or recommended by WS BDM program in may include exclusion through use of various barriers, habitat modification of structures or vegetation, live trapping and translocation or euthanasia of birds, harassment of birds or bird flocks, and shooting.

Because shooting may be considered as a component of the non-chemical, the deposition of lead shot in the environment is a factor considered in this EA.

Lead Shot: Threats of lead toxicosis to waterfowl from the deposition of lead shot in waters where such species fed were observed more than one hundred years ago (Sanderson and Belrose 1986). As a result of discoveries made regarding impacts to several species of ducks and geese, federal restrictions were placed on the use of lead shot for waterfowl hunting in 1991. "Beginning September 1, 1991, the contiguous 48 United States, and the States of Alaska and Hawaii, the Territories of Puerto Rico and the Virgin Islands, and the territorial waters of the United States, are designated for the purpose of Sec. 20.21 (j) as nontoxic shot zones for hunting waterfowl, coots, and certain other species. 'Certain other species' refers to those species, other than waterfowl or coots, affected by reason of being included in aggregate bags and concurrent seasons."

All WS BDM shooting activities conform to federal, state and local laws. If activities are conducted near or over water, WS uses steel shot during activities. Consequently, no deposition of lead in nontoxic shot zones is likely to occur as a result of WS BDM actions in Pennsylvania. Therefore, cumulative impacts are not likely to occur if toxic shot is used. Additionally, WS will evaluate other BDM actions which entail the use of shot on a case by case basis to determine if deposition of lead shot poses any risk to non-

target animals, such as domestic livestock. If such risk exists, WS will use nontoxic shot in those situations.

Roost Harassment/Relocation: Some potential exists for cumulative impacts to human health and safety related to the harassment of roosting bird flocks such as European starlings in urban environments. If birds are dispersed from one site and relocate to another where human exposure to concentrations of bird droppings over time occurs, human health and safety could be threatened. If WS is providing direct operational assistance in relocating such birds, coordination with local authorities may be conducted to assure they do not re-establish in other undesirable locations.

SUMMARY

No significant cumulative environmental impacts are expected from any of the 4 alternatives. Under the Proposed Action, the lethal removal of birds by WS would not have a significant impact on overall starling, pigeon, grackle, cowbird, and sparrow populations in Pennsylvania, but some local reductions may occur. No risk to public safety is expected when WS' services are provided and accepted by requesting individuals in Alternatives 1, 2, and 3, since only trained and experienced wildlife biologists/specialists would conduct and recommend BDM activities. There is a slight increased risk to public safety when persons who reject WS assistance and recommendations in Alternatives 1, 2 and 3 and conduct their own BDM activities, and when no WS assistance is provided in Alternative 4. In all 4 Alternatives, however, it would not be to the point that the impacts would be significant. Although some persons will likely be opposed to WS' participation in BDM activities on public and private lands within the Commonwealth of Pennsylvania, the analysis in this EA indicates that WS Integrated BDM 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 5. Summary of Potential Impacts.

Issues	***Alternative 1 Technical Assistance Only***	***Alternative 2 Integrated Bird Damage Management Program (Proposed Action/No Action)***	***Alternative 3 Nonlethal BDM Only by WS***	***Alternative 4 No Federal WS BDM Program***
Target Species Effects	No effect by WS. Low effect - reductions in local starling, pigeon, grackle, cowbird, and sparrow numbers by non-WS personnel likely; would not significantly affect state and regional populations.	Low effect - reductions in local starling, pigeon, grackle, cowbird, and sparrow numbers; would not significantly affect state and regional populations	Low effect - reductions in local starling, pigeon, grackle, cowbird, and sparrow numbers by non-WS personnel likely; would not significantly affect state and regional populations.	No effect by WS. Low effect - reductions in local starling, pigeon, grackle, cowbird, and sparrow numbers by non-WS personnel likely; would not significantly affect state and regional populations
Effects on Other Wildlife Species, Including T&E Species	No effect by WS. 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 effect by WS. Impacts by non-WS personnel would be variable.
Human Health and Safety Risks	Efforts by non-WS personnel to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater potential of not reducing bird damage than under the proposed action.	The proposed action has the greatest potential of successfully reducing this risk.	Impacts could be greater under this alternative than the proposed action.	Efforts by non-WS personnel to reduce or prevent conflicts could result in less experienced persons implementing control methods, leading to a greater potential of not reducing bird damage than under the proposed action.

Issues	*Alternative 1 Technical Assistance Only*	*Alternative 2* *Integrated Bird Damage Management Program (Proposed Action/No Action)*	*Alternative 3* *Nonlethal BDM Only by WS*	*Alternative 4 No Federal WS BDM Program*
Aesthetic Enjoyment of Birds	Low to moderate effect. Local bird numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state starling, pigeon, grackle, cowbird, and sparrow populations.	Low to moderate effect at local levels; Some local populations may be reduced; WS bird damage management activities do not adversely affect overall regional or state starling, pigeon, grackle, cowbird, and sparrow populations.	Low to moderate effect. Local bird numbers in damage situations would remain high or possibly increase when non-lethal methods are ineffective unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state starling, pigeon, grackle, cowbird, and sparrow populations.	Low to moderate effect. Local bird numbers in damage situations would remain high or possibly increase unless non-WS personnel successfully implement lethal methods; no adverse affect on overall regional and state starling, pigeon, grackle, cowbird, and sparrow populations.
Aesthetic Damage Caused by Birds	Moderate to High effect - birds may move to other sites which can create aesthetic damage problems at new sites.	Low effect - bird damage problems most likely to be resolved without creating or moving problems elsewhere.	Moderate to High effect - birds may move to other sites which can create aesthetic damage problems at new sites. Less likely than Alt. 1 and 4.	High effect - bird problems less likely to be resolved without WS involvement. Birds may move to other sites which can create aesthetic damage problems at new sites
Humaneness Concerns of Methods Used	No effect by WS. Impacts by non-WS personnel would be variable.	Low to moderate effect - methods viewed by some people as inhumane would be used by WS.	Lower effect than Alt. 2 since only non-lethal methods would be used by WS	No effect by WS. Impacts by non-WS personnel would be variable.

CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

5.1 LIST OF PREPARERS/REVIEWERS

Jason Suckow, State Director, USDA-APHIS-Wildlife Services, Summerdale, PA
Emily Chapin, Wildlife Technician, USDA-APHIS-Wildlife Services, Summerdale, PA
David Reinhold, NEPA Coordinator, USDA-APHIS-Wildlife Services, Riverdale, MD
Joanne Garrett, OSS Director, USDA-APHIS-Wildlife Services, Riverdale, MD

5.2 LIST OF PERSONS CONSULTED

Daniel Brauning, Wildlife Biologist, Wildlife Diversity Section, Pennsylvania Game Commission
Calvin DuBrock, Wildlife Management Director, Pennsylvania Game Commission

APPENDIX A
LITERATURE CITED

Audubon. 2003. West Nile Virus – Effects on Wildlife. www.audubon.org/bird/wnv/

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

Arhart, D.K. 1972. Some factors that influence the response of European starlings to aversive visual stimuli. M.S. Thesis. Oregon State University Corvallis.

_____ , M.L., J.S. Humphrey, and D.G. Decker. 1997. Feeding deterrence of anthraquinone, anthracene, and anthrone to rice-eating birds. J. Wildl. Manage. 61(4):1359-1365.

Barnes, T.G. 1991. Eastern bluebirds, nesting structure design and placement. College of Agric. Ext. Publ. FOR-52. Univ. of Kentucky, Lexington, KY, 4pp.

Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B.T. Bennett, P. Pascoe, E. Shull, L.C. Cork, R. Franis-Floyd, K.D. Amass, R. Johnson, R.H. Schmidt, W. Underwood, G.W. Thorton, and B.Kohn. 2001. 2000 Report of the AVMA Panel on Euthanasia. J. Am. Vet Med Assoc 218:669-696.

