PENNSYLVANIA WILDLIFE ACTION PLAN

2015–2025

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Harrisburg, Pennsylvania

October 1, 2015

Cover collage: Hal Korber, Pennsylvania Game Commission

Cover photo credits (clockwise): Child with binoculars, E. Crisfield; scarlet tanager, PGC/ J. Dingel; Headwater stream, PGC/H. Korber; N. leopard frog, J. Wheatly; WNS bat, G. Turner; box turtle, PGC/ H. Korber; landowner assistance, PGC/H. Korber; Southern redbelly dace, Criswell; monarch butterfly, PFBC/D. Day; fire and sprout, PGC/Korber.

Cover and logo design: Stephen R. Perry, srpcreative.com, Blue Bell, Pennsylvania

Report layout: Jennifer DeCecco, Pennsylvania Game Commission

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2015–2025

Edited

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Recommended citation:

PGC-PFBC (Pennsylvania Game Commission and Pennsylvania Fish & Boat Commission). 2015. Pennsylvania Wildlife Action Plan, 2015-2025. C. Haffner and D. Day, editors. Pennsylvania Game Commission and Pennsylvania Fish & Boat Commission, Harrisburg, Pennsylvania.

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INTRODUCTION

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Foreword

by Scott Weidensaul

Rosalie Edge -- one of the unsung heroes of 20th century conservation, a savior of King's Canyon, Yosemite and Olympic national parks, among other natural jewels -- is best known in Pennsylvania for founding Hawk Mountain Sanctuary in 1934.

Perched along the Kittatinny Ridge, Hawk Mountain was the world's first refuge for birds of prey, established at a time when raptors were almost universally persecuted, and roundly vilified even by professional ornithologists. It was an extraordinarily far-sighted move, but Mrs. Edge was an uncommonly far-sighted person.

"The time to save a species is when it is still common," she repeated throughout her long and effective career. "The only *way to save a species is to never let it become rare."*

It's taken much of the intervening 80 years for the rest of the conservation world to catch up with that simple wisdom. We've seen the cost -- in lost biodiversity, in dollars, in anguish and political controversy -- when we wait until the eleventh hour to mount last-ditch efforts to save vanishing plants and animals.

Sometimes we have no choice, if we're not to let some unique and precious thread of evolutionary history vanish on our watch. But there is a better way -- as Rosalie Edge said, to save species while they remain common, to keep them safely back from the precipice for their sakes, and ours.

Easier said than done, of course. For centuries, people squandered Pennsylvania's natural capital with little or no thought for the future. Our human population has grown to almost 13 million; development has consumed more open space in the past quarter century than the previous two hundred years combined. The toll on native species has been drastic, and in some cases irreparable. For many species, it's well past the eleventh hour, and only heroic measures can save them.

But for many more, though, there is still time -- if we're prudent, and far-sighted in our own way. Of course, resources are scarce and never fully meet the need, which is why careful planning -- along with solid science, public engagement and creative management -- are going to be necessary if we're to follow Rosalie Edge's advice.

Keeping common species common is one of the core principles of Pennsylvania's 2015-2025 State Wildlife Action Plan -- the comprehensive framework designed to guide wildlife conservation in the state over the next decade. It is a complex document; in addition to preserving common creatures, it is designed to strengthen populations of imperiled species (and the habitats on which they depend); promote partnerships between agencies and organizations to leverage what resources are available; and mesh Pennsylvania's efforts with those on regional, national and international scales, because wildlife observes no boundaries, and we cannot be constrained by them, either.

With a 10-year horizon in mind, the plan depends on the best available science, and employs a variety of approaches that reflect the hard-won knowledge of the past century of wildlife conservation, from

reintroductions and monitoring to restoration, conserving habitat connectivity, and adaptive management.

Science and management only go so far; real success in an ever-more-crowded world demands the support of the wider public. So a big piece of the puzzle, and one addressed in the plan, is better engaging the millions of Pennsylvanians who don't realize they have a very personal stake in the conservation of the Commonwealth's native wildlife, especially the 75 percent of species not hunted, trapped or fished.

Fortunately, that important message is seeping in. Recent surveys have found that conserving nongame wildlife was ranked as "very important" by more than two-thirds of Pennsylvanians. Add those who believe such conservation is at least "somewhat important," and the number rises to almost nine out of 10.

Such support is essential for us to stay the course on a conservation landscape as challenging as ever, from habitat loss to climate change and invasive species.

And new threats can emerge suddenly. When Pennsylvania's last comprehensive wildlife plan was approved in 2005, no one had heard of white nose syndrome, which wasn't discovered until the following year in New York. A decade on, millions of bats have died from this introduced fungal disease, and the little brown bat -- once the most common species in Pennsylvania -- is treated in this plan as a "species of greatest conservation need," its population reduced by more than 90 percent.

In all, there are 664 other species of greatest conservation need detailed in this plan -- 90 birds, 19 mammals, 65 fish, 22 reptiles, 18 amphibians and 450 invertebrates. That's a significant chunk of Pennsylvania's natural diversity -- but for many of them, there is still time to help them. Still time to keep them common, or make them so once again.

In the end, the 2015-2025 State Wildlife Action Plan is a declaration -- an affirmation that each of these wild creatures is an important part of a vivid, vibrant Penn's Woods, and the birthright of every Pennsylvanian.

As you read through the plan, you'll see some names that are familiar, and many that are strange. For every bald eagle or wood thrush, there is a creek heelsplitter or a saffron-winged meadowhawk, a spinycheek crayfish or Acadian hairstreak. For every box turtle there is a rusty-patched bumblebee or a blue-spotted salamander, a black dash, pink papershell, great ash sphinx, northern long-eared bat or yellow-bellied flycatcher.

Some have no English names at all, and may be a cipher as much as they are flesh-and-blood organisms. For example, what is the status of the Monongahela crayfish, Cambarus monongalensis, *known only from the Appalachian Plateau of southwestern Pennsylvania, West Virginia and a small slice of Virginia? This is a crawdad that is shockingly, stunningly, gasp-out-loud blue -- and the last systematic survey of its range was conducted 109 years ago.*

Whether animals are instantly recognizable or known only to specialists, found in forests and streams statewide or restricted to tiny enclaves, each represents a genetic legacy stretching back millions of

years. Each was honed by deep evolutionary history and natural selection to fit the contours of the Keystone State's waters, woodlands and meadows.

This plan -- the foresight and vision from which it was crafted, and the hard work it will take to implement it in the decade ahead -- is a step toward preserving each of those species. And, in a very direct and real way, preserving ourselves as well.

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Scott Weidensaul is the author of more than two dozen books on natural history, including the Pulitzer Prize finalist *Living on the Wind*, about bird migration, and *Mountains of the Heart*, a natural history of the Appalachians. His newest book, *The Peterson Reference Guide to Owls of North America and the Caribbean*, will be published in 2015. He lives in the mountains of Schuylkill County, where he studies the migration of owls and hummingbirds. He is a co-director of Project Owlnet, which coordinates owl migration research through a network of 125 banding stations across North America, and is a co-founder of Project SNOWstorm, an international collaboration to study snowy owls.

Acknowledgments

Appreciation

The extensive list of contributors presented in these acknowledgments reflects a truly concerted effort by Pennsylvania's conservation community to develop an effective and comprehensive State Wildlife Action Plan. We gratefully acknowledge the guidance, technical assistance and administrative support from Commission staff, partner agencies and conservation organizations that dedicated their time and knowledge to this endeavor. Frequently, accomplished tasks were well beyond normally assigned duties or conducted by devoted volunteers. Public comments provided during the open review period greatly enhanced the Plan and further demonstrate a commitment to Pennsylvania's fish and wildlife. We are eager to build on this knowledge and enthusiasm as we implement this Plan.

We especially thank:

- Scott Weidensaul for his eloquent words to set the stage for the Plan in the Foreword.
- Joseph Tavano (PGC), for his technical savvy and endurance to transform the species account spreadsheets into the final species account documents. These documents will guide implementation of this Plan for the next 10 years.
- Elizabeth Crisfield, PhD (PGC, 2013), who expertly compiled needed information to facilitate the revision during the early phases.
- Jennifer DeCecco (PGC, 2015), for her creative eye to transform the basic report into a user-friendly and visually appealing document.
- Joseph Kosack (PGC), who as Chief Editor for this Plan, provided his editing skills and understanding of communication to greatly enhance the final document. Having served this role in 2005, we truly appreciate his willingness to once again edit this large document.
- Daniel Brauning (PGC) and Christopher Urban (PFBC) for their support and guidance through the revision process.
- Nate Zalik (PGC) for his contributions to, and technical review of, the Plan.

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Funding

Partial support for developing the 2015 Pennsylvania Wildlife Action Plan was provided by the following grants:

F13AF00958: T-8-3 Competitive State Wildlife Grant - Pennsylvania Wildlife Action Plan 2.0, Prioritization and Mapping Enhancements

F14AF00255: PA SWG-Planning and Revision of the Pennsylvania Wildlife Action Plan

F09AF00090: T2-7-R-1 Freshwater Aquatic Invertebrate Conservation, Protection, and Restoration

F09AF00091: T2-8-R PA Wildlife Diversity Conservation Program

F15AF00779: PA SWG T2-20-1 Pennsylvania Wildlife Diversity Conservation Program

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Abbreviations

AFWA	Association of Fish and Wildlife Agencies
AMJV	Appalachian Mountain Joint Venture
AML	Abandoned Mine Land
APPLCC	Appalachian Landscape Conservation Cooperative
AR5	Fifth Assessment Report
ASMFC	Atlantic States Marine Fisheries Commission
BBS	Breeding Bird Survey
Bd	*Batrachochytrium dendrobatidis*
BMP	Best Management Practice
BOEM	Bureau of Ocean Energy Management
BWHM	Bureau of Wildlife Habitat Management
BWM	Bureau of Wildlife Management
CAP	Chiapas Appalachian Pacific
CCRF	Climate Change Response Framework
CCVA	Climate Change Vulnerability Assessment
CCVI	Climate Change Vulnerability Index
CMIP5	Coupled Model Intercomparison Project 5
CMP	Conservation Measures Partnership
CRA	Chiapas Regional Alliance
CREP	Conservation Reserve Enhancement Program
CSC	Climate Science Center
CUNY	City University of New York
EBTJV	Eastern Brook Trout Joint Venture
ELOHA	Ecological Limits of Hydrologic Alteration
FERC	Federal Energy Regulatory Commission
FIA	Forest Inventory Analysis (U.S. Forest Service)
FOTG	Field Office Technical Guide
FSA	Farm Service Agency
GCM	General Circulation Model
GHG	Greenhouse Gas(es)
GMO	Genetically Modified Organism
HABS	Harmful Algal Blooms
HFRP	Healthy Forests Reserve Program
HWA	Hemlock Woolly Adelgid
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IUCN	International Union for Conservation of Nature

JV	Joint Venture
LC	Landscape Capability
LCC	Landscape Conservation Cooperative
LCI	Landscape Condition Index (synonymous with Landscape Context Index)
LTM	Land Transformation Modeling
LTRMP	Long-Term Ecological Research Program
NAAT	National Advisory Acceptance Team
NABCI	North American Bird Conservation Initiative
NIACS	Northern Institute of Applied Climate Science
NALCC	North Atlantic Landscape Conservation Cooperative
NCDC	National Climate Data Center
NEAFWA	Northeast Association of Fish and Wildlife Agencies
NECSC	Northeast Climate Science Center
NEFWDTC	Northeast Fish and Wildlife Diversity Technical Committee
NFWF	National Fish and Wildlife Foundation
NGO	Non-Governmental Organization
NHD	National Hydrography Database
NID	National Inventory of Dams
NOAA	National Oceanographic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NWI	National Wetland Inventory
Pa.B	Pennsylvania Bulletin
PABS	Pennsylvania (PA) Biological Survey
PADCED	Pennsylvania Department of Commerce and Economic Development
PADCNR	Pennsylvania Department of Conservation and Natural Resources
PADEP	Pennsylvania Department of Environmental Protection
PAISMP	Pennsylvania Invasive Species Management Plan
PALTA	Pennsylvania (PA) Land Trust Association
PennDOT	Pennsylvania Department of Transportation
PFBC	Pennsylvania Fish and Boat Commission
PGC	Pennsylvania Game Commission
PISC	Pennsylvania Invasive Species Council
PLAP	Private Landowner Assistance Program
PNDI	Pennsylvania Natural Diversity Inventory
PNHP	Pennsylvania Natural Heritage Program
PRI	Public Radio International
PVC	Polyvinyl Chloride
RCN	Regional Conservation Needs
RCP	Representative Concentration Pathway
RRT	Regional Review Team
RSGCN	Regional Species of Greatest Conservation Need
SGCN	Species of Greatest Conservation Need
SGL	State Game Land

SMCRA	Surface Mining Control and Reclamation Act of 1977
SRAFRC	Susquehanna River Anadromous Fish Restoration Cooperative
SRBC	Susquehanna River Basin Commission
SSWAP	Statewide Surface Water Assessment Program
T&E	Threatened & Endangered
TNC	The Nature Conservancy
TRACS	Tracking and Reporting Actions for the Conservation of Species
TWW	Teaming With Wildlife
UCS	Union of Concerned Scientists
UMGLLCC	Upper Midwest Great Lakes Landscape Conservation Cooperative
USACOE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDA-FS	U.S. Department of Agriculture-Forest Service
USDA-FSA	U.S. Department of Agriculture-Farm Service Agency
USDA-NRCS	U.S. Department of Agriculture-Natural Resources Conservation Service
USDOE	U.S. Department of Energy
USDOI	U.S. Department of Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WEVCA	Wind Energy Voluntary Cooperative Agreement
WLFW	Working Lands for Wildlife
WMI	Wildlife Management Institute
WNS	White nose syndrome
WPC	Western Pennsylvania Conservancy
WREP	Wetland Reserve Enhancement Program
WSFR	Wildlife and Sport Fish Restoration
WSI	Winter Severity Index
WUI	Wildlife Urban Interface

Executive Summary

Highlights

The purpose of the Pennsylvania Wildlife Action Plan is *to conserve Pennsylvania's native wildlife, maintain viable habitat, and protect and enhance Species of Greatest Conservation Need*. With this emphasis on species, a total of 664 Species of Greatest Conservation Need were identified through the processes more fully discussed in this Plan (Chapter 1).

Species of Greatest Conservation Need

	Total
Birds	90
Mammals	19
Fishes	65
Amphibians	18
Reptiles	22
Invertebrates	450
Grand Total	**664**

Species Accounts (Chapter 1, Appendix 1.4) provide a succinct summary of the status, threats, conservation actions, monitoring and research needs for all vertebrate species. Given the large number of invertebrate species, species accounts were only developed for federally or state-listed mussels.

Of the many threats identified for birds, mammals, reptiles, amphibians and fish, 53% belonged to four threat categories:

- Residential and Commercial Development (15%)
- Energy Production and Mining (13%)
- Pollution (13%)
- Invasive and Other Problematic Species, Genes and Diseases (12%)

Addressing these threats to vertebrate Species of Greatest Conservation Need, a total of 865 conservation actions were identified, and the more common actions were in these categories:

- Planning
  (*e.g., development of best management practices*)
- Direct Management of Natural Resources
  (*e.g., forest structure management, dam removal, invasive species control*)
- Law and Policy
- Technical Assistance
  (*e.g., environmental review of project areas, technical assistance to landowners)*

For terrestrial and aquatic invertebrate species, specific conservation actions for individual species, families or informal taxonomic groups (Chapter 1; Leppo et al. 2015) and included the categories:

- Direct Management of Natural Resources
- Law and Policy
- Outreach
- Planning
- Data Collection and Analysis
- Land and Water Rights Acquisition and Protection
- Technical Assistance

These conservation actions provide guidance for managing the species and habitats identified in this Plan. Fish and wildlife, like humans, live in dynamic environmental conditions and thus this Plan must be able to adapt as new information is gathered about threats, species and their habitats. To do this, as discussed in Chapter 5, we will monitor the species and their habitats, as well as our progress towards implementing this Plan.

Opportunities for the Plan

This comprehensive Plan includes a list of Species of Greatest Conservation Need, extent and condition of their habitats, threats to those species and habitats, and conservation actions to address the threats. In addition to these crucial components, this Plan also provides guidance to monitor these actions and how the Plan will be updated to remain a viable conservation tool. The Plan also identifies who will be working to address these needs (Species Accounts), and how conservation partners and the public will be engaged in plan implementation. It's a lot for one plan! Yet, as discussed throughout the document, the need is great, and implications are substantial for these species. Over the next decade, implementing the conservation actions identified in this Plan may well establish the trajectory for recovery and protection of these species and their habitats for forthcoming decades. Thus, the 2015 Pennsylvania Wildlife Action Plan is an investment in conserving the Commonwealth's natural heritage for future generations.

The 2015 Pennsylvania Wildlife Action Plan is an investment in conserving the Commonwealth's natural heritage for future generations.

Background

State Wildlife Action Plans are non-regulatory, proactive natural resource management documents designed to prevent species imperilment, and recover endangered and threatened species (i.e., listed species). U.S. Fish and Wildlife Service approval of the Pennsylvania Wildlife Action Plan provides a nexus to federal funds through the State Wildlife Grants Program, the nation's core program for preventing species endangerment. In the late 1990s, the U.S. Congress recognized the high costs of recovering federally listed species. Generally, once listed, wildlife populations and habitats are often diminished to the extent that recovery can be expensive, bringing with them an uncertain future. Identifying at-risk species prior to federal listing, and proactively addressing their needs, could avert costly recovery efforts. Beyond financial considerations, ecologically, potential outcomes are better with larger populations. The health of wildlife is often an early indicator of disease and pollution that affect us all. State Wildlife Action Plans help identify problems affecting wildlife and, perhaps, address those

concerns before they impact humans. For species already listed as threatened or endangered, State Wildlife Action Plans provide a path for their recovery.

By October 2005, all states, the District of Columbia, and U.S. Territories had submitted a State Wildlife Action Plan, and all plans were approved by the U.S. Fish and Wildlife Service. As required by Congress, all State Wildlife Action Plans must be comprehensively reviewed and revised no less than every 10 years. In this context, the 2015 Pennsylvania Wildlife Action Plan is this comprehensive revision, developed with the vision of *healthy, sustainable native wildlife populations, natural communities and habitats in Pennsylvania*.

Early in the revision process, the framework for the 2015 Pennsylvania Wildlife Action Plan was established in the six Goals, their associated Objectives, and Strategies. These goals provide the focus for implementing the conservation actions. This is a Wildlife *Action* Plan and foremost is the conservation of native wildlife and associated habitats (Goal 1). To provide that conservation actions are appropriate and beneficial they need to be based upon sound science founded in surveys, monitoring and research (Goal 2). Many species occurring in Pennsylvania depend on habitats throughout the Northeast region. Thus, supporting management efforts outside of the Commonwealth are beneficial for our species. Growing collaboration among states and the District of Columbia is fostering range-wide conservation of species, supported by Goal 3. Implementing this plan will require broad support among partners and the public. Fostering this collaboration will involve communication, as well as legislative, administrative and financial support (Goals 4 and 5). Crucial to successfully implementing this Plan is distributing timely and well-designed information to Pennsylvania's citizens (Goal 6). An informed and motivated public will greatly enhance species and habitat management.

Goals of the 2015 Pennsylvania Wildlife Action Plan

1. Conserve Pennsylvania's native wildlife and its habitat by implementing conservation actions in the Wildlife Action Plan.
2. Base wildlife conservation decisions on the best available science, with an emphasis on Species of Greatest Conservation Need and their habitat.
3. Contribute to range-wide conservation of Species of Greatest Conservation Need.
4. Strengthen the state's capacity to conserve Pennsylvania's native wildlife.
5. Continue to improve cooperation within and between public agencies and other partners in wildlife conservation planning and implementation.
6. Develop a knowledgeable citizenry that supports and participates in wildlife conservation.

Revision Process

The 2015 Pennsylvania Wildlife Action Plan is the culmination of intensive effort by each Commission's staff, an Advisory Committee, the Pennsylvania Biological Survey (PABS), and several technical

committees (Acknowledgments) who guided revision of the 2005 Pennsylvania Wildlife Action Plan (formerly Comprehensive Wildlife Conservation Strategy). Members of these committees and their knowledge of the Commonwealth's natural resources established a firm foundation for the revision process.

Adopting the Association of Fish and Wildlife Agencies (AFWA) "Best Practices" guidance for State Wildlife Action Plans (AFWA 2012), the intent of this revision process was to be "*explicit and transparent about which criteria are used so it will be clear and repeatable to any user of a plan how priorities were established"* (*sensu* Groves 2003).

New for the 2015 Pennsylvania Wildlife Action Plan, and contributing to this "clear and repeatable" approach, was the flowchart for determining Species of Greatest Conservation Need (Chapter 1). Also, used for the first time was the NatureServe© Rank Calculator version 3.1 (Master et al. 2012) which provided a consistent process for evaluating a species' state conservation status, including a threats assessment. The Species of Greatest Conservation Need prioritization process, adapted from Bunnell et al. (2009), aimed to optimize use of existing species assessment data within a defensible, transparent prioritization scheme that focused on preventing imperilment, in addition to recovering critically imperiled species.

In the intervening years of the 2005 Pennsylvania Wildlife Action Plan, there has been a growing interest in more completely addressing species needs by reaching beyond state boundaries. Thus, in this revised Plan is a greater emphasis on Northeast (Maine to Virginia) regionally important species and habitats. Through the Northeast Association of Fish and Wildlife Agencies (NEAFWA), Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTC), Regional Conservation Needs Grant Program, the Landscape Conservation Cooperatives, and the Northeast Climate Science Center, this regional focus has expanded and is discussed extensively in Chapters 3 and 4. To facilitate this regional approach to species conservation, the Northeast region also has adopted the Northeast Terrestrial and Aquatic Habitat Classification Systems (Anderson et al. 2013b) (Chapter 2), a standardized habitat classification system allowing comparisons of habitats among states. In 2005, this system was not available, thus confounding regional analyses. This system also allows standard species-habitat associations (Chapter 2).

A standardized threats classification system (Salafsky et al. 2008), endorsed by the International Union for the Conservation of Nature (IUCN 2012), also has been adopted by Northeastern states to facilitate consistency between State Wildlife Action Plans (Crisfield 2013). Among the many threats identified, climate change has over-arching impacts on natural resources, as well as human activities, and is thoroughly discussed in the 2015 Plan (Chapter 3). Recognizing the growing implications for Pennsylvania's fish and wildlife, in Amendment 2 (2010) to the 2005 Pennsylvania Wildlife Action Plan, Pennsylvania committed to more fully incorporating climate change into the next comprehensive revision of the Plan. Increasing availability of data, better climate models and a greater understanding of current and potential impacts of this threat are advances over the past 10 years. Regional analysis by the Northeast Climate Science Center (NECSC) (Staudinger et al. 2015a) has enhanced understanding of this threat to the Commonwealth's natural resources.

As developed for habitats and threats, common categories for conservation actions were incorporated into this Plan (Chapter 4). These categories were based largely on U.S. Fish and Wildlife Service Wildlife TRACS (Tracking and Reporting Actions for the Conservation of Species) (USFWS 2015).

The public will be vital to successful implementation of this Plan. To more fully understand public perspectives, attitudes of Pennsylvania residents towards nongame species were gathered through a structured survey (Responsive Management 2014) (Introduction; Chapter 8). The public 's perspectives also were gathered through review of a complete draft during the 30-day public comment period, prior to official submission to the U.S. Fish and Wildlife Service (Chapter 8; to be summarized after the comment period). To provide continued public engagement, Objectives and Strategies in Goal 6 were developed to guide public participation of the Plan.