Belant, J. L., T. W. Seamans, L. A. Tyson, and S. K. Ickes. 1996. Repellency of methyl anthranilate to pre- exposed and naive Canada geese. J. Wildl. Manage. 60:923-928.

Besser, J.F., W. C. Royal, and J. W. DeGrazio. 1967. Baiting European starlings with DRC-1339 at a cattle feedlot. J. Wildl. Manage. 3:48-51.

_____ , J. W. DeGrazio, and J.L. Guarino. 1968. Costs of wintering European starlings and red-winged blackbirds at feedlots. Journal of Wildl. Manage. 32:179-180.

Bishop, R. C. 1987. Economic values defined. Pages 24 -33 in D. J. Decker and G. R. Goff, eds. Valuing wildlife: economic and social perspectives. Westview Press, Boulder, CO. 424 p.

Blackwell, B.F., G.E. Bernhardt, R.A. Dolbeer. 2002. Lasers as nonlethal avian repellents. J. Wildl. Manage. 66:250-258.

Blanton, E. M., B. U. Constantin, and G. L. Williams. 1992. Efficacy and methodology of urban pigeon control with DRC-1339. Proc. East. Wildl. Damage Cont. Conf. 5:58-62.

Bomford, M. 1990. Ineffectiveness of a sonic device for deterring European starlings. Wild. Soc. Bull. 18:(2):151-156.

Booth, T.W. 1994. Bird Dispersal Techniques. Pages E19-23 in S.E. Hyngstrom, R. M. Timm, and G.E. Larson, eds. Prevention and control of wildlife damage. Univ. Of Nebraska. Lincoln, NE.

Boyd, F. L., and D. I. Hall. 1987. Use of DRC 1339 to control crows in three roosts in Kentucky and Arkansas. Third Eastern Wildlife Damage Control Conference 3:3-7.

Brauning, D.W. 1992. Atlas of Breeding Birds in Pennsylvania. University of Pittsburgh Press, Pittsburgh, PA.

Bull, J. and J. Farrand, Jr. 1977. The Audubon Society Field Guide to North American Birds, Eastern Region. Alfred A. Knopf, Inc., New York, NY.

CDFG (California Department of Fish and Game). 1991. California department of fish and game. Final environmental document - bear hunting. Sections 265, 365, 366, 367, 367.5. Title 14 Calif. Code of Regs. Calif. Dept. of Fish and Game, State of California, April 25, 1991. 13pp.

Center for Disease Control and Prevention (CDC). 2003. West Nile Virus. www.cdc.gov.ncidod/dvbid/westnile/birds&mammals.htm.

CEQ (Council for Environmental Quality). 1981. Forty most asked questions concerning CEQ's National Environmental Policy Act regulations. (40 CFR 1500-1508) Fed. Reg. 46(55):18026-18038.

Clark, L. 1997. Dermal contact repellents for European starlings: foot exposure to natural plant products. J. Wildl. Manage. 61(4): 1352-1358.

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

Conover, M. R. 1982. Evaluation of behavioral techniques to reduce wildlife damage. Proc. Wildl.-Livestock Relation. Sym. 10:332-344.

Cornell University. 2003. West Nile Virus: Transmission, Infection, & Symptoms. Environmental Risk Analysis Program, Cornell University – Department of Communication & Center for the Environment. http://environmentalrisk.cornell.edu/WNV/Summary2.cfm

Cummings, J. L., P. A. Pochop, J. E. Davis Jr., and H. W. Krupa. 1995. Evaluation of Rejex-It AG-36 as a Canada goose grazing repellent. J. Wildl. Manage. 59:47-50

Cunningham, D.J., E.W. Schafer, and L.K. McConnell. 1981. DRC-1339 and DRC-2698 residues in European starlings: preliminary evaluation of their effects on secondary hazard potential. Proc. Bird Control Semin. 8:31-37.

Davis, J.W., R.C. Anderson, L. Karstad, and D.O. Trainer. 1971. Infectious and Parasitic Diseases of Wild Birds. Iowa State University Press, Ames, Iowa.

Day, G. I., S. D. Schemnitz, and R. D. Taber. 1980. Capturing and marking wild animals. pp. 61-88 *in* Wildlife management techniques manual. S. D. Schemnitz ed. The Wildlife Society, Inc. Bethesda, MD. 686 pp.

Decino, T.J., D.J. Cunningham, and E.W. Schafer. 1966. Toxicity of DRC-1339 to European starlings. J. Wildl.\ Manage. 30(2):249-253.

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

DeHaven, R.W. and J.L. Guarino. 1969. A nest box trap for European starlings. Bird Banding 40:49-50.

Dolbeer, R.A., C.R. Ingram, and J.L. Seubert. 1976. Modeling as a management tool for assessing the impact of blackbird control measures. Proc. Vertebr. Pest Conf. 7:35-45.

_____, Richard A.; Woronecki, Paul P.; Stickley, Allen R., Jr. and White, Stephen B. 1978. Agricultural impact of winter population of blackbirds and starlings. Wilson Bull.:90 (1): 31-44.

_____ , P.P. Woronecki, and R.L. Bruggers. 1986. Reflecting tapes repel blackbirds from millet, sunflowers, and sweet corn. Wildl. Soc. Bull. 14:418-425.

_____ , M.A. Link, and P.P. Woronecki. 1988. Naphthalene shows no repellency for European starlings. Wildl. Soc. Bull. 16:62-64.

_____ , L. Clark, P.P. Woronecki, and T.W. Seamans. 1992. Pen tests of methyl anthranilate as a bird repellent in water. Proc. East. Wildl. Damage Control Conf. 5:112-116.

_____ , J.L. Belant, and L. Clark. 1993. Methyl anthranilate formulations to repel birds from water at airports and food at landfills. Proc. Great Plains Wildl. Damage Contr. Workshop. 11:42-52.

_____. 1994. Blackbirds: damage preventention and control methods for blackbirds. Pages E25-32 in S.E. Hyngstrom, R. M. Timm, and G.E. Larson, eds. Prevention and control of wildlife damage. Univ. Of Nebraska. Lincoln, NE.

_____ , D.F. Mott, and J.L. Belant. 1995. Blackbirds and European starlings killed at winter roosts from PA-14 applications, 1974-1992: Implications for regional population management. Proc. East. Wildl. Damage Control Conf.

_____ , R. A. 1997. Feathered and furry fod - a serious problem at U. S. airports. Bird Strike Briefing, National Aerospace FOD Prevention Conf., 24-26 June 1997, Seattle WA. USDA / Wildl. Serv., National Wildl. Res. Ctr., Ohio Field Sta., 6100 Columbus Ave., Sandusky, OH 44870 USA.

_____ , T.W. Seamans, B.F. Blackwell, J.L. Belant. 1998. Anthraquinone formulation (Flight Control™) shows promise as avian feeding repellent. J. Wildl. Manage. 62(4)1558-1564.

Ehrlich, P. R.., D. S. Dobkin, and D. Wheye. 1988. The birder's handbook: a field guide to the natural history of North American birds. Simon & Schuster, Inc. New York. 785pp.

EPA (U.S. Environmental Protection Agency). 1980 (Sept.). Pesticide registration standard: 4-aminopyridine: avitrol. Office of Pesticides and Toxic Substances. Washington, DC.

_____ . 1995. R.E.D. Facts — Starlicide (3-chloro-p-toluidine hydrochloride). USEPA, Prevention, Pesticides and Toxic Substances. EPA-738-F-96-003. 4 p.