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Road Map to the 8 Required Elements

Required Element	Required Element Description (NAAT 2004)	Chapter(s)	Appendices	Tables	Figures
1	**Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.**	1	1.1, 1.3, 1.4		
1A	The Plan indicates sources of information (e.g., literature, data bases, agencies, individuals) on wildlife abundance and distribution consulted during the planning process.	1, References	1.1, 1.4	1.1	
1B	The Plan includes information about both abundance and distribution for species in all major groups to the extent data are available. There are plans for acquiring information about species for which adequate abundance and/or distribution information is unavailable.	1	1.1, 1.2 1.4	1.1, 1.2, 1.3	
1C	The Plan identifies low and declining populations to the extent data are available.	1	1.3, 1.4		1.4
1D	All major groups of wildlife have been considered or an explanation is provided as to why they were not	1	1.1, 1.2	1.2	
1E	The Plan describes the process to select the species in greatest need of conservation.	1	1.2		1.2, 1.4
2	**Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in the 1st Element.**	2	2.1		
2A	The Plan provides a reasonable explanation for the level of detail provided; if insufficient, the Plan identifies the types of future actions that will be taken to obtain the information.	2			
2B	Key habitats and their relative conditions are described in enough detail such that the State can determine where (i.e., in which regions, watersheds, or landscapes within the State) and what conservation actions need to take place.	2	2.1		

Required Element	**Required Element Description** (NAAT 2004)	Chapter(s)	Appendices	Tables	Figures
3	**Descriptions of problems which may adversely affect species identified in the 1st Element or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.**	1, 2, 3	1.4	1.10, 1.11, 1.12, 3.13, 3.14, 3.18	1.7, 1.8
3A	The Plan indicates sources of information (e.g., literature, databases, agencies, individuals) used to determine the problems or threats.	1, 2, 3, Literature Cited	1.1		
3B	The threats/problems are described in sufficient detail to develop focused conservation actions.	1, 3	1.4		
3C	The Plan considers threats/problems, regardless of their origins (local, State, regional, national and international), where relevant to the State's species and habitats.	1, 2, 3	1.4		
3D	If available information is insufficient to describe threats/problems, research and survey efforts are identified to obtain needed information.	1, 2	1.1, 1.4		
3E	The priority research and survey needs, and resulting products, are described sufficiently to allow for the development of research and survey projects after the Plan is approved.	1, 2	1.1, 1.4		
4	**Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.**	1, 4	1.4	1.13, 1.14	1.9, 1.10
4A	The Plan identifies how conservation actions address identified threats to species of greatest conservation need and their habitats.	1	1.4		
4B	The Plan describes conservation actions sufficiently to guide implementation of those actions through the development and execution of specific projects and programs.	1, 4	1.4		

Required Element	**Required Element Description** (NAAT 2004)	Chapter(s)	Appendices	Tables	Figures
4C	The Plan links conservation actions to objectives and indicators that will facilitate monitoring and performance measurement of those conservation actions (outlined in Element #5).	1	1.4		
4D	The Plan describes conservation actions (where relevant to the State's species and habitats) that could be addressed by Federal agencies or regional, national or international partners and shared with other States.	1, 4	1.4		
4E	If available information is insufficient to describe needed conservation actions, the Plan identifies research or survey needs for obtaining information to develop specific conservation actions.	1, 4	1.4		
4F	The Plan identifies the relative priority of conservation actions.	1	1.4		
5	**Descriptions of the proposed plans for monitoring species identified in 1st Element and their habitats, for monitoring the effectiveness of the conservation actions proposed in the 4th Element, and for adapting these conservation actions to respond appropriately to new information or changing conditions.**	1, 5	1.4, 5.1		
5A	The Plan describes plans for monitoring species identified in Element 1, and their habitats.	1, 5	1.4, 5.1		
5B	The Plan describes how the outcomes of the conservation actions will be monitored.	1	1.4		
5C	If monitoring is not identified for a species or species group, the Plan explains why it is not appropriate, necessary or possible.	1			
5D	Monitoring is to be accomplished at one of several levels including individual species, guilds, or natural communities.	1, 5	1.4, 5.1		
5E	The monitoring utilizes or builds on existing monitoring and survey systems or explains how information will be obtained to determine the effectiveness of conservation actions.	5	1.4, 5.1		

Required Element	**Required Element Description** (NAAT 2004)	Chapter(s)	Appendices	Tables	Figures
5F	The monitoring considers the appropriate geographic scale to evaluate the status of species or species groups and the effectiveness of conservation actions.	5			
5G	The Plan is adaptive in that it allows for evaluating conservation actions and implementing new actions accordingly.	1, 5	1.4		
6	**Descriptions of procedures to review the Plan at intervals not to exceed ten years.**	6		6.1	
6A	The State describes the process that will be used to review the Plan within the next ten years.	6		6.1	
7	**Descriptions of the plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.**	7			
7A	The State describes the extent of its coordination with and efforts to involve Federal, State and local agencies, and Indian tribes in the development of its Plan.	7	7.3, Exhibit 1		
7B	The State describes its continued coordination with these agencies and tribes in the implementation, review, and revision of its Plan.	7			
8	**Descriptions of the necessary public participation in the development, revision, and implementation of the Plan.**	8			
8A	The State describes the extent of its efforts to involve the public in the development of its Plan.	8	8.1-Exhibits 1, 2		8.1-8.5
8B	The State describes its continued public involvement in the implementation and revision of its Plan.	8	Appendix 8.1		

Introduction

> *The people have a right to clean air, pure water, and to the preservations of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people.* (Pennsylvania Constitution, Article 1 § 27)

Pennsylvania's natural resources are the foundation of its beauty and cultural heritage and – just like Article 1 of the state constitution – the 2015 Pennsylvania Wildlife Action Plan, a non-regulatory, proactive conservation blueprint, helps ensure these resources remain available for future generations. Millions of Pennsylvanians enjoy hunting, fishing and wildlife watching (USDOI et al. 2012), which brings quality to our lives while contributing to local economies (Southwick Associates 2011). The Pennsylvania Fish & Boat Commission (PFBC) and Pennsylvania Game Commission (PGC) are privileged to support these activities by managing fish and wildlife populations for all citizens of the Commonwealth, present and future (Introduction, Agency Authorities and Missions). However, with 480 birds and mammals, nearly 200 fishes, close to 80 reptiles and amphibians, and an estimated >10,000 invertebrates – some of which have no state agency oversight (i.e., terrestrial invertebrates) – we cannot possibly focus on every species. Developing this revised Wildlife Action Plan and its predecessor, the 2005 Pennsylvania Comprehensive Wildlife Conservation Strategy, allowed for a comprehensive status assessment of native species most in need (Chapter 1), factors contributing to a species' status (Chapter 1, Appendix 1.4; Chapter 3), and the condition of supporting habitats (Chapter 2). From this, recommended actions to help this smaller subset of species – referred to as Species of Greatest Conservation Need - and their habitats over the next decade were identified (Chapter 1, Appendix 1.4; Chapter 4).

The 2015 Pennsylvania Wildlife Action Plan is for all Pennsylvanians with an interest in taking action for wildlife.

Publishing the 2005 Pennsylvania Comprehensive Wildlife Conservation Strategy (now Wildlife Action Plan) was a historic moment. For the first time, state fish and wildlife agencies were provided an opportunity through the congressionally appropriated State & Tribal Wildlife Grants Program, enacted in 2001, to take stock of 'unmet needs' of all wildlife and associated habitats, including those that are not hunted or fished (Public Law 106-291). Indeed, over 80% of Pennsylvania's fish and wildlife species fall into this category. Traditionally, conservation of vulnerable species was reactionary, focused on rarity – the ones on the precipice of extirpation (i.e., no longer existing in a state) or extinction (i.e., no longer existing on the planet). For example, many state threatened and endangered species programs emerged following passage of the federal Endangered Species Act in 1973 that provided funding to states for such purposes. Yet, focusing on already imperiled species is expensive. The new opportunity to

comprehensively evaluate all wildlife and habitats, and take action proactively, shifted the paradigm for state fish and wildlife agencies and the conservation community.

Here we are, 10 years later, and progress has been made (Introduction, Accomplishments), but much is left to do. Within the provisions of the 2001 enacting legislation, states were required to update their Plans within a decade to keep them current. Since 2012, the PGC and PFBC Steering Committee (Chapter 7) has worked to update all eight required elements (Introduction, Required Elements) with input from an advisory committee (Chapter 7), several *ad hoc* committees (Acknowledgments, Chapter 6, Appendix 6-Exhibit 2), and the public (Chapter 8). The 2005 Plan has been refreshed to meet new challenges, with the following guidance from the Steering Committee:

- 10-year planning horizon
- Focused and strategic
- Measurable actions
- Accessible and usable by resource practitioners and citizens
- Progress reporting, and incorporating into agency strategic plans
- Comprehensive, science-based, and spatially explicit
- Emphasize important role of Pennsylvania in supporting regional biodiversity

The size of this document speaks to the enormity of the task and bringing the contents to fruition will take teamwork and commitment. The 2015 Pennsylvania Wildlife Action Plan is for all Pennsylvanians with an interest in taking action for wildlife. Whether you read it cover-to-cover, or jump to a particular section of interest, we hope you will find at least one action or research, survey, or monitoring need that resonates for you. Working together, we can enhance Pennsylvania's Species of Greatest Conservation Need over the next decade and beyond.

Foundations of the Revised Plan

As an early task in the revision process, the Steering Committee, Advisory Committee, agency staff, and other conservation partners (e.g., Pennsylvania Teaming With Wildlife Coalition) reviewed features of the 2005 Wildlife Action Plan (i.e., Vision, Guiding Principles) to determine their current relevance. These features provide the foundation for developing and implementing the revised Plan, and were thus considered crucial components of the early revision process. The Goals provided the framework for the Objectives and Strategies, which were developed later in the revision process.

Vision

Healthy, sustainable native wildlife populations, natural communities and habitats in Pennsylvania.

Guiding Principles

- Conserve Pennsylvania's native imperiled species and their habitats
- Keep common native species common
- Recognize Pennsylvania's regionally important roles in conserving species and habitats
- Promote partnerships for wildlife conservation

Conserve Pennsylvania's native imperiled species and their habitats is the basis for the plan. As directed by Congress, the intent of the State Wildlife Action Plan is to identify species that may become threatened or endangered and to take proactive measures to address the threats that are degrading their habitats or directly affecting the species.

Keep common native species common is an effort to maintain native populations of foundational species (e.g., insectivores, herbivores) upon which broad ecological functions rely. Although they may currently be abundant, substantive loss of these "common species" could be detrimental to imperiled or declining species.

Recognize Pennsylvania's regionally important role in conserving species and habitats expresses that Pennsylvania is located at the intersection of several ecological regions or river basins (e.g., Ohio River Basin, Susquehanna River Basin) important to a broad range of species. Many species rely on Pennsylvania's management and protection of core habitats and corridors. Pennsylvania has a long history of working with other states throughout the northeast on conservation priorities as a member of the Northeast Association of Fish and Wildlife Agencies.

Promote partnerships for wildlife conservation recognizes that natural resource conservation in Pennsylvania is dependent upon the support of a broad coalition of agencies at all levels of government, conservation organizations, and the public. The resource needs are too great to be addressed by any single entity and require this collective response.

Purpose

To conserve Pennsylvania's native wildlife, maintain viable habitat, and protect and enhance Species of Greatest Conservation Need.

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Goals

➢ Goal 1

Conserve Pennsylvania's native wildlife and its habitat by implementing conservation actions in the Wildlife Action Plan.

Objective

1.1 Protect, restore, maintain or enhance all populations of Species of Greatest Conservation Need.

Strategy

1.1.1 Implement at least one priority conservation action for each Species of Greatest Conservation Need or ecosystem, focusing on actions with benefits to multiple species.

1.1.2 Implement species action (management) plans with an emphasis on multi-species benefits.

1.1.3 Head-start reintroduction of at least one native extirpated or severely depleted species or population when limiting factors have been addressed and there is high confidence for success.

1.1.4 Support artificial propagation of Species of Greatest Conservation Need, when re-establishment is feasible and ecologically valid.

1.1.5 Integrate conservation actions for Species of Greatest Conservation Need with resource management activities (e.g., timber harvest, water management).

1.1.6 Protect diverse populations and genetic material across the full range of species occurrences to facilitate adaptive capacity.

Objective

1.2 Maximize the benefit of land protection and habitat management decisions to Species of Greatest Conservation Need.

Strategy

1.2.1 Identify where conservation actions should be implemented to maximize the benefit to Species of Greatest Conservation Need and their habitats using best available data and technology.

1.2.2 Implement conservation actions in priority areas where current protection and management actions are considered insufficient to avert declines in Species of Greatest Conservation Need and their habitats.

1.2.3 Restore and acquire land to enhance connectivity between secured lands in resilient landscapes (see Anderson et al. 2011) to facilitate fish, wildlife, and plant migration, range shifts, and other transitions.

1.2.4 Develop native plant best management practices for habitat restoration and enhancement projects on public and private lands to promote Species of Greatest Conservation Need.

Objective

1.3 Track implementation of Pennsylvania's Wildlife Action Plan to ensure effectiveness of conservation actions and adapt management strategies.

Strategy

1.3.1 Annually monitor the biological response to State Wildlife Action Plan-related projects designed to achieve objectives for Species of Greatest Conservation Need and their habitats.

1.3.2 With agency partners, semi-annually assess the percentage of Pennsylvania Wildlife Action implementation.

➢ Goal 2

Base wildlife conservation decisions on the best available science, with an emphasis on Species of Greatest Conservation Need and their habitats.

Objective

2.1 Identify and resolve data deficiencies that limit implementation of conservation actions.

Strategy

2.1.1 Compile and analyze existing data for Species of Greatest Conservation Need and data deficient species (e.g., population, distribution, habitat).

2.1.2 Develop or update species management plans to guide conservation decisions for priority Species of Greatest Conservation Need.

2.1.3 Develop and implement survey protocols for Species of Greatest Conservation Need, data deficient species, and ecological communities.