_____ . 1997. 4-Aminopyridine. Health Assessment Information. Taken from USEPA IRIS data file No. 504-24-5 (03/01/97) at Internet site http://www.epa.gov/ngispgm3/irisdat/0440.DAT

ETOXNET (Extension Toxicology Network). 1996. 4-Aminopyridine. Pesticide Information Profiles. Coop. Ext. Offices at Cornell Univ., OR State Univ., Univ. of ID, Univ. of CA-Davis, and the Instit. for Envir. Toxicology, MI State Univ. Information taken from Internet site http://ace.ace.orst.edu/info/extoxnet/pips/4-aminop.htm.

_____ . 2000. 4-Aminopyridine. Pesticide Information Profiles. Coop. Ext. Offices at Cornell Univ., OR State Univ., Univ. of ID, Univ. of CA-Davis, and the Instit. for Envir. Toxicology, MI State Univ. Information taken from Internet site http://pmep.cce.cornell.edu/profiles/ extoxnet/24d- captan/4aminopyridine-ext.html

Feare, C., A.J. Isaacson, P.A. Sheppard, and J.M. Hogan. 1981. Attempts to reduce starling damage at dairy farms. Protection Ecol. 3(2):173-181.

_____ . 1984. The Starling. Oxford University Press. Oxford New York.

Fitzwater, W. D. 1994. House Sparrows. pp. E101-108 *in* Prevention and control of wildlife damage. S. Hygnstrom, R. Timm, and G. Larson eds. Coop. Ext. Serv. Univ. of Nebr.-Lincoln.

Forbes, J.E. 1995. European starlings are expensive nuisance on dairy farms. Ag. Impact. 17(1):4.

Friedman, H. 1929. The cowbirds. Charles C. Thoman, Pub., Baltimore, MD. 421 pp.

Fuller-Perrine, L.D. and M.E. Tobin. 1993. A method for applying and removing bird exclusion netting in commercial vineyards. Wildl. Soc. Bull. 21:47-51.

Glahn, J.F. 1982. Use of starlicide to reduce starling damage at livestock feeding operations. Proc. Great Plains Wildl. Damage Control Workshop. 5:273-277.

_____ . 1983. Blackbird and starling depredations at Tennessee livestock farms. Proc. Bird Control Semin. 9:125-134.

_____ , and D.L. Otis. 1981. Approach for assessing feed loss damage by European starlings at livestock feedlots. ASTM Spec. Tech. Publ. No.752. p.38-45.

_____ , and D.L. Otis. 1986. Factors influencing blackbird and European starling damage at livestock feeding operations. J. Wildl. Manage. 50:15-19.

_____ , S.K. Timbrook, and D.J. Twedt. 1987. Temporal use patterns of wintering European starlings at a southeastern livestock farm: implications for damage control. Proc. East. Wildl. Damage Control Conf. 3:194-203.

_____ , and E. A. Wilson. 1992. Effectiveness of DRC-1339 baiting for reducing blackbird damage to sprouting rice. Proc. East. Wildl. Damage Cont. Conf. 5:117-123.

_____, G. Ellis, P. Fiornelli, and B. Dorr. 2000. Evaluation of low to moderate power lasers for dispering double-crested cormorants from their night roosts. Proceedings of the 9th Wildlife Damage Management Conference. 9:34-35.

Grabill, B.A. 1977. Reducing starling use of wood duck boxes. Wildl. Soc. Bull. 5(2):67-70.

Graves, G. E., and W. F. Andelt. 1987. Prevention and control of woodpecker damage. Service in Action, Colo. St. Univ. Coop. Ex. Serv. Publ. no 6.516. Ft. Collins, Colo. 2 pp.

Heusmann, H.W., W.W. Blandin, and R.E. Turner. 1977. Starling deterrent nesting cylinders in wood duck management. Wildl. Soc. Bull. 5(1):14-18.

_____ , and R. Bellville. 1978. Effects of nest removal on starling populations. Wilson Bull. 90(2):287- 290.

Holler, N. R. and E. W. Schafer. 1982. Potential secondary hazards of Avitrol baits to sharp-shinned hawks and American kestrels. J. Wildl. Manage. 46:457-462

Hughes, Daymond and Doug Hoffman. 2003. Environmental Assessment: Reducing Pigeon, Starling, and Sparrow Damage through an Integrated Wildlife Damage Management Program in the State of Georgia. United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services.

Ingold, D.J. 1994. Influence of nest site competition between European starlings and woodpeckers. Wilson Bull 1106(2):227-241.

Johnson, R. J. 1994. American crows. Pages E33-40 in S.E. Hyngstrom, R. M. Timm, and G.E. Larson, eds. Prevention and control of wildlife damage. Univ. Of Nebraska. Lincoln, NE.

_____, R.J., and J.F. Glahn. 1994. European starlings. p. E-109 - E-120 in Hygnstrom, S.E., R.M. Timm, and G.E. Larson, Prevention and control of wildlife damage - 1994. Univ. NE Coop. Ext., Instit. o f Ag. and Nat. Res., Univ. of NE-Lincoln, USDA, APHIS, ADC, Great Plains Ag. Council Wildl. Committee.

_____, J. J., D. B. Hurlbut, M. L. Avery, and J. C. Rhyans. 1999. Methods for the diagnosis of acute 3- chloro-p-toluidine hydrochloride poisoning in birds and the estimation of secondary hazards to wildlife. Environ. Toxicology and Chemistry. 18:2533-2537.

Knittle, C.E. and J.L. Guarino. 1976. Reducing a local population of European starlings with nest-box traps. Proc. Bird Control. Semin. 7:65-66.

Kreps, L. B. 1974. Feral pigeon control. Proc. Vertebr. Pest. Conf. 6:257-262.

Kerpez, T.A. and N.S. Smith. 1990. Competition between European starlings and native woodpeckers for nest cavities in saguaros. Auk. 107:367-375.

Larsen, K. H., and J. H. Dietrich. 1970. Reduction of a raven population on lambing grounds with DRC-1339. J. Wildl. Manage. 34:200-204.

Mason, J.R., R.E. Stebbings and G.P. Winn. 1972. Noctules and European starlings competing for roosting holes. J. Zool. 166:467.

_____ , A. H. Arzt, and R.F. Reidinger. 1984. Evaluation of dimethylanthranilate as a nontoxic starling repellent for feedlot settings. Proc. East. Wildl. Damage Control Conf. 1:259-263.

_____ , M.A. Adams, and L. Clark. 1989. Anthranilate repellency to European starlings: chemical correlates and sensory perception. J. Wildl. Manage. 53:55-64.

_____ , and L. Clark. 1992. Nonlethal repellents: the development of cost-effective, practical solutions to agricultural and industrial problems. Proc. Vertebr. Pest Conf. 15:115-129.

McCracken H.F. 1972. Starling control in Sonoma County. Proc. Vertebr. Pest Conf. 5:124-126.

McGilvrey, F.B. and F.M. Uhler. 1971. A starling deterrent wood duck nest box. J. Wildl. Manage. 35:793-797.

Meanley, B. and W. C. Royall. 1976. Nationwide estimates of blackbirds and European starlings. Proc. Bird Control Seminar. 7:39-40.

Miller, J.W. 1975. Much ado about European starlings. Nat. Hist. 84(7):38-45

Morbidity and Mortality Weekly Report (MMWR). 2002. Provisional Surveillance Summary of the West Nile Virus Epidemic – United States, January-November 2002. Center for Disease and Surveillance; December 20, 2002. Vol. 51; No. 50.

Mott. D.F. 1985. Dispersing blackbird-starling roosts with helium-filled balloons. Proc. East. Wildl. Damage Conf. 2:156-162.

Nickell, W.P. 1967. European starlings and sparrow hawks occupy same nest box. Jack-Pine Warbler 45:55

NTSB (National Transportation Safety Board). 1999. Safety Recommendation to the Federal Aviation Administration, Washington, D.C. 20591. A-99-86 through -94.