2.1.4 Document occurrences of Species of Greatest Conservation Need, data deficient species and ecological communities.

2.1.5 Assess genetic diversity across the full range of species occurrences.

Objective

2.2 Assess trends in Species of Greatest Conservation Need and data deficient species.

Strategy

2.2.1 Monitor Species of Greatest Conservation Need to more fully assess population trends or changes in distribution.

2.2.2 Develop new, or adapt current, monitoring to provide trend detection with sufficient precision and accuracy to guide management actions.

2.2.3 Use standardized survey and monitoring protocols for Species of Greatest Conservation Need and data deficient species.

2.2.4 Monitor the effectiveness of conservation, restoration and enhancement projects, and modify, as needed, using adaptive management principles.

Objective

2.3 Evaluate habitat for effective conservation decision-making.

Strategy

2.3.1 Determine limiting habitat factors, threats and management needs for Species of Greatest Conservation Need.

2.3.2 Develop or update habitat survey strategies and protocols.

2.3.3 Survey habitats to characterize current condition and identify conservation actions to support Species of Greatest Conservation Need.

Objective

2.4 Obtain habitat or other ecologically relevant trend data to guide conservation actions.

Strategy

2.4.1 Identify deficiencies in habitat data that limit conservation action decision-making.

2.4.2 Develop or update monitoring strategies and protocols for priority habitats.

2.4.3 At ecologically appropriate spatial (e.g., basin, ecoregion) and temporal scales, monitor the quantity, distribution and condition of major habitat elements and trends.

2.4.4 Use habitat trend data to support decision-making for conservation and recovery of Species of Greatest Conservation Need.

2.4.5 Monitor impacts of recreational activities on habitats.

2.4.6 Use conservation easements and other land protection measures to incentivize private landowners to conserve Species of Greatest Conservation Needs and their habitats.

Objective

2.5 Evaluate threats to Species of Greatest Conservation Need and their habitats.

Strategy

2.5.1 Identify knowledge gaps (e.g., species adaptive capacity, risks) for existing and anticipated stressors (e.g., climate change, invasive species, energy development).

2.5.2 Identify an ecologically-connected network of terrestrial, freshwater, and coastal conservation areas that are expected to be resilient to pervasive threats (e.g., climate change) and likely to support a broad range of fish, wildlife, and habitats under alternative future conditions.

2.5.3 Track threats to understand impacts, including cumulative effects of multiple threats, to Species of Greatest Conservation Need and their habitats.

Objective

2.6 Assimilate Species of Greatest Conservation Need and habitat data into a structured, logical format to support conservation action decisions.

Strategy

2.6.1 Develop a geospatial framework that supports conservation decision-making.

2.6.2 Evaluate the functionality of the decision-support framework and adapt accordingly to increase effectiveness of conservation actions.

Objective

2.7 Support research that addresses species and habitat management needs.

Strategy

2.7.1 Continually assess limiting factors to populations (e.g., habitat requirements, species population demographics, threats, effectiveness of conservation actions).

2.7.2 Conduct ecologically-based research to address critical data gaps.

2.7.3 Conduct research on the potential impacts of recreational activities on habitats.

2.7.4 Evaluate the effects of conservation practices on target and non-target species, habitats and threats.

2.7.5 Validate modeling and statistically-based analytical tools and outputs for use in effective conservation decision-making.

2.7.6 Assess the economics of State Wildlife Action Plan implementation.

Objective

2.8 Support data compilation and entry into statewide, regional and national data repositories.

Strategy

2.8.1 Apply information systems for recording, analysis, storage, retrieval and reporting for all Species of Greatest Conservation Need, data deficient species, conservation actions and other relevant data for Pennsylvania and the Northeast Region.

2.8.2 Enter verified sightings of Species of Greatest Conservation Need, data deficient species, or unusual wildlife occurrences into geospatial databases.

2.8.3 Align climate data and models with decision-support tools for conservation actions.

2.8.4 Support revisions of ecological community/habitat classification systems for planning and implementation initiatives.

2.8.5 Develop and maintain analytical and decision-support tools to guide implementation of conservation actions.

➢ Goal 3

Contribute to range-wide conservation of Species of Greatest Conservation Need.

Objective

3.1 Support regional, national, and global species protection and management.

Strategy

3.1.1 Consider Pennsylvania's role within a regional/national/global context when identifying "responsibility" species and ecological communities for conservation action.

3.1.2 Actively participate in, and provide resources to, regional initiatives (e.g., Northeast Fish and Wildlife Diversity Technical Committee, Regional Conservation Needs Grants Program, Landscape Conservation Cooperatives) that support Pennsylvania's Species of Greatest Conservation Need and their habitats.

3.1.3 Encourage data sharing, compilation and analysis to support range-wide conservation of Pennsylvania's Species of Greatest Conservation Need.

3.1.4 Actively participate in, and provide resources to, international conservation initiatives for shared species, such as AFWA's Southern Wings program.

3.1.5 Maintain contacts with climate science centers and use models and tools for management planning and implementation.

➢ Goal 4

Strengthen the state's capacity to conserve Pennsylvania's native wildlife.

Objective

4.1 Maintain and broaden support for fish and wildlife diversity conservation.

Strategy

4.1.1 Communicate the economic benefits of Pennsylvania's Wildlife Action Plan to develop public support for sustainable conservation funding.

4.1.2 Use results from Responsive Management (2014) to inform subsequent surveys that can guide funding options for fish and wildlife diversity conservation.

4.1.3 Seek support from private foundations, individuals, corporations and/or institutions for implementing Pennsylvania's Wildlife Action Plan.

4.1.4 Provide technical information to government leaders to support stable, long-term funding for State Wildlife Action Plan implementation.

4.1.5 Cooperatively seek funding with federal and state agency partners to support Pennsylvania Wildlife Action Plan implementation.

4.1.6 Engage local (e.g., conservancies, land trusts), regional (e.g., Landscape Conservation Cooperatives), and national organizations (e.g., Association of Fish and Wildlife Agencies), to foster grassroots support of the State Wildlife Action Plan and funding.

4.1.7 Work with the Wildlife Action Plan Advisory Committee to host a biennial, cross-cutting conference focused on Wildlife Action Plan conservation priorities.

Objective

4.2 Maintain and enhance the capacity to manage Pennsylvania's fish and wildlife.

Strategy

4.2.1 Maintain an active volunteer program to support Pennsylvania's Wildlife Action Plan.

4.2.2 Recruit and maintain qualified, well-trained, and well-equipped staff and volunteers in state fish and wildlife management agencies.

4.2.3 Provide continuing education opportunities to staff to ensure decisions are based on current science and technologies.

4.2.4 Provide administrative support for efficient and effective implementation of programs (e.g., State & Tribal Wildlife Grants Program) supporting Pennsylvania's Wildlife Action Plan.

Objective

4.3 Leverage funding opportunities for projects supporting Pennsylvania Wildlife Action Plan priorities.

Strategy

4.3.1 Encourage Pennsylvania Department of Environmental Protection to provide additional points when scoring Growing Greener proposals that align with Wildlife Action Plan priorities.

4.3.2 Continue to work with Pennsylvania Department of Conservation and Natural Resources' Wild Resource Conservation Program to fund research and conservation needs identified in the Wildlife Action Plan.

4.3.3 Collaborate with the *Wildlife For Everyone Endowment Foundation* to provide funding for projects that support Species of Greatest Conservation Need and their habitats.

4.3.4 Engage partners (e.g., agencies, nongovernmental organizations, private foundations, institutes) to leverage financial and technical support for Wildlife Action Plan Priorities.

➢ Goal 5

Continue to improve cooperation within and between public agencies and other partners in wildlife conservation planning and implementation.

Objective

5.1 Maintain an effective Wildlife Action Plan.

Strategy

5.1.1 Convene conservation partners at a frequency sufficient to assess knowledge gaps, document progress and ensure a relevant State Wildlife Action Plan.

5.1.2 Coordinate with local, state, and federal governments, private landowners and other conservation partners to support Pennsylvania's Wildlife Action Plan.

5.1.3 Between 2015 and 2025, update Pennsylvania's Wildlife Action Plan to maintain technical and administrative relevance.

5.1.4 Conduct a comprehensive review and revision of Pennsylvania's Wildlife Action Plan by October 2025.

Objective

5.2 Engage technical experts in planning and implementation to maintain a science-based plan.

Strategy

5.2.1 Work with agencies, research institutions, and non-governmental organizations, especially the Pennsylvania Biological Survey (PABS), to maintain a technically current Wildlife Action Plan.

5.2.2 Work with conservation partners to document conservation actions specifically supporting Pennsylvania's Wildlife Action Plan.

5.2.3 Seek input from researchers and practitioners on implementation strategies and alternative approaches for more effective conservation actions.

5.2.4 Incorporate climate data into data management and decision-support tools.

Objective

5.3 Foster coordination and collaboration among partners.

Strategy

5.3.1 Through multiple media formats, provide updates on activities and accomplishments pertaining to Pennsylvania's Wildlife Action Plan.

5.3.2 Encourage open and active exchange of information and ideas in decision-making.

5.3.3 Maintain an active institutional framework (e.g., Advisory Committee) to ensure participation of conservation partners.

5.3.4 Collaborate with public land management agencies to implement Pennsylvania's Wildlife Action Plan.

5.3.5 In areas of mutual interest and activity, clearly identify roles, objectives, outputs of participating agencies and organizations.

Objective

5.4 Improve integration and coordination of Pennsylvania's Wildlife Action Plan within each Commission.

Strategy

5.4.1 Within each Commission, work closely with relevant offices and staff to collectively implement Pennsylvania's Wildlife Action Plan.

5.4.2 Provide information to Commission staff on planning activities, problems, needs and accomplishments of Pennsylvania's Wildlife Action Plan.

5.4.3 Use internal training opportunities to build institutional support for Pennsylvania's Wildlife Action Plan.

Objective

5.5 Promote integration of Pennsylvania Wildlife Action Plan priorities with existing local, state and federal planning documents.

Strategy

5.5.1 Provide to County Conservation Districts a summary of Wildlife Action Plan priority species, habitats and conservation actions for integration into watershed management plans and District work plans.

5.5.2 Work with Pennsylvania Department of Community and Economic Development to integrate statewide land use planning into the Municipal Planning Code.

5.5.3 Link State Forest Action Plan and State Wildlife Action Plan priorities.

➢ Goal 6

Develop a knowledgeable citizenry that supports and participates in wildlife conservation.

Objective

6.1 Enhance coordination among conservation partners to foster a well-informed citizenry.

Strategy

6.1.1 Increase coordination and communication between resource managers, natural resource and social scientists through new and existing forums.

6.1.2 Develop current and relevant information on Species of Greatest Conservation Need and their habitats and distribute through engaging formats and media.

6.1.3 Evaluate the effectiveness of public awareness and outreach efforts through statistically valid surveys and other evaluation instruments.

6.1.4 Broaden support for State Wildlife Action Plan by reaching out to new, potential partners.

6.1.5 Re-assess public needs, values and expectations on a regular basis to identify outreach needs.

6.1.6 Increase public awareness and understanding of natural resources, ecosystem services and associated threats (e.g., climate change, invasive species, pathogens) and risks to Species of Greatest Conservation Need and their habitats.

Objective

6.2 Encourage public input and participation in wildlife management decisions and activities.

Strategy

6.2.1 Provide timely public notice and reasonable availability of information related to key decisions affecting conservation.

6.2.2 Distribute technical information to landowners, land managers and local governmental agencies focused on habitat protection, restoration, and enhancement for Species of Greatest Conservation Need.

6.2.3 Encourage open and active exchange of information and ideas through social media, public meetings or other effective sources of communication.

6.2.4 Engage the public through targeted education and outreach efforts and stewardship opportunities.

6.2.5 Promote private landowner engagement in the conservation of Pennsylvania's wildlife and habitats.

Objective

6.3 Support conservation outreach initiatives.

Strategy

6.3.1 Develop and implement a Pennsylvania Wildlife Action Plan outreach strategy.

6.3.2 Identify wildlife conservation information needs of the public and ways in which those needs can be met most effectively.

6.3.3 Implement projects that have been demonstrated to effectively convey wildlife conservation information to the public.

6.3.4 Provide wildlife-oriented educational experiences to public leaders, agencies, organizations, businesses, communities and landowners.

6.3.5 Collaborate with traditional and non-traditional partners to increase public awareness of Species of Greatest Conservation Need, their habitats and associated threats to these species and habitats.