Peterson, R.T. 1980. Eastern Birds. Houghton Mifflin Co., Boston, MA.

Pochop, P.A. 1998. Comparison of white mineral oil and corn oil to reduce hatchability of ring-billed gull eggs. Proc. Vertebr. Pest Conf. 18:411-413.

_____ , J.L. Cummings, J.E. Steuber, and C.A. Yoder. 1998. Effectiveness of several oils to reduce hatchability of chicken eggs. J. Wildl. Manage. 62(1):395-398.

Rappole, J.H., S.R. Derrickson, and Z. Hubalek. 2000. Migratory birds and the spread of West Nile virus in the Western Hemisphere. Emerging Infectious Diseases 6(4):319-328.

RJ Advantage, Inc. 1997.

Robbins, C. S. 1973. Introduction, spread, and present abundance of the house sparrow in North America. Ornithol. Monogr. 14:3-9.

Rossbach, R. 1975. Further experiences with the electroacoustic method of driving European starlings from their sleeping areas. Emberiza 2(3):176-179.

Rowsell, E. V.; Carnie, J. A.; Wahbi, S. D.; Al-Tai, A. H. and Rowsell, Kathleen V. 1979. L-serine dehydratase and L-serine-pyruvate aminotransferase activities in different animal species. Comp. Biochem. Physiol. B Comp. Biochem.; 63 (4): 543-555.

_____ , T.J. DeCino, and J.F. Besser. 1967. Reduction of a Starling Population at a Turkey Farm. Poultry Science. Vol. XLVI No. 6. pp 1494-1495.

Royall, W. C. 1977. Blackbird-Starling Roost Survey. Bird Damage Research Report #52. Denver Wildlife Research Center. 54pp.

Sanderson, Glen C., and Frank C. Bellrose. 1986. A review of the problem of lead poisoning in waterfowl. Illinois Natural History Survey, Champaign, IL. Spec. Publ. 4. Jamestown ND: Northern Prairie Wildl. Res. Ctr. Home Page. Http://www.npwrc.usgs.gov/resource/othrdata/pbpoison/pbpoison.htm (Version 170CT97). 34pp.

Sauer, J. R., S. Schwartz, and B. Hoover. 1996. The Christmas bird count home page. Version 95.1. Patuxent Wildlife Research Center, Laurel, MD (Info. retrieved from http://www.mbr- pwrc.usgs.gov/bbs/cbc.html).

_____., J. E. Hines, and J. Fallon. 2003. The North American breeding bird survey, results and analysis 1996 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center. Laurel, MD.

Schafer, E. W. Jr., R. B. Brunton, and N. F. Lockyer. 1974. Hazards to animals feeding on blackbirds killed with 4-aminopyrine baits. J. Wildl. Manage. 38:424-426.

_____, E. W., Jr. 1981. Bird control chemicals – nature, modes of action, and toxicity. Pages 129-139 in CRC handbook of pest management in agriculture. Vol. 3. CRC Press, Cleveland, OH.

_____, E. W., Jr. 1984. Potential primary and secondary hazards of avicides. Proc. Vert. Pest Conf. 11:217-222.

_____, E. W. 1991. "Bird control chemicals-nature, mode of action and toxicity." pp. 599-610 *in* CRC Handbook of Pest Management in Agriculture Vol. II. CRC Press, Cleveland, OH.

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

Schmidt, R.H. and R.J. Johnson. 1984. Bird dispersal recordings: an overview. ASTM STP 817. 4:43-65.

Seamans, T.W., D.W. Hamershock, and G.E. Bernhardt. 1995. Determination of body density for twelve bird species. Ibis 137:424-428.

Shake, W.F. 1967. Starling wood duck interrelationships. M.S. Thesis. Western Illinois University, Macomb.

Shirota, Y.M. and S. Masake. 1983. Eyespotted balloons are a device to scare gray European starlings. Appl. Ent. Zool. 18:545-549.

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

Stickley, A.R. and R.J. Weeks. 1985. Histoplasmosis and its impact on blackbird/starling roost management. Proc. East. Wildl. Damage Control. Conf. 2:163-171.

Terres, J.K. 1980. The Audubon Society Encyclopedia of North American Birds. Wings Bros. New York, New York.

Tobin, M. E., P. P. Woronecki, R. A. Dolbeer, R. L. Bruggers. 1988. Reflecting tape fails to protect ripening blueberries from bird damage. Wildl. Soc. Bull. 16:300-303.

Twedt, D.J., and J.F. Glahn. 1982. Reducing starling depredations at livestock feeding operations through changes in management practices. Proc. Vertebr. Pest Conf. 10:159-163.

USDA (U.S. Department of Agriculture), Animal and Plant Health Inspection Service (APHIS), Animal Damage Control (ADC) Strategic Plan. 1989. USDA, APHIS, ADC Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737.

_____ , (APHIS) Animal and Plant Health Inspection Service, (ADC) Animal Damage Control Program. 1997 (revised). Final Environmental Impact Statement. USDA, APHIS, ADC Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737.

USFWS (U.S. Fish and Wildlife Service). 1981. Domestic Pigeon. USDI. 4 pp.

USGS (U.S. Geological Service). 2003. Breeding Bird Survey. Internet site: http://www.mbr-pwrc.usgs.gov/bbs/.

United States Geological Survey (USGS)-National Wildlife Health Center (NWHC). 2003. NWHC West Nile Virus Project. www.nwhc.usgs.gov/research/west_nile.html

Vogt, P.F. 1997. Control of nuisance birds by fogging with REJEX-IT®TP-40. Proc. Great Plains Wildl. Damage Contr. Workshop 13. p. 63-66.

Von Jarchow, B.L. 1943. European starlings frustrate sparrow hawks in nesting attempt. Passenger Pigeon. 5(2):51.

Weber, W.J. 1979. Health Hazards from Pigeons, European starlings, and English Sparrows. Thompson Publ. Fresno, Calif. 138 p.

Weitzel, N.H. 1988. Nest site competition between the European starling and native breeding birds in northwestern Nevada. Condor. 90(2):515-517.

West, R.R., J.F. Besser and J.W. DeGrazio. 1967. Starling control in livestock feeding areas. Proc. Vertebr. Pest Conf. San Francisco, CA.

_____. and J.F. Besser. 1976. Selection of toxic poultry pellets from cattle rations by starlings. Proc. Bird Control Semin. 7:242-244.

Wildlife Society, The. 1990. Conservation policies of the Wildlife Society. The Wildlife Society. Wash., D.C. 20 pp.

Williams, R. E. 1983. Integrated management of wintering blackbirds and their economic impact at south Texas feedlots. Ph.D. Dissertation, Tex. A&M Univ., College Station. 282 pp.

Williams, D.E., and R.M. Corrigan. 1994. Pigeons (Rock Doves). pp E-87 to E-96 *in* S. E. Hygnstrom, R. M. Timm and G. E. Larson (eds.) Prevention and Control of Wildlife Damage. Univ. Nebraska and USDA-APHIS-WS and Great Plains Agric. Council Wildl. Comm., Lincoln, Nebr.

Wilmer, T.J. 1987. Competition between European starlings and kestrels for nest boxes: a review. Raptor Res. Rep. No. 6 p. 156-159.

Woronecki, P. P., R. A. Dolbeer, and T. W. Seamans. 1990. Use of alpha-chloralose to remove waterfowl from nuisance and damage situations. Proc. Vertbr. Pest Conf. 14:343-349.

Wright, E.N. 1973. Experiments to control starling damage at intensive animal husbandry units. Bull. OEPP. 9:85-89.