Agency Authorities and Missions

Introduction

With responsibility for managing vertebrate and aquatic invertebrate fauna, the Pennsylvania Game Commission (PGC) and Pennsylvania Fish and Boat Commission (PFBC) are the lead agencies developing and guiding implementation of Pennsylvania's Wildlife Action Plan. This leadership role is based on legislative authority as well as the missions of each agency. Inscribed within their respective missions are recreation and education opportunities that support and enhance the experiences of users of the Commonwealth's natural resources. These legal provisions and functions support PGC and PFBC oversight responsibility for Pennsylvania's Wildlife Action Plan.

Pennsylvania Game Commission

Agency Authority

Established in 1895, the PGC is an independent administrative agency of the Commonwealth of Pennsylvania mandated by law "*… to protect, propagate, manage and preserve the game or wildlife of this Commonwealth …*" with the mission to manage all wild birds and mammals and their habitats for present and future generations.

Title 34, (Pa. C.S.), § 103 of the Game and Wildlife Code, states that "*the ownership, jurisdiction over and control of game or wildlife is vested in the commission as an independent agency of the Commonwealth in its sovereign capacity to be controlled, regulated and disposed of in accordance with this title.*"
Included in this responsibility is the authority to:

- Regulate, protect, propagate, manage and preserve game or wildlife and game or wildlife habitat.

- Regulate the importation, possession and/or release of wildlife in the Commonwealth.
- Add to or change the classification of any wild bird or wild animal.
- Manage and develop its lands and waters and other government or private lands and waters under agreement with the owners as it considers advisable and enact and enforce regulations to ensure the prudent and proper use of these lands.
- Collect, classify and preserve statistics, data and information.
- Enter into cooperative agreements with the Secretary of the Interior, any government agency, individual, corporation or educational or research institution to further the programs of the commission. The Commonwealth assents to the provisions of the Federal Wildlife Restoration Act.

Readers are encouraged to review the PGC Strategic Plan (see About Us, then Strategic Plan).

Pennsylvania Fish and Boat Commission

Agency Authority

With a focus on aquatic resources, the Pennsylvania Fish and Boat Commission (PFBC), was founded in 1866 and complements the Pennsylvania Game Commission's wildlife resource management. As an independent agency of the Commonwealth of Pennsylvania, the Commission's mission is "*to protect, conserve, and enhance the Commonwealth's aquatic resources and provide fishing and boating opportunities*".

The mission of the PFBC reflects the statutory responsibilities in the Fish and Boat Code, Title 30 Pa. C.S. §321, in which the Commission is vested with the authority to administer and enforce this title and other laws of the Commonwealth related to:

- Encouragement, promotion and development of the fishery interests.
- Protection, propagation and distribution of fish. Fish is defined in the statute as "all game fish, fish bait, bait fish, amphibians, reptiles and aquatic organisms."
- Management of boating and the operation of boats.
- Encouragement, promotion and development of recreational boating.

Inclusive in this authority, the Pennsylvania Fish and Boat Commission has responsibility and authority to:

- Promulgate rules and regulations concerning fishing to aid in the better protection, preservation and management of fish.
- Publish bulletins, literature, posters and other printing as may be appropriate to the work of the Commission.
- Enter into cooperative agreements with federal, state and local agencies or any educational or research institution or any other person or entity to carry out or further the programs of the commission.
- Propagate, protect, manage and distribute fish and the stock waters within the Commonwealth.
- Conduct fieldwork, gather spawning fish and transfer fish.

- Promote public interest in recreational fishing in the Commonwealth.
- Purchase lands and waters to make them available for use by the citizens of the Commonwealth for fishing, boating and other recreational purposes.
- Promulgate regulations concerning the protection, preservation and management of fish and fish habitat, permitting and prohibiting fishing, the ways, manner, methods and means of fishing, and the health and safety of persons who fish or may be in the vicinity of such persons on, in or along the waters of the Commonwealth.
- Conduct and establish cooperative fish restoration projects.
- Conduct comprehensive studies of the migratory fish habits.
- Establish a Pennsylvania Threatened Species List and a Pennsylvania Endangered Species List.
- Promulgate rules and regulations governing the catching, taking, killing, importation, introduction, transportation, removal, possession, selling, offering for sale or purchasing of threatened and endangered species and, if deemed advisable, may issue permits for catching taking or possessing any of those species.

Readers are encouraged to review the PFBC Strategic Plan.

Summary

The respective legal authorities, strategic plans and missions of the Pennsylvania Game Commission and the Pennsylvania Fish and Boat Commission provide the basis for leading the development and stewardship of the Pennsylvania Wildlife Action Plan. The Commissions, together with conservation partners, strive to provide fiscally responsible programs that conserve, enhance and protect Pennsylvania's fish and wildlife resources and habitats.

Required Elements

State Wildlife Action Plans are developed based upon *Eight Required Elements* identified by Congress. These Required Elements provide for a comprehensive assessment of each state's imperiled species, or Species of Greatest Conservation Need (SGCN). In this Plan, the numbered chapters represent each of these Required Elements and include:

1 - Species. Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.

2 - Habitat. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in the 1st element.

3 - Threats. Descriptions of problems which may adversely affect species identified in the 1st element or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.

4 - Conservation Actions. Descriptions of conservation actions determined to be necessary to conserve the identified species and habitats and priorities for implementing such actions.

5 - Monitoring. Descriptions of the proposed plans for monitoring species identified in the 1st element and their habitats, for monitoring the effectiveness of the conservation actions proposed in the 4th element, and for adapting these conservation actions to respond appropriately to new information or changing conditions.

6 - Plan Revision. Descriptions of procedures to review the Strategy/Plan at intervals not to exceed 10 years.

7 - Partner Coordination. Descriptions of the plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the Plan-Strategy with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.

8 - Public Participation. Descriptions of the necessary public participation in the development, revision, and implementation of the Plan.

Background: The 2005 Pennsylvania Wildlife Action Plan

The 2005 Pennsylvania Wildlife Action Plan (formerly Comprehensive Wildlife Conservation Strategy) was the culmination of a collaborative effort among the Pennsylvania Game Commission (PGC), Pennsylvania Fish and Boat Commission (PFBC), and numerous conservation partners to identify the needs and conservation actions required to protect the Commonwealth's at-risk and imperiled species. After its timely submission, the document was rigorously reviewed by a Regional Review Team (RRT) and the National Advisory Acceptance Team (NAAT) and approved in April 2006. Details regarding development and structure of the 2005 Pennsylvania Wildlife Action Plan are described in PGC-PFBC (2005). This conservation framework and associated achievements for Pennsylvania's Species of Greatest Conservation Need and their habitats provide context for this comprehensive revision.

In the 2005 Pennsylvania Wildlife Action Plan, five goals, with over 100 strategic and operational objectives and 1,000 Prioritized Implementation Actions, were identified to address the needs of the Commonwealth's imperiled species and their habitats. In this section, we review amendments, goals and accomplishments of that plan.

Amendments

In the intervening years since its approval, via amendments, Pennsylvania has added two Species of Greatest Conservation Need and identified climate change as an emerging issue:

- ✓ **Amendment 1 – Native Eastern Brook Trout (*Slavelinus fontinalis*) (Addition):**

Native Eastern brook trout is not only Pennsylvania's state fish, but also represents an important species to the Commonwealth's aquatic ecology. In the amendment, this species was considered abundant in Pennsylvania, yet its addition to the Pennsylvania Wildlife Action Plan was justified based upon numerous threats, as well as substantial decline in populations and distribution throughout its range. The addition of a species to the State Wildlife Action Plan is a major amendment, thus requiring a public comment period (FWS-AFWA Guidance Memo, 08.21.12). The amendment was approved by the USFWS in March 2008.

✓ **Amendment 2 – Climate Change (Emerging Issue):**

Although climate change was noted in Pennsylvania's 2005 SWAP, further elaboration of this emerging issue was considered important as a consequence of potentially broad ecological implications for Pennsylvania, coupled with growing interest in public policy to address this threat. Climate change effects were highlighted by the Intergovernmental Panel on Climate Change (IPCC) report (IPCC 2007) and, in collaboration with the Association of Fish and Wildlife Agencies (AFWA 2009) climate change report for State Wildlife Action Plans, the impetus increased for further discussion of this threat to Pennsylvania's Wildlife Action Plan, and the amendment was approved by the USFWS in February 2010. In this amendment, the PGC and the PFBC committed to "a full inclusion of climate change adaption priorities and pitfalls in the PA Wildlife Action Plan revision of 2015".

✓ **Amendment 3 – American Shad (*Alosa sapidissima*) (Addition):**

American shad populations have been greatly depressed for many years as a result of dams and poor water quality on the Lower Susquehanna, Schuylkill and Lehigh Rivers. In 2010, in response to continued declines, highlighting the interest in this species, the Atlantic States Marine Fisheries Commission (ASFMC) passed Amendment 3 to the Interstate Fisheries Management Plan for shad and herring (ASFMC 2010). This ASFMC amendment called for all states and jurisdictions to close American shad fisheries unless they can demonstrate that the fishery is sustainable. At the time of the proposed amendment to the Pennsylvania Wildlife Action Plan, in Pennsylvania, fishing for American shad was closed on the rivers encompassed by this amendment. The amendment, which identifies actions to enhance American shad populations, was approved by the USFWS in April 2012.

State & Tribal Wildlife Grants Program

State & Tribal Wildlife Grants (SWG)Program funding, coupled with extensive non-federal match provided by the PGC, PFBC and conservation partners, has been crucial to implementing the 2005 Plan. From FY01 through FY14, Pennsylvania received $25,179,579 in SWG funds, shared equally between the Commissions. These federal funds then leveraged an additional $20,881,694 in non-federal match (e.g., matching funds, services of volunteers, services and materials) for a total of $46,061,273 supporting 110 projects conducted under this program.

Implementing Pennsylvania's Wildlife Action Plan

The number and scope of State & Tribal Wildlife Grant-funded projects demonstrate the concerted efforts to implement the 2005 Pennsylvania Wildlife Action Plan. For this summary, a comprehensive

review of each project is not feasible, rather we provide an overview illustrating the progress to-date with addressing key components of this Plan.

Issues, Goals and Objectives

Overview

Of five goals in the 2005 Pennsylvania Wildlife Action Plan, most effort has been directed at Goals 1 and 2 (Table 1) and associated objectives. The need to focus on Goal 1 was based on the recognition that basic data were lacking for many Species of Greatest Conservation Need and addressing these data gaps, especially for higher-priority species, would be crucial for making informed management decisions. Data gaps, primarily in species distribution and habitat condition were seen as major drawbacks to developing management plans and guiding species recovery. Indeed, State & Tribal Wildlife Grants provided the first opportunity to comprehensively evaluate and address the needs of these species.

Yet, for species with sufficient or more robust data, it was important to plan and implement conservation actions for their recovery and long-term viability as evidenced by a similar number of

Table 1. Number of State & Tribal Wildlife Grants Program-funded projects addressing each of the five goals in the 2005 Pennsylvania Wildlife Action Plan (PGC-PFBC 2005).

Goal	Description	Number of projects*
1	Improve the scientific basis for making conservation decisions for wildlife, with special emphasis on species of greatest conservation concern.	92
2	Plan, prioritize, and implement actions that will conserve the state's diversity of wildlife and its habitat	101
3	Develop a knowledgeable citizenry that supports and participates in wildlife conservation.	14
4	Ensure that the necessary resources are available to conserve Pennsylvania's wildlife.	3
5	Expand and improve coordination of the public agencies and other partners in wildlife conservation planning and implementation.	5

* PGC or PFBC administered projects.

projects addressing Goal 2. With a rapidly changing landscape, providing quality habitats was considered crucial for species survival, and these projects were typically directed at habitat enhancement (e.g., timber stand improvement for golden-winged warbler (*Vermivora chrysoptera*), dam removal for migratory fishes).

Projects addressed at least one goal, yet contingent on the project scope, complex projects may have addressed multiple goals. For example, a habitat enhancement project also may have included a monitoring component, thus making it relevant to both Goals 1 and 2.

Fewer projects encompassed Goals 3, 4 and 5, yet this does not diminish the importance of these goals. Rather, the emphasis on Goals 1 and 2 reflects greater urgency whereas insufficient funding and staff capacity limited the ability to address Goals 3, 4 and 5. For these goals, some initiatives may not have been supported by State & Tribal Wildlife Grants.

The focus of SWG-funded projects also is demonstrated by categorizing projects into the U.S. Fish and Wildlife Service (USFWS) Wildlife TRACS (Tracking and Reporting Actions for the Conservation of Species) Level 1 Action classes (Salafsky et al. 2008; USFWS 2014). Accordingly, through these Level 1 Action classes, 69 of 110 (62.7%) projects had a primary action directed towards data collection and analysis (Table 2), further reflecting the emphasis on improving the scientific basis for decision making.

Issue 1: Basis for Decision-Making

Goal 1**:** Improve the scientific basis for making conservation decisions for wildlife, with special emphasis on species of greatest conservation concern.

Background**:** Determining effective conservation actions is dependent on availability of current, high-quality data. In 2005, a lack of basic information (e.g., range, population, basic life-history) for many Species of Greatest Conservation Need hindered resource managers' efforts to direct protection and recovery of these species. Beyond the major challenge of maintaining data on a large number of species, the availability of data was distributed inconsistently among taxonomic groups, with extensive, high-quality data available for some groups (e.g., birds) while other groups (e.g., amphibians and reptiles) lacked basic information such as species range. Beyond basic inventory data, there was further desire for greater understanding of the ecosystem roles of species in the Pennsylvania. Although the direct effect of conservations actions on target species may have been recognized, the effects on non-target species were less understood. Among the deficiencies have been: insufficient data to make sound cost/benefit analyses for conservation actions; a lack of understanding regarding on-the-ground implications of research; and insufficient knowledge of multi-dimensional threats (e.g., encroachment, habitat fragmentation, exotic and invasive species).

Review: With a large number of species across a rapidly changing landscape, the emphasis during plan implementation was to develop current, comprehensive data on the distribution, abundance, population structure and other demographics of Species of Greatest Conservation Need. Gathering high-quality data for these species often required specialized resources and personnel because these species posed particular challenges for surveying or monitoring due factors such as: difficulty in detection or sampling, complicated life-histories; low abundance and sparse distribution; and migratory behaviors. State & Tribal Wildlife Grants funding greatly enhanced the capacity of the Commissions and partners to: 1) document the diversity of wildlife in Pennsylvania, including distribution, abundance, and status; 2) identify species of greatest conservation concern; 3) identify critical habitats and their status; and 4) identify key threats to species and habitats.

Table 2. Number of State Wildlife Grant-funded projects grouped by Wildlife TRACS Level 1 Action classes.

TRACS Level 1 Action Code	Description	Number of Projects*
1	Coordination and Administration	4
2	Direct Management of Natural Resources	15
3	Data Collection and Analysis	69
4	Land and Water Rights Acquisition and Protection	2
5	Planning	11
6	Species Reintroduction and Stocking	3
7	Technical Assistance	6

* PGC or PFBC administered projects.

Examples:

- Second Atlas of Breeding Birds in Pennsylvania (Wilson et al. 2012)
- Web-based Registry and Study of Seasonal Pools in PA
- 2014 Pennsylvania Nongame Public Opinion Survey (Responsive Management 2014)
- Pennsylvania Amphibian and Reptile Survey (PARS)
- Allegheny Woodrat Conservation in Pennsylvania: A Multipronged Approach (Case Study)

Another use of these newly acquired data was to evaluate the official designation of several state threatened and endangered species (Table 3). These evaluations have resulted in both an improved species status such as delisting of Pennsylvania Threatened, Endangered and Candidate species, as well as shifting species to a more imperiled designation. Removing a species from the state threatened, endangered and candidate list indicates that the population and reproductive capacity of the species is adequate to cope with current and anticipated environmental conditions. Further, removing a species from a state threatened and endangered species list reduces the likelihood that the species will become federally listed. Therefore, newly acquired data through State & Tribal Wildlife Grant-funded projects support the Congressional intent of State Wildlife Action Plans to prevent species from becoming threatened and endangered. Delisting species also reduces administrative burdens and expenses associated with their protection and management, demonstrates that threatened and endangered species designation is not permanent and, with sufficient resources and safeguards, recovery can be achieved.

Although data, acquired primarily through State & Tribal Wildlife Grants-funded projects, identified an improved status (i.e., de-listed or upgraded) for 17 species, for another 18 species results lead to the determination of a more imperiled status (Table 3) thus contributing to their new, downgraded listing. Such listings are not a positive reflection of these species' conservation status. Nevertheless, early identification of greater imperilment, along with increased understanding of factors contributing to their decline, is crucial for prompt intervention and implementation of recovery actions for these species.

These newly acquired data from State & Tribal Wildlife Grant-funded projects provided information for these changes in state designations. However, the upgrade/delisting in designations were not solely the result of specific management actions funded through State & Tribal Wildlife Grant projects. Rather, improvements in a species imperilment status also may be attributable to collective long-term improvements in environmental conditions brought about by regulatory protections, better land stewardship, species protections, and other factors.

Issue 2: Planning and implementation

Goal 2: Plan, prioritize, and implement actions that will conserve PA's diversity of wildlife and its habitat.

Background: As a feature of their missions, the Commissions have long-supported planning and recovery initiatives for their respective jurisdictional species. Yet, despite these planning efforts, constraints such as insufficient funding, limited availability of personnel, inadequate coordination among conservation partners and a lack of application of conservation actions have provided only partial implementation success.

For this goal, special emphasis was placed on habitat inventory and monitoring, species inventory and monitoring, habitat conservation and management, and prioritization and management of recovery actions. Species recovery planning and implementation require extensive collaboration among conservation partners and enhanced communication was considered crucial to maximize on-the-ground conservation efforts.

Review: Building on available data, implementation of State Wildlife Action Plan priorities has been targeted toward key habitats and critically imperiled species. These projects have focused extensively on protection and restoration across a broad range of habitats such as grasslands, forest, barrens, caves, wetlands, and rivers and streams. Similarly, the types of actions taken have been diverse such as disturbance to bats, dam removal and fish passage projects to enhance aquatic connectivity, and forest management practices to improve bird habitat. The availability of State & Tribal Wildlife Grants funding, along with Commission and partner contributions, were essential for these implementation projects.

Examples:

- ***Restoration and Management of Globally Significant PA Barrens Habitats***
- ***Fort Indiantown Gap NGTC Grassland Habitat***
- ***Piney Tract Important Bird Area Grasslands Management, Implementing a Forestland BMP for Golden-winged Warbler Breeding Habitat on Public Lands in PA***
- ***Bat Hibernacula Gating***
- ***Fish Passage & Habitat Restoration Planning***
- ***Species Action Plans- Bog Turtle (Glyptemys muhlenbergii), Eastern Massasauga (Sistrurus catenatus catenatus), Eastern Pearlshell (Margaritifera margaritifera), Eastern Spadefoot (Scaphiopus holbrookii), Timber Rattlesnake (Crotalus horridus)***

Table 3. State regulatory status changes (endangered, threatened, candidate) of Pennsylvania Species of Greatest Conservation Need, 2005-2015 (58 Pa. Code, Chapter 75, § 75.1-75.3 (fish, amphibian, reptiles, mussels), 58 Pa. Code, Chapter 133, § 133.21 (birds), § 133.41 (mammals).

		Status (2005)				Status (2015)			
Common Name	**Scientific Name**	**Endangered**	**Threatened**	**Candidate**	**Not listed**	**Endangered**	**Threatened**	**Candidate**	**Delisted**
Smallmouth buffalo	*Ictiobus bubalus*		X						X[a]
Longhead darter	*Percina macrocephala*		X						X[a]
Channel darter	*Percina copelandi*		X						X[a]
River redhorse	*Moxostoma carinatum*			X					X[a]
Longnose gar	*Lepisteous osseus*			X					X[a]
Silver chub	*Macrhybopsis storeriana*	X							X[b]
Goldeye	*Hiodon alosoides*		X						X[b]
Mooneye	*Hiodon tergisus*		X						X[b]
Skipjack herring	*Alosa chrysochloris*		X						X[b]
Brook silverside	*Labidesthes sicculus*			X					X[b]
American brook lamprey	*Lampetra appendix*			X					X[c]
Bluebreast darter	*Etheostoma camrum*		X						X[K]
Spotted darter	*Etheostoma maculatum*		X						X[K]
Tippecanoe darter	*Etheostoma tippecanoe*		X						X[K]
Gilt darter	*Percina evides*		X						X[K]
Eastern spadefoot toad	*Scaphiopus holbrookii holbrookii*	X[d]					X[e]		
Rough green snake	*Opheodrys aestivus*		X			X[d]			
Northern cricket frog	*Acris crepitans*				X	X[b]			
Blue-spotted salamander	*Ambystoma laterale*				X	X[b]			
Eastern mud turtle	*Kinosternon subrubrum subrubrum*				X	X[c]			
Eastern pearlshell mussel	*Margaritifera margaritifera*				X	X[d]			
Rabbitsfoot mussel	*Quadrula cylindrica cylindrica*				X	X[f]			

Snuffbox mussel	*Epioblasma triquetra*		X	X[f]	
Salamander mussel	*Simpsonaias ambigua*		X	X[g]	
Round hickorynut mussel	*Obovaria subrotunda*		X	X[c]	
Pistolgrip mussel	*Quadrula verrucosa*		X	X[c]	
Rayed bean mussel	*Villosa fabalis*		X	X[c]	
Chesapeake logperch	*Percina bimaculata*		X	X[c]	
Sheepnose mussel	*Plethobasus cyphyus*		X	X[f]	
Northern redbelly dace	*Phoxinus eos*		X	X[b]	
Bald Eagle	*Haliaeetus leucocephalus*	X			X[h]
Northern Harrier	*Circus cyaneus*		X	X[i]	
Long-eared Owl	*Asio otus*		X	X[i]	
Upland Sandpiper	*Batramia longicauda*	X		X[i]	
Northern flying squirrel	*Glaucomys sabrinus macrotis*		X	X[j]	

[a]3-7-2009 (39 Pa.B. 1202), [b]7-3-2010 (40 Pa.B. 3664), [c]12-22-2012 (42 Pa.B. 7684), [d]9-10-2005 (35 Pa.B. 5010), [e]12-7-2013 (43 Pa.B. 7085), [f]7-11-2009 (39 Pa.B. 3442), [g]1-30-2010 (40 Pa.B. 620), [h]03-15-14 (44 Pa.B. 1429), [i]11-17-12 (42 Pa.B. 7106), [j]12-22-07 (37 Pa.B. 6748), [k]07-18-15 (Pa.B. 3841)

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CASE STUDY: **Allegheny Woodrat (Neotoma magister) Conservation in Pennsylvania: A Multipronged Approach**

Joseph Duchamp, Indiana University of Pennsylvania, Indiana, PA
Reginald Hoyt, Delaware Valley University, Doylestown, PA
Justin Vreeland, Pennsylvania Game Commission, Huntingdon, PA

Project Locations

Habitat Assessment and Testing of Supplemental Feeding: Chestnut Ridge, Pennsylvania

*Statewide Genetic Assessment (*also implementing habitat management):* State Game Lands: 42, 48, 51, 67*, 71*, 74, 75, 89, 100, 104, 111, 112*, 121, 138, 153, 211, 229, 264, and 296; State Forests: Buchanan, Elk, Forbes, Loyalsock, Rothrock, Sproul, Tiadaghton, Tioga, Tuscarora; State Parks: Bucktail, Colton Point, Laurel Ridge, Ohiopyle, Trough Creek.

Captive Breeding Program: Delaware Valley University, Doylestown, Pennsylvania

Species of Greatest Conservation Need/Priority Habitat affected

The Allegheny woodrat (*Neotoma magister*) is listed as threatened in Pennsylvania. It is a Northeastern U.S. priority species (Terwilliger Consulting & NEFWDTC 2013), and is declining throughout its range (Pennsylvania contains >5% percent of the global population). This species typically lives in small colonies within larger metapopulations and occupies complex rock outcrops along steep slopes surrounded by heavily forested landscapes.

Project Purpose

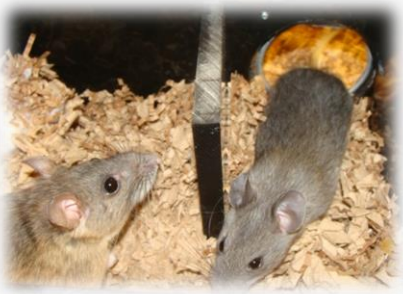
The project goal is to stabilize or increase declining populations of Allegheny woodrats in Pennsylvania. Project objectives included identifying quality habitat, enhancing habitat to improve food resources, characterizing statewide genetic diversity, and developing a breeding colony to aid population management and reinforce genetic diversity.

Project Description

In 2006, projects began to identify quality habitat and develop best habitat management practices. Woodrats were trapped across 12 sites over 4 years. Survival was higher at locations with greater diversity of hard mast trees, adult density and fecundity were higher at sites with less canopy cover, and adult density and recruitment improved with greater amounts of food.
Treatments to improve food productivity and diversity at five sites consisted of creating 0.1 – 2-acre patch cuts to release soft-

mast-producing shrubs and increase forb production; controlling non-native invasive plants; daylighting suppressed hard-mast-producing trees; reinforcing desirable tree species diversity by selectively controlling black birch, red maple, and striped maple; and creating grape arbors. Woodrat populations were monitored to evaluate population response. No immediate effect was observed between the year prior to treatment and the subsequent 2 years, but effects of habitat enhancement may require several years to be fully realized.