APPENDIX B

BIRD DAMAGE MANAGEMENT METHODS AVAILABLE FOR USE OR RECOMMENDATION BY THE PENNSYLVANIA WILDLIFE SERVICES PROGRAM

NON-LETHAL, NON-CHEMICAL METHODS

Agricultural producer and property owner practices: These consist primarily of non-lethal preventive methods such as cultural methods and habitat modification. Cultural methods and other management techniques are implemented by the agricultural producer or property owners/managers. Resource owners/managers 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:

> **Cultural methods:** Cultural methods may include altering planting dates so that crops are not young and vulnerable to damage when the damage-causing species are present, or the planting of crops that are less attractive or less vulnerable to such species. At feedlots or dairies, cultural methods generally involve modifications to the level of care or attention given to livestock, which may vary depending on the age and size of the livestock. Animal husbandry practices include, but are not limited to, techniques such as night feeding, indoor feeding, closed barns or corrals, removal of spilled grain or standing water, and use of bird proof feeders (Johnson and Glahn 1994).
>
> **Environmental/Habitat modification** can be an integral part of BDM. Wildlife production and/or presence is directly related to the type, quality, and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain bird species or to repel certain birds. In most cases, the resource or property owner is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of BDM strategies at or near airports to reduce bird-aircraft strike hazards by eliminating bird nesting, roosting, loafing, or feeding sites. Generally, many bird problems on airport properties can be minimized through management of vegetation and water from areas adjacent to aircraft runways. Habitat management is often necessary to minimize damage caused by starlings that form large roosts during late autumn and winter. Bird activity can be greatly reduced at roost sites by removing all the trees or selectively thinning the stand.

Animal behavior modification: This refers to tactics that alter the behavior of wildlife to reduce damage. Animal behavior modification may involve use of scare tactics or fencing to deter or repel animals that cause loss or damage (Twedt and Glahn 1982). Some of the methods included in this category are:

- Bird-proof barriers
- Electronic guards
- Propane exploders
- Pyrotechnics
- Distress Calls and sound producing devices
- Chemical frightening agents
- Repellents
- Scare crows
- Mylar tape
- Lasers
- Eye-spot balloons

These techniques are generally only practical for small areas. Scaring devices such as distress calls, helium-filled eye-spot balloons, raptor effigies and silhouettes, mirrors, and moving disks can be effective, but usually for only a short time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Graves and Andelt 1987, Mott 1985, Shirota et al. 1983, Conover 1982, Arhart 1972). Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et al. 1986, Tobin et al. 1988).

Bird proof barriers can be effective, but are often cost-prohibitive as the aerial mobility of birds usually requires overhead barriers as well as peripheral fencing or netting. Exclusionary devices, adequate to stop bird movements, can also restrict movements of livestock, people and other wildlife (Fuller-Perrine and Tobin 1993). Netting can be used to exclude birds from a specific area by the placement of bird-proof netting over and around the specific resource to be protected. Exclusion may be impractical in most settings (e.g., commercial agriculture); however, it can be practical in small areas (e.g., personal gardens) or for high-value crops (e.g., grapes) (Johnson 1994). Although this alternative would provide short-term relief from damage, it may not completely deter birds from feeding, loafing, staging, or roosting at that site. The public often finds exclusionary devices, such as netting, unsightly and fear the devices will lower the aesthetic value of the neighborhood when used over personal gardens.

Auditory scaring devices such as propane exploders, pyrotechnics, electronic guards, scarecrows, and audio distress/predator vocalizations are effective in many situations for dispersing damage-causing bird species. These devices are sometimes effective, but usually only for a short period of time before birds become accustomed and learn to ignore them (Schmidt and Johnson 1984, Bomford 1990, Rossbach 1975, Mott 1985, Shirota and Masake 1983, and Arhart

1972). Williams (1983) reported an approximate 50% reduction in blackbirds at two south Texas feedlots as a result of pyrotechnics and propane cannon use. However, these devices are often not practical in dairy or feedlot situations because of the disturbance to livestock, although livestock can generally be expected to habituate to the noise. Birds, too, quickly learn to ignore scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

Visual scaring techniques such as the use of Mylar tape (highly reflective surface produces flashes of light that startles birds), eye-spot balloons (the large eyes supposedly give birds a visual cue that a large predator is present), flags, lasers, and effigies (scarecrows), are occasionally effective in reducing bird damage. Mylar tape has produced mixed results in its effectiveness to frighten birds (Dolbeer et.al. 1986, and Tobin et.al. 1988). Birds quickly learn to ignore visual and other scaring devices if the birds' fear of the methods is not reinforced with shooting or other tactics.

Lasers are a non-lethal technique recently evaluated by the USDA, APHIS, WS, National Wildlife Research Center (NWRC) (Blackwell et al. 2002, Glahn et al. 2000). For best results and to disperse numerous birds from a roost, the laser is most effectively used in periods of low light, such as after sunset and before sunrise. In the daytime, the laser can also be used during overcast conditions or in shaded areas to move individual and small numbers of birds, although the effective range of the laser is much diminished. Blackwell et al. (2002) tested lasers on several bird species and observed varied results among species. Lasers were ineffective at dispersing pigeons and mallard with birds habituating in approximately 5 minutes and 20 minutes, respectively (Blackwell et al. 2002). As with other BDM tools, lasers are most effective when used as part of an integrated management program.

Nest destruction is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction is generally only applied when dealing with a single bird or very few birds. This method is used to discourage birds from constructing nests in areas which may create nuisances for home and business owners. Heusmann and Bellville (1978) reported that nest removal was an effective, but time-consuming method because problem bird species are generally abundant and highly mobile and can easily return to damage sites from long distances. This method poses no imminent danger to pets or the public.

Egg addling/destruction is a method of suppressing reproduction in local nuisance bird populations by destroying egg embryos prior to hatching. Egg addling is conducted by vigorously shaking an egg numerous times, causing detachment of the embryo from the egg sac. Egg destruction can be accomplished in several different ways, but the most commonly used methods are manually gathering eggs and breaking them, or by oiling or spraying the eggs with a liquid which covers the entire egg and prevents the egg from

obtaining oxygen. Although WS does not commonly use egg addling or destruction, it is a valuable damage management tool and has proven effective in some applications.

Lure crops/alternate foods: When depredations cannot be avoided by careful crop selection or modified planting schedules, lure crops can sometimes be used to mitigate the loss potential. Lure crops are planted or left for consumption by wildlife as an alternative food source. This approach provides relief for critical crops by sacrificing less important or specifically planted fields. Establishing lure crops is sometimes expensive, requires considerable time and planning to implement, and may attract other unwanted species to the area.

NON-LETHAL, CHEMICAL METHODS

Avitrol is a chemical frightening agent (repellent) that is effective in a single dose when mixed with untreated baits, normally in a 1:9 ratio. Avitrol, however, is not completely non-lethal in that a small portion of the birds are generally killed (Johnson and Glahn 1994). Prebaiting is usually necessary to achieve effective bait acceptance by the target species. This chemical is registered for use on pigeons, crows, gulls, blackbirds, starlings, and English (house) sparrows in various situations. Avitrol treated bait is placed in an area where the targeted birds are feeding. Usually, a few birds will consume the treated bait and become affected by the chemical. The affected birds then broadcast distress vocalizations and display abnormal flying behavior, thereby frightening the remaining flock away.

Avitrol is a restricted use pesticide that can only be sold to certified applicators and is available in several bait formulations where only a small portion of the individual grains carry the chemical. It can be used anytime of the year, but is used most often during winter and spring. Any granivorous bird associated with the target species could be affected by Avitrol. Avitrol is water soluble, but laboratory studies have demonstrated that Avitrol is strongly absorbed onto soil colloids and has moderately low mobility. Biodegradation is expected to be slow in soil and water, with a half-life ranging from three to 22 months. However, Avitrol may form covalent bonds with humic materials, which may serve to reduce its availability for intake by organisms from water. It is non-accumulative in tissues and is rapidly metabolized by many species (Schafer 1991).

Avitrol is acutely toxic to avian and mammalian species; however, blackbirds are more sensitive to the chemical and there is little evidence of chronic toxicity. Laboratory studies with predator and scavenger species have shown minimal potential for secondary poisoning, and during field use only magpies and crows appear to have been affected (Schafer 1991). However, a laboratory study by Schafer et al. (1974) showed that magpies exposed to two to 3.2 times the published Lethal Dose (LD_{50}) in contaminated prey for 20 days were not adversely affected and three American kestrels that were fed contaminated blackbirds for seven to 45 days were not adversely affected. Some hazards may occur to predatory species consuming unabsorbed chemical in the GI tract of affected or dead birds (Holler and Shafer 1982, Schafer 1981). A formal Risk Assessment found no probable risk is expected for pets and the public, based on low

concentrations and low hazards quotient value for non-target indicator species tested on this compound (USDA 1997, Appendix P).

Methyl anthranilate (artificial grape flavoring used in foods and soft drinks for human consumption) could be used or recommended by WS as a bird repellent. Methyl anthranilate (MA) (artificial grape flavoring food additive) has been shown to be a promising repellent for many bird species (Dolbeer et al. 1993). Cummings et al. (1995) found effectiveness of MA declined significantly after 7 days. Belant (1996) found MA ineffective as a bird grazing repellent, even when applied at triple the recommended label rate. MA is also under investigation as a potential bird taste repellent. MA may become available for use as a livestock feed additive (Mason et al. 1984; Mason et al. 1989). It is registered for applications to turf or to surface water areas used by unwanted birds. The material has been shown to be nontoxic to bees (LD_{50} > 25 micrograms/bee[4]), nontoxic to rats in an inhalation study (LC_{50} > 2.8 mg/L[5]), and of relatively low toxicity to fish and other invertebrates. Methyl anthranilate is naturally occurring in concord grapes and in the blossoms of several species of flowers and is used as a food additive and perfume ingredient (Dolbeer et al. 1992; RJ Advantage, Inc. 1997). It has been listed as "Generally Recognized as Safe" (GRAS) by the FDA (Dolbeer et al. 1992).

Water surface and turf applications of MA are generally considered expensive. For example, the least intensive application rate required by label directions is 20 lbs. of product (8 lbs. active ingredient) per acre of surface water at a cost of about $64/lb., with retreating required every 3-4 weeks (RJ Advantage, Inc. 1997). The cost of treating turf areas would be similar on a per acre basis. Also, MA completely degrades in about 3 days when applied to water (RJ Advantage, Inc. 1997), which indicates the repellent effect is short-lived.

Another potentially more cost-effective method of MA application is by use of a fog-producing machine (Vogt 1997). The fog drifts over the area to be treated and is irritating to the birds while being non-irritating to any humans that might be exposed. Fogging applications must generally be repeated 3-5 times after the initial treatment before the birds abandon a treatment site (Dr. P. Vogt, RJ Advantage, Inc., Pers. Comm. 1997). Applied at a rate of about .25 l./acre of water surface, the cost is considerably less than when using the turf or water treatment methods.

MA is also being investigated as a livestock feed additive to reduce or prevent feed consumption by birds. Such chemicals undergo rigorous testing and research to prove safety, effectiveness, and low environmental risks before they would be registered by EPA or the FDA.

---

[4] An LD_{50} is the dosage in milligrams of material per kilogram of body weight, or, in this case in micrograms per individual bee, required to cause death in 50% of a test population of a species.

[5] An LC_{50} is the dosage in milligrams of material per liter of air required to cause death in 50% of a test population of a species through inhalation.

Particulate feed additives have been investigated for their bird-repellent characteristics. In pen trials, European starlings rejected grain to which charcoal particles were adhered (L. Clark, NWRC, Pers. Comm. 1999). If further research finds this method to be effective and economical in field application, it may become available as a bird repellent on livestock feed. Charcoal feed additives have been explored for use in reducing methane production in livestock and should have no adverse effects on livestock, on meat or milk production, or on human consumers of meat or dairy products (L. Clark, NWRC, Pers. Comm. 1999).

Other chemical repellents: A number of other chemicals have shown bird repellent capabilities. Anthraquinone, a naturally occurring chemical found in many plant species and in some invertebrates as a natural predator defense mechanism, has shown effectiveness in protecting rice seed from red-winged blackbirds and boat-tailed grackles (Avery et al. 1997). It has also shown effectiveness as a foraging repellent against Canada goose grazing on turf and as a seed repellent against brown-headed cowbirds (Dolbeer et al. 1998). Compounds extracted from common spices used in cooking and applied to perches in cage tests have been shown repellent characteristics against roosting European starlings (Clark 1997). Naphthalene (moth balls) was found to be ineffective in repelling European starlings (Dolbeer et al. 1988).

Tactile repellents: A number of tactile repellent products are on the market which reportedly deters birds from roosting on certain structural surfaces by presenting a tacky or sticky surface that the birds avoid. However, experimental data in support of this claim are sparse (Mason and Clark 1992). The repellency of tactile products is generally short-lived because dust tends to stick to the product. Additionally, tactile repellents may not be aesthetically pleasing and may require expensive clean-up costs as the material may run down the sides of buildings in hot weather.

Alpha-chloralose is a central nervous system depressant used as an immobilizing agent to capture and remove pigeons, waterfowl and other birds. It is labor intensive and in some cases, may not be cost effective (Wright 1973, Feare et al. 1981). Alpha-chloralose is typically delivered as a well contained bait in small quantities with minimal hazards to pets and humans; single bread or corn baits are fed directly to the target birds. Trained and certified WS personnel are present at the site of application during baiting to retrieve the immobilized birds. Unconsumed baits are removed from the site following each treatment. Alpha-chloralose was eliminated from more detailed analysis in USDA (1997) based on critical element screening; therefore, environmental fate properties of this compound were not rigorously assessed. However, the solubility and mobility are believed to be moderate and environmental persistence is believed to be low. Bioaccumulation in plants and animal tissue is believed to be low. Alpha-chloralose is used in other countries as an avian and mammalian toxicant. The compound is slowly metabolized, with recovery occurring a few hours after administration (Schafer 1991). The dose used for immobilization is designed to be about two to 30 times lower than the LD_{50}. Mammalian data indicate higher LD_{50} values than birds. Toxicity to aquatic organisms is unknown (Woronecki et al. 1990), but the compound is generally not soluble in water and, therefore, should remain unavailable to aquatic organisms. Factors

supporting the determination of this low potential included the lack of exposure to pets, non-target species and the public, and the low toxicity of the active ingredient. Other supporting rationale for this determination included relatively low total annual use and a limited number of potential exposure pathways. The agent is currently approved for use by WS as an Investigative New Animal Drug by the FDA rather than a pesticide.

LETHAL, MECHANICAL METHODS

Shooting is more effective as a dispersal technique than as a way to reduce bird densities when large numbers of birds are present. Normally, shooting is conducted with shotguns, rifles, or air rifles. Shooting is a very target-specific method and is normally used to remove a single offending bird. However, at times, a few birds could be shot from a flock to make the remainder of the birds more wary and to help reinforce non-lethal methods. Shooting can be relatively expensive because of the staff hours sometimes required (USDA 1997). It is selective for target species and may be used in conjunction with the use of spotlights, decoys, and calling. Shooting with shotguns, air rifles, or rim and center fire rifles is sometimes used to manage bird damage problems when lethal methods are determined to be appropriate. The birds are killed as quickly and humanely as possible. WS complies with all firearm safety precautions when conducting BDM activities and all laws and regulations governing the lawful use of firearms are strictly followed.

Firearm use is a very sensitive public concern because of issues relating to public safety and misuse. 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 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.