In 2012, 10 woodrats were transferred from Purdue University to Delaware Valley University to start a captive breeding program ultimately to generate a source population of animals to supplement declining colonies. Six additional animals were provided in 2013 by the Pennsylvania Game Commission. In mid-2015, the population totaled 8 individuals. Offspring produced from this effort will be released within existing woodrat populations in need of genetic rescue or will be provided for reintroduction efforts.



During 2013-2014, woodrat habitat sites were sampled to collect genetic data on disparate woodrat populations. Woodrats were captured at 51 of 100 sites; 179 woodrats were captured. Analyses of population structure and genetic diversity is ongoing. Final results of this project will enable informed genetic management of fragmented populations and help direct genetic rescue and reintroduction efforts.

Project Partners

Delaware Valley University; Indiana University of Pennsylvania; Pennsylvania Department Conservation and Natural Resources; Pennsylvania Game Commission; Purdue University

References

Smyser, T. J., J. E. Duchamp, S. A. Johnson, J. L. Larkin, and O. E. Rhodes Jr. 2012. Consequences of metapopulation collapse: comparison of genetic attributes between two Allegheny woodrat metapopulations. Conservation Genetics **13**: 849–858.

Terwilliger Consulting & NEFWDTC (Northeast Fish and Wildlife Diversity Technical Committee). 2013. Taking action together: Northeast regional synthesis for State Wildlife Action Plans. A report submitted to the Northeast Fish and Wildlife Diversity Technical Committee, Locustville, Virginia.

Issue 3: Education

Goal 3**:** Develop a knowledgeable citizenry that supports and participates in wildlife conservation.

Background: Although educational activities are eligible for only limited State & Tribal Wildlife Grant support, this goal was considered crucial for maintaining programs that benefit Species of Greatest Conservation Need and their habitats. Responsive Management (1996) demonstrated that Pennsylvanians overwhelmingly supported legal hunting and fishing, were extremely interested in fish and wildlife, and were heavily involved in wildlife-related recreation. This public opinion survey also highlighted that hunters and non-hunters shared nearly identical levels of support for various wildlife management activities. Pennsylvania residents cared about fish and wildlife resources and almost half wanted more information (Responsive Management 1996).

To maintain and enhance an informed public, this goal was designed to identify outreach needs, enlist public participation in wildlife decision-making, provide technical and financial support to private landowners, and offer conservation and wildlife-recreation educational opportunities.

Review: With limited funding, and more immediate needs of data acquisition, species protection and habitat management, Goal 3 was relevant to relatively few projects (Table 1). Yet, despite few State & Tribal Wildlife Grant-funded projects addressing this Goal, information from these projects proved foundational. For example, the 2014 Nongame Survey (Responsive Management 2014) is providing statistically significant data with which to develop and expand outreach initiatives that will inform the public about issues and opportunities pertaining to Pennsylvania's Species of Greatest Conservation Need and their habitats.

Addressing habitat needs of species is contingent on good land stewardship and in Pennsylvania, for example, approximately 16.7 million acres (6.7 million hectares) are forested, of which 70% (11.8 million acres; 4.8 million hectares) are in private ownership (McCaskill et al. 2013). Since 2005, the PGC, through its Private Landowner Assistance Program (PLAP), has been assisting private landowners by providing management guidance in support of Species of Greatest Conservation Need (PGC Website 2015). In addition to developing habitats more beneficial to at-risk species, these landowners also have become better informed about their properties and the species under their care. Through this program, more than 1,275 landowners have been assisted in the management of over 197,250 acres (79,824 hectares) (Colt et al. 2015).

Examples:

- ***2014 Pennsylvania Residents' Nongame Public Opinion Survey***
- ***Web-based Registry and Study of Seasonal Pools in PA***
- ***PGC Private Landowners Assistance Program (PLAP)***
- ***Pennsylvania State Wildlife Grant: Planning and Revision of the Pennsylvania Wildlife Action Plan.***

Issue 4: Funding and Resources

Goal 4**:** Ensure the necessary resources are available to conserve Pennsylvania's wildlife.

Background: Throughout their histories, the Pennsylvania Game Commission and Pennsylvania Fish & Boat Commission have relied on hunting and angling revenues from license sales directed extensively to support game species and habitat management. Funding from other sources (e.g., USFWS Section 6 related to federally endangered species recovery) provided limited support for nongame species. Non-consumptive uses, which have economic benefits, were not directly linked to support of nongame species or their habitats. Yet, the Commissions are responsible for the management and protection of all fish and wildlife species regardless of their harvest status. Unfortunately, funding was inadequate to stop or reverse the declining trends of nongame species. However, Responsive Management (1996) found a public willing to support various funding mechanisms for nongame species management including: a voluntary conservation stamp (88% respondents supporting); increased speeding fines (63% support); a five percent (5%) user fee on birdseed and outdoor-related equipment (57% support); a fee for non-sportsmen using Game Lands (56%), and; a garbage tax (52%). The intent of this goal was to broaden the financial support for fish and wildlife management beyond traditional constituents, inform legislators of resource issues and needs, and to help provide long-term funding for these species.

Review: A period of declining government funding challenged Pennsylvania's conservation community to ensure that leaders were kept informed about the value of this work.

Understanding not only current public sentiment, but also temporal changes in attitudes helped highlight the benefits of conservation initiatives. For example, compared to the 1996 Nongame Survey (Responsive Management 1996), the 2014 Nongame Survey (Responsive Management 2014) found increased public interest and support for nongame species protection and management (Fig.1). Public interest is an important factor in securing administrative and legislative support.

To provide for a well-informed leadership, in 2006, Pennsylvania participated in the Association of Fish and Wildlife Agencies' Teaming with Wildlife Coalition Fly-In in Washington, D.C. Subsequently, a team of Pennsylvania's conservation community annually provides information to Members of Congress on activities and needs related to the Pennsylvania Wildlife Action Plan (Example PFBC-State Wildlife Grant Annual Summaries). This communication highlights the progress and ongoing relevance of the Pennsylvania Wildlife Action Plan to the Commonwealth's citizens.

State & Tribal Wildlife Grant funding and leveraged non-federal match have been the primary funding sources for implementing the Pennsylvania Wildlife Action Plan. Yet, these sources are unable to fully fund the conservation needs of Pennsylvania's Species of Greatest Conservation Need. Further, new and ongoing threats to species and habitats (e.g., invasive species, urban development) are increasing the management challenges for resource professionals. So, the search continues for new funding sources to meet these needs.

Leveraging federal funds with non-federal sources could not be possible without a shared vision and common goals with Pennsylvania's conservation community. For example, each year the DCNR involves

the PGCN and PFBC to identify funding priorities through Pennsylvania's Wild Resources Conservation Program grants. By annually identifying common project requirements, crucial non-federal matching funds have been available for compatible State Wildlife Grant Projects. Further, by working closely with federal partners, such as the Pennsylvania Office of the U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) and the Pennsylvania Field Office of the U.S. Fish and Wildlife Service, federal funding beyond SWG has been directed to Pennsylvania Wildlife Action Plan priority species, such as golden-winged warbler and bog turtle (USDA-NRCS Golden-winged Warbler Conservation; Bog Turtle). The Commissions highly regard these and other partnerships and remain steadfast in fostering current and new collaborative initiatives.

Q16. Do you think managing and conserving nongame wildlife is an important or unimportant function of the Fish and Boat and Game Commissions?

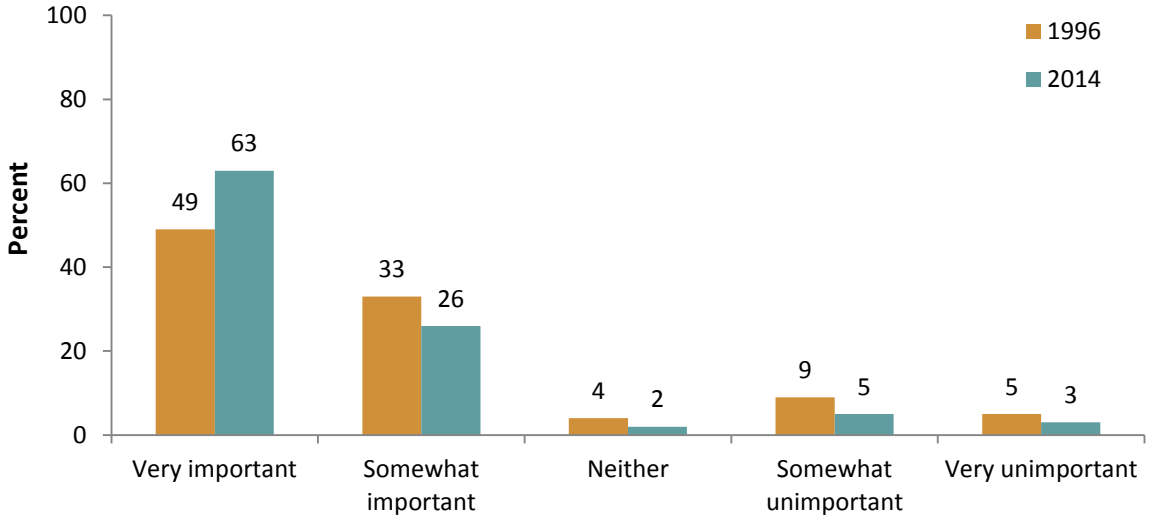


Fig. 1. Change in public opinion, 1996-2014, for nongame wildlife conservation and management by the Fish and Boat Commission and Game Commission (Responsive Management 2014).

The Commissions have further enhanced their capacity to protect the Commonwealth's Species of Greatest Conservation Need and habitats by expanding wildlife diversity program staffing to provide greater support to landowners and technical assistance for permit reviews. For the PGC, the emphasis has been to foster land stewardship and support private landowner habitat management by adding regional wildlife diversity biologists who can guide private landowners towards the most appropriate habitat management practices for their property. To accommodate expeditious review of an increasing number of permit requests, the PFBC expanded the Natural Diversity section to include taxonomic specialists (e.g., malacologist, herpetologist, non-game ichthyologist, invertebrate ecologist).

Identifying potential support for, and sources of, additional nongame funding can be formidable. In the 2014 Nongame Survey (Responsive Management 2014), respondents were asked their favorability

towards new or expanded funding sources (Fig. 2). The survey found preferential funding sources were user-based fees (e.g., fishing & hunting licenses, water consumption, conservation stamp) rather than funding that is generated by the general public (e.g., energy taxes, increased "tipping" fees for garbage disposal). Public support for wildlife diversity conservation (Responsive Management 2014) coupled with a preliminary understanding of the types of funding sources that may be amenable to the public to support conservation efforts provides an opportunity for subsequent discussions related to reliable, sustainable funding for wildlife diversity conservation.

Overall, a stable, non-federal funding source has not yet been developed, but the Commissions and conservation partners continue to seek opportunities that go beyond current funding support for the Pennsylvania Wildlife Action Plan.

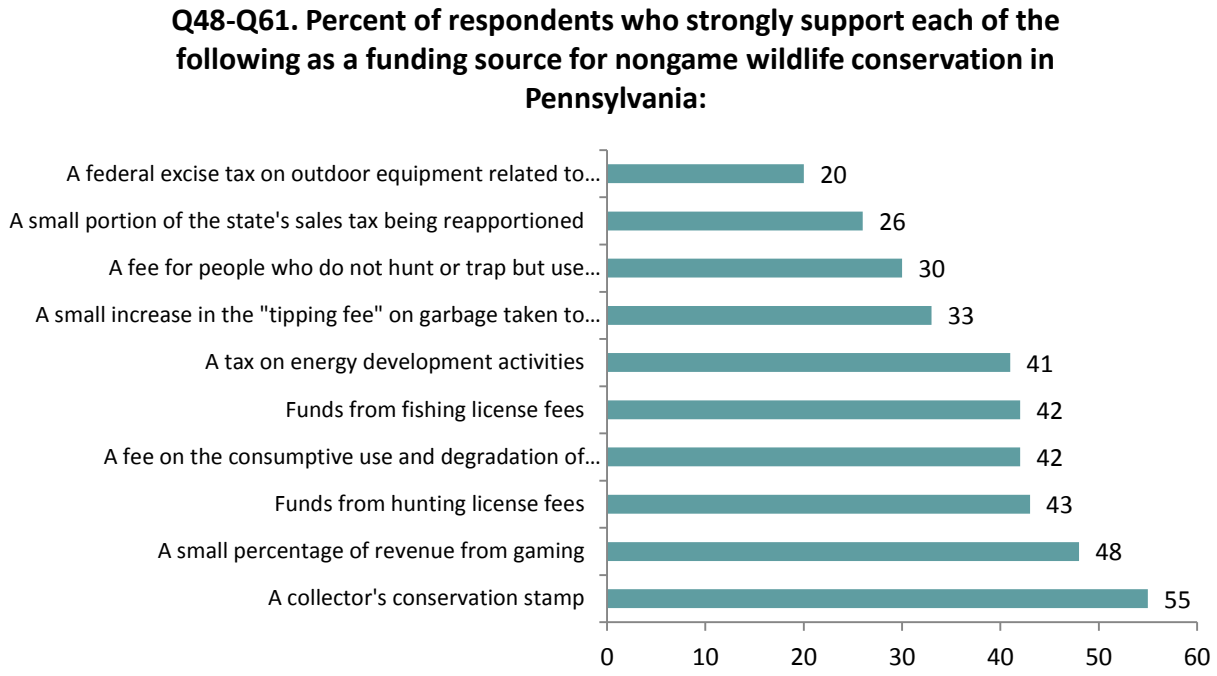


Fig. 2. Percent of respondents who strongly support the proposed option as a funding source for nongame conservation in Pennsylvania (Responsive Management 2014).