Live traps (although live traps are non-lethal, birds may be euthanized upon capture): In most situations live trapped birds are subsequently euthanized. Relocation to other areas following live capture would not generally be effective because problem bird species are highly mobile and can easily return to damage sites from long distances; habitats in other areas are generally already occupied; and relocation would most likely result in bird damage problems at the new location. Translocation of wildlife is also 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. Live traps include:

> ***Decoy traps*** are used by WS for preventive and corrective damage management. Decoy traps are similar in design to the Australian Crow Trap as reported by Johnson and Glahn (1994) and McCracken (1972). Live decoy birds of the same species that are being targeted are usually placed in the trap with sufficient food and water to assure their survival. Perches are configured in the trap to allow

birds to roost above the ground and in a more natural position. Feeding behavior and calls of the decoy birds attract other birds which enter and become trapped themselves. Active decoy traps are monitored daily, every other day, or as appropriate, to remove and euthanize excess birds and to replenish bait and water. Decoy traps and other cage/live traps, as applied and used by WS, pose no danger to pets or the public and if a pet is accidentally captured in such traps, it can be released unharmed.

Nest box traps may be used by WS for corrective damage management and are effective in capturing local breeding and post breeding European starlings and other targeted secondary cavity nesting birds (DeHaven and Guarino 1969, Knittle and Guarino 1976).

Mist nets are more commonly used for capturing small-sized birds such as English sparrows and finches, but can be used to capture larger birds such as ducks and ring-neck pheasants or even smaller nuisance hawks and owls. This method was introduced into the United States in the 1950's from Asia and the Mediterranean where it was used to capture birds for the market (Day et al. 1980). The mist net is a fine black silk or nylon net, usually 3 to 10 feet wide and 25 to 35 feet long. Net mesh size determines which birds can be caught and overlapping "pockets" in the net cause birds to entangle themselves when they fly into the net.

Cannon nets are normally used for larger birds such as pigeons, feral ducks, and waterfowl and use mortar projectiles to propel a net up and over birds which have been baited to a particular site. This type of net is especially effective for waterfowl that are flightless during the molt and other birds which are typically shy to other types of capture.

Cervical dislocation is sometimes used to euthanize birds which are captured in live traps. The bird is stretched and the neck is hyperextended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA approves this technique as humane method of euthanasia and states that cervical dislocation, when properly executed, is a humane technique for euthanasia of poultry and other small birds (Beaver et al. 2001). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and is rapidly accomplished (Beaver et al. 2001).

Snap traps are modified rat snap traps used to remove individual woodpeckers, European starlings, and other cavity nesting birds. The trap treadle is baited with peanut butter or other food attractants and attached near the damage area. These traps pose no imminent danger to pets or the public and are usually located in positions inaccessible to people and most non-avian animals. They are very selective because they are usually set in the defended territory of the target birds.

LETHAL, CHEMICAL METHODS

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

CO2 is sometimes used to euthanize birds which are captured in live traps. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and sealed shut. CO_2 gas is released into the bucket or chamber and birds quickly die after inhaling the gas. This method is approved as a euthanizing agent by the AVMA (Beaver et al. 2001). CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

Starlicide (3-chloro-p-toluidine hydrochloride) is a restricted use pesticide that is formulated as a 0.1% ready-to-use product and is commercially available to certified applicators or persons under their supervision. This avicide may be recommended or used by WS to control ravens, European starlings, crows, pigeons, cowbirds, grackles, magpies, and certain gull species. Starlicide may be used in feedlots, around buildings and fenced non-crop areas, bird staging and roosting areas, federal and state wildlife refuges, and other sites (EPA 1995). Starlicide is similar to DRC-1339 used in feedlots; however, it contains 0.1% DRC-1339 (USDA 1997, Appendix P). Therefore, the properties of this product are similar to DRC-1339 (discussed below).

DRC-1339 (3-chloro-p-toluidine hydrochloride) is the principal chemical method that would be used for bird damage management under the Proposed Action. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, and pigeon control at feedlots, dairies, airports, and in urban areas (West et al. 1967, Besser et al. 1967, Decino et al. 1966). Studies continue to document the effectiveness of DRC-1339 in resolving blackbird/starling problems at feedlots (West and Besser 1976, Glahn 1982, Glahn et al. 1987), dispersing crow roosts in urban/suburban areas (Boyd and Hall 1987), and Blanton et al. (1992) reports that DRC-1339 appears to be a very effective, selective, and safe means of urban pigeon population reduction. Glahn and Wilson (1992) noted that baiting with DRC-1339 is a cost-effective method of reducing damage by blackbirds to sprouting rice.

DRC-1339 is a slow acting avicide that is registered with the EPA for reducing damage from several species of birds, including blackbirds, starlings, pigeons, crows, ravens, magpies, and gulls. DRC-1339 has several EPA Registration Labels (56228-10, 56228-17, 56228-28, 56228-29, and 56228-30) depending on the application or species involved in the bird damage management project. DRC-1339 was developed as an avicide because of its differential toxicity to mammals. DRC-1339 is highly toxic to sensitive species, but only slightly toxic to non-sensitive birds, predatory birds, and mammals (Johnson et al.

1999, Schafer 1991, 1981). For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/bird to cause death (Royall et al. 1967). Most bird species that are responsible for damage, including starlings, blackbirds, pigeons, crows, magpies, and ravens, are highly sensitive to DRC-1339. Many other bird species such as raptors (Schafer 1981), sparrows, and eagles are classified as non-sensitive. Numerous studies show that DRC- 1339 poses minimal risk of primary poisoning to non-target and T&E species (USDA 1997). Secondary poisoning has not been observed with DRC-1339 treated baits, except crows eating gut contents of pigeons (Kreps 1974). During research studies, carcasses of birds which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1981). This can be attributed to relatively low toxicity to species that might scavenge on blackbirds and starlings killed by DRC-1339 and its tendency to be almost completely metabolized in the target birds which leaves little residue to be ingested by scavengers. Secondary hazards of DRC-1339 are almost nonexistent (Johnson et al. 1999, Schafer 1991, 1984). DRC-1339 acts in a humane manner producing a quiet and apparently painless death.

DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. DRC-1339 tightly binds to soil and has low mobility. The half life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (i.e., degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low (USDA 1997). Appendix P of USDA (1997) contains a thorough risk assessment of DRC-1339 and the reader is referred to that source for a more complete discussion. That assessment concluded that no adverse effects are expected from use of DRC-1339.

APPENDIX C

Federal and State Listed Threatened and Endangered Species in Pennsylvania

FEDERALLY LISTED, PROPOSED AND CANDIDATE SPECIES
(in Pennsylvania)

Common Name	Scientific Name	Status[1]	Distribution (by County and/or Watershed)
FISHES			
Shortnose sturgeon[2]	*Acipenser brevirostrum*	E	Delaware River & other Atlantic coastal waters
REPTILES			
Bog turtle	*Clemmys muhlenbergii*	T	Current - Adams, Berks, Bucks, Chester, Cumberland, Delaware, Franklin, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill, York. Historic - Crawford, Mercer, Philadelphia Co.
Eastern massasauga rattlesnake	*Sistrurus catenatus catenatus*	C	Current - Butler, Crawford, Mercer and Venango Co. Historic - Allegheny and Lawrence Co.
BIRDS			
Bald eagle	*Haliaeetus leucocephalus*	T	Suitable habitats across the state. Recent nesting in Butler, Cameron, Centre, Chester, Crawford, Dauphin, Erie, Forest, Huntingdon, Lancaster, Lebanon, Mercer, Northumberland, Pike, Tioga, Venango, Warren, Wayne and York Co. Wintering concentrations occur near ice-free sections of rivers, lakes and reservoirs, including the Delaware River.
Piping plover	*Charadrius melodus*	E	Migratory. No nesting in Pennsylvania since 1950s. Designated critical habitat on Presque Isle, Erie Co.
MAMMALS			
Indiana bat	*Myotis sodalis*	E	Winter hibernacula: Armstrong, Blair, Lawrence, Luzerne, Mifflin and Somerset Co.
MOLLUSKS			
Dwarf wedgemussel	*Alasmidonta heterodon*	E	Current - Delaware River (Wayne Co.). Historic - Delaware River watershed (Bucks, Carbon, Chester and Philadelphia Co.); Susquehanna River watershed (Lancaster Co.)
Clubshell mussel	*Pleurobema clava*	E	French Creek and Allegheny River watersheds (Clarion, Crawford, Erie, Forest, Mercer, Venango and Warren Co.); Shenango River (Ohio River watershed; Mercer and Crawford Co.)
Northern riffleshell	*Epioblasma torulosa rangiana*	E	French Creek and Allegheny River watersheds (Clarion, Crawford, Erie, Forest, Mercer, Venango and Warren Co.)
PLANTS			
Northeastern bulrush	*Scirpus ancistrochaetus*	E	Current - Adams, Bedford, Blair, Carbon, Centre, Clinton, Cumberland, Dauphin, Franklin, Huntingdon, Lackawanna, Lehigh, Lycoming, Mifflin, Monroe, Perry, Snyder and Union Co. Historic - Northampton Co.
Small-whorled pogonia	*Isotria medeoloides*	T	Current - Centre, Chester and Venango Co. Historic - Berks, Greene, Monroe, Montgomery and Philadelphia Co.

[1] *E = Endangered, T = Threatened, PE = Proposed Endangered, PT = Proposed Threatened, C = Candidate*
[2] *Shortnose sturgeon is under the jurisdiction of the National Marine Fisheries Service*

Revised 2/27/03

U.S. FISH AND WILDLIFE SERVICE
315 SOUTH ALLEN ST., SUITE 322, STATE COLLEGE, PA 16801

FEDERALLY LISTED AND PROPOSED SPECIES THAT NO LONGER OCCUR IN PENNSYLVANIA

COMMON NAME	SCIENTIFIC NAME	STATUS**	FORMER DISTRIBUTION
MAMMALS			
Canada lynx	*Lynx canadensis*	PT	north-central PA (Tioga Co.)
Delmarva Peninsula fox squirrel	*Sciurus niger cinereus*	E	mature forests of southeastern PA (Delaware and Chester Co.)
Eastern cougar	*Felis concolor cougvar*	E	state-wide
Grey wolf	*Canis lupus*	E	state-wide
MOLLUSKS			
Fanshell*	*Cyprogenia stegaria*	E	Ohio River drainage
Orange pimpleback*	*Plethobasus striatus*	E	Ohio River drainage
Pink mucket pearly mussel*	*Lampsilis abrupta*	E	Ohio River drainage
Ring pink mussel*	*Obovaria retusa*	E	Ohio River drainage
Rough pigtoe*	*Pleurobema plenum*	E	Ohio River drainage
INSECTS			
American burying beetle	*Nicrophorus americanus*	E	state-wide
Karner blue butterfly	*Lycaeides melissa samuelis*	E	pine barrens, oak savannas (wild lupine habitat) (Wayne Co.)
Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*	T	along large rivers in southeastern PA
PLANTS			
Eastern prairie fringed orchid	*Platanthera leucophaea*	T	wet prairies, bogs (Crawford Co.)
Sensitive joint-vetch	*Aeschynomene virginica*	T	freshwater tidal marshes of Delaware river (Delaware and Philadelphia Co.)
Virginia spiraea*	*Spiraea virginiana*	T	along Youghiogheny River (Fayette Co.)
Smooth coneflower	*Echinacea laevigata*	E	serpentine barrens (Lancaster Co.)

Revised 10/19/00

* It is possible that remnant populations of some of these species (indicated with an *) may still occur in Pennsylvania, however, there have been no confirmed sightings of these species for over 70 years.

** E = Endangered, T = Threatened, PT = Proposed Threatened

The following is a partial list of additional species that no longer occur in Pennsylvania: moose, bison, wolverine, passenger pigeon, Bachman's sparrow, greater prairie-chicken, olive sided flycatcher, Bewick's wren, eastern tiger salamander, blue pike, butterfly mussel, Diana fritillary butterfly, precious underwing moth, deertoe mussel, marbled underwing moth, cobblestone tiger beetle, mountain clubmoss, crested yellow orchid, red milkweed, American barberry, small white lady's slipper, etc, etc.

U.S. FISH AND WILDLIFE SERVICE
315 SOUTH ALLEN ST., SUITE 322, STATE COLLEGE, PA 16801

Plants

Last Revised 4/30/03

8/15/2003

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	G5	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 PUNICEUS VAR FIRMUS	FIRM ASTER	G5T5	S2	TU	PT	
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

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 OBOVATA	AMERICAN BEAKGRAIN	G4G5	S3	PE	PR	
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
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	G2G3	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 LINEARIS	NARROW-LEAVED GENTIAN	G4G5	S3	N	PR
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 BOREALIS	SMALL-FLOATING MANNA-GRASS	G5	S2	PE	PT
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 ODORATA	VANILLA SWEET-GRASS	G5	S1	PE	PE
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 STRACTUM	ST ANDREW'S SACROS	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	
LYGODIUM PALMATUM	HARTFORD FERN	G4	S3	PR	PR	
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	TU	
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	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 GRACILLIMA	BUSHY NAIAD	G5?	S2	PT	PT
NAJAS MARINA	HOLLY-LEAVED NAIAD	G5	S1	PE	PE
NELUMBO LUTEA	AMERICAN LOTUS	G4	S1	PE	PE
NUPHAR LUTEA SSP PUMILA	YELLOW COWLILY	G5T4T5	SU	TU	TU
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	S1	PX	PE
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	G5TU	SH	PE	PE
PANICUM ANNULUM	SERPENTINE PANIC-GRASS	G5T?	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	G4?Q	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
PHYLA LANCEOLATA	LANCE FOG-FRUIT	G5	S2	TU	PR
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 AMPHIBIUM VAR STIPULACEUM	A WATER SMARTWEED	G5T5	S2	TU	TU	
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 BICUPULATUS	PONDWEED	G4?	S2	N	TU	
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 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	SMALL GLOBE BEAKED-RUSH	G5	S1	TU	PE	
RHYNCHOSPORA GRACILENTA	BEAKED-RUSH	G5	SX	PX	PX	
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	5X	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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
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	
SPIRODELA PUNCTATA	EASTERN WATER-FLAXSEED	G5	SH	TU	TU	
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	
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 PALUSTRE	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 GEMINISCAPA	BLADDERWORT	G4G5	S3	N	TU	
UTRICULARIA INFLATA	FLOATING BLADDERWORT	G5	S1S2	N	TU	
UTRICULARIA INTERMEDIA	FLAT-LEAVED BLADDERWORT	G5	S2	PT	PT	
UTRICULARIA MINOR	LESSER BLADDERWORT	G5	S2S3	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	
WOLFFIA BOREALIS	DOTTED WATER-MEAL	G5	S1	TU	TU	
WOLFFIELLA GLADIATA	BOG-MAT	G5	S2	PR	PR	
WOODWARDIA AREOLATA	NETTED CHAINFERN	G5	S2	N	PT	
XYRIS MONTANA	NORTHERN YELLOW-EYED GRASS	G4	S3	PR	PR	
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	

Vertebrates

Last Revised 6/11/02

8/15/2003

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	

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	

Invertebrates

Last Revised 6/11/02

8/15/2003

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	G7	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			

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 HAYHURSTI	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			

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.

The Nature Conservancy (6 August 1996 version)

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.

The Nature Conservancy (6 August 1996 version)

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

---

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.