Issue 5: Coordination

Goal 5: Improve coordination of the public agencies and other partners in wildlife conservation planning and implementation.

Background: Nearly a decade ago, it was recognized that the power of conservation lies in the synergy of diverse, committed partners working together toward a common goal. The 2005 Pennsylvania Wildlife Action Plan provided a blueprint and common goals for statewide fish and wildlife conservation. Yet, it was not intended to replace existing or newly developed conservation plans at the local, regional, or state level. Crucial to its success across the Commonwealth has been communication and coordination

among the diverse stakeholders (e.g., land managers, scientists, private landowners, and conservation organizations) to meet the Plan's ambitious goals for fish and wildlife conservation. On-the-ground conservation actions take place at federal, state, county, township, and local levels yet, to be most effective, such actions should be guided by an overall strategy or plan such as Pennsylvania Wildlife Action Plan.

Review: Pennsylvania is fortunate to host a broad, active coalition of governmental agencies (i.e., federal, state, county, local), non-governmental organizations, private foundations, corporations and private landowners with a common interest of ensuring the long-term viability of Pennsylvania's natural heritage. Development of the 2005 Pennsylvania Wildlife Action Plan was emblematic of this coordination, with data and materials contributed by numerous partners. This collaboration has been essential for plan implementation.

Accomplishments

Habitats

To facilitate implementation and accommodate the congressionally specified *Eight Required Elements,* the 2005 Pennsylvania Wildlife Action plan was organized by major habitat types. Therefore, review of projects by habitat type provides one perspective for documenting plan implementation. All major habitats are addressed by the 110 State & Tribal Wildlife Grant Projects, which are either underway or completed (Table 4).

Reflecting Pennsylvania's forested landscape, in forest habitats (i.e., combined deciduous-mixed and coniferous forests), 17 (46%) bird projects were conducted. Yet, given broad habitat requirements of birds, nine other habitat types also were encompassed. By comparison, a more consistent distribution among habitats was observed in the 72 mammal projects, with 24 projects, approximately 25%, focused in deciduous and coniferous forests, with other key habitats consisting of riparian forests (11 projects; 15%), shrubland-thickets (10 projects; 14%) and rock habitats (11 projects; 15%). Projects in rock habitats primarily focused on Allegheny woodrats (*Neotoma magister*) and multiple bat species.

Not surprisingly, of the 18 fish projects, 16 (89%) were conducted in streams & rivers, with only two projects (11%) in wetlands. For amphibian and reptile projects, wetlands were a priority focus (11 projects; 30%) (Table 4). Yet, like birds, amphibian and reptile projects were distributed across seven other habitat types. Among the remaining amphibian and reptile projects, 16 (43%) were conducted in deciduous-mixed forests, streams and rivers, and grasslands.

Mussel surveys conducted in streams and rivers dominated the invertebrate project categories, with wetlands and vernal pools the target of three or fewer invertebrate projects. Habitat-based projects were directed across a broad range of habitat types with seven (47%) projects in streams and rivers and grasslands.

Table 4. Number of State & Tribal Wildlife Grant Projects grouped by major taxonomic groups and habitat types, 2001-2014.

Project Focus	Deciduous-Mixed Forests	Coniferous Forests	Wetlands	Streams & Rivers	Rock Habitats	Vernal Pools	Sandy Beach Habitat	Urban-Suburban Habitat	Grasslands	Shrublands-Thickets	Riparian Forests
Birds	11	6	5	2	3	1	2	3	5	5	4
Mammals	17	7	5	3	11	1	1	4	2	10	11
Fish	0	0	2	16	0	0	0	0	0	0	0
Amphibian and Reptiles	5	0	11	6	1	3	0	0	5	3	3
Invertebrates (includes Mussels)	1	1	3	10	1	3	1	1	1	1	3
Habitats	8	8	8	9	7	8	7	7	11	9	9
Other (e.g., Administrative, multiple species)	0	0	2	3	2	2	0	0	2	0	3

Species

Two of the 110 State & Tribal Wildlife Grant funded projects (i.e., the Pennsylvania Wildlife Action Plan 2.0 - Prioritization and Mapping Enhancements (Competitive State & Tribal Wildlife Grant) and PA State & Tribal Wildlife Grant-Planning and Revision of the PA WAP) assessed all 209 vertebrate and 425 invertebrates as part of the 2015 Pennsylvania Wildlife Action Plan revision. Within the remaining 108 State & Tribal Wildlife Grant-funded projects, 254 species were either targeted (i.e., identified in a grant proposal) or noted (i.e., observed, assessed, evaluated) in reports (Table 5). For vertebrate groups, nearly all Species of Greatest Conservation Need were considered as part of at least one project. In some cases these included comprehensive works such as the Second Breeding Bird Atlas, Pennsylvania Amphibian and Reptile surveys (PARS), and the Fish Faunal Database. Species-specific projects also were conducted often for higher priority species (i.e., Immediate, High-level concern).

In contrast to the large number of vertebrate species included in State & Tribal Wildlife Grant Projects, with the exception of freshwater mussels, less than 10% of invertebrate species were encompassed by a project (Table 5). This minimal focus on non-mussel invertebrate species is attributed to limited funding and, for terrestrial invertebrates, lack of jurisdictional authority by either Commission. However, for mussels, the PFBC directed considerable effort to collecting data (e.g., species range, relative abundance) and developing a database that serves as a data repository. The continental imperilment

status of many mussel species, along with habitat degradation, invasive species, and lack of current, comprehensive data, were incentives for these projects. This emphasis on invertebrate species is continuing with a 2015 project that will update species presence and habitats in the Ohio River.

Table 5. Species of Greatest Conservation Need in the 2005 State Wildlife Action Plan compared to the number of species addressed through State & Tribal Wildlife Grant-funded projects, 2001-2014.

	SGCN (2005)	SGCN addressed	Comments
Birds	79	79	
Mammals	22	24	Includes two bat species that were not SGCN in 2005, but are SGCN in 2015.
Fish	71	87	Includes 11 spp. collected, not SGCN in 2005, but are SGCN in 2015 and 5 data deficient species.
Amphibians	15	20	Includes 5 spp. collected, not SGCN in 2005, but are SGCN in 2015.
Reptiles	22	24	Includes 4 spp. collected, not SGCN in 2005, but are SGCN in 2015.
Mussels	42	53	Includes 15 spp., not SGCN in 2005, but expected to be SGCN in 2015.

Conservation Actions-Prioritized Implementation Actions (PIAs)

Other measures of progress with implementing the 2005 Pennsylvania Wildlife Action Plan included an evaluation of efforts directed at Prioritized Implementation Actions (PIAs). To provide a comprehensive overview of progress on the 2005 Wildlife Action Plan, the PGC and PFBC reviewed the status of the PIAs and assessed progress within five broad categories (Table 6). Evaluating the PIAs not only documented progress on the 2005 Wildlife Action Plan, but also highlighted needs for the 2015 plan. Pennsylvania's active implementation of the 2005 Wildlife Action Plan is reflected in 578 of 1,034 (55.9%) habitat-associated PIAs being identified as "initiated," "ongoing" or "completed" (Fig. 3). PIAs characterized as "ongoing" (353; 34.1%) dominated the overall number of PIAs, with the lowest number (61; 5.9%) considered "completed". Yet, characterizing a PIA as "completed" or "ongoing" may not fully reflect the purpose of the PIA since some actions are unlikely to be completed under reasonable circumstances. For example, PIAs associated with monitoring, outreach, data compilation and similar activities would be expected to be ongoing, because such activities frequently require continual or periodic implementation or updating. Despite the many projects and great progress, it is apparent by the number of PIAs identified as "not started," and "initiated," that resources (i.e., funding, staff capacity) have been insufficient to address the need. Further, these PIAs do not fully account for emerging threats (e.g.,

energy development, invasive species, increasing effects of climate change), that have expanded the tasks to be addressed.

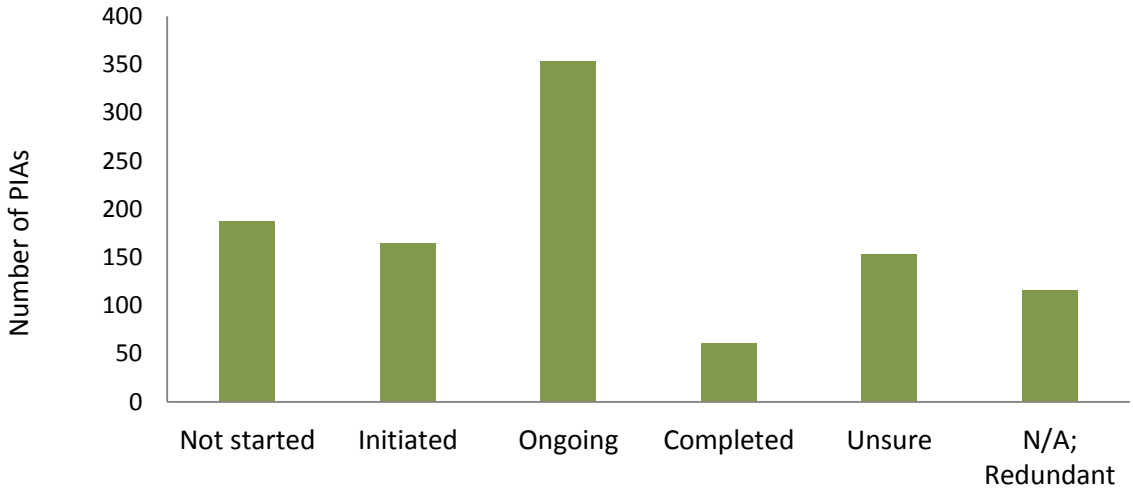


Fig. 3. Completion status of 2005 Pennsylvania Wildlife Action Plan Prioritized Implementation Actions (PIAs), 2013 (PGC and PFBC, unpublished data).

This summary also illustrates the need within the revised Pennsylvania Wildlife Action Plan to provide a more focused approach to Pennsylvania's Species of Greatest Conservation Need and habitat concerns to allow greater opportunity for completing tasks. When developed in 2005, it was difficult to anticipate the Commonwealth's capacity to implement conservation actions in the Pennsylvania Wildlife Action Plan. For this revised plan, it is likely that completing actions may be more attainable when actions are directed at specific, well-defined needs. The 2015 Pennsylvania Wildlife Action Plan *Species Accounts* and other features of the revised plan make stronger connections between the needs, conservation actions and monitoring. With nearly 200 PIAs characterized as "not started," along with approximately 150 for which reviewers were uncertain about their status, identifying a smaller number of more focused conservation actions could contribute to a more reasonably scaled plan with greater potential for success.

Additional Accomplishments

Since its approval in 2006, members of Pennsylvania's conservation community have directly and indirectly supported implementation the Pennsylvania Wildlife Action Plan through their programs. Unfortunately, a tracking and reporting system for projects implemented through these "external" programs is not available, thus precluding a comprehensive overview of these efforts. Despite the lack of a reporting system, substantive programs have supported Pennsylvania Wildlife Action Plan implementation (Table 7).

Table 6. Categories used for the Pennsylvania Game Commission and Pennsylvania Fish & Boat Commission status assessment of 2005 Pennsylvania Wildlife Action Plan prioritized implementation actions, 2013.

Category	Description
Not Started	The action has not yet been addressed.
Initiated	Early stages of implementation such as meetings, planning, preliminary implementation of actions.
Ongoing	Effort on this action has advanced beyond "initiated," and is continuing, or requires additional work before the status can be considered complete.
Completed	Within the context of one or more agencies, or organizations, the action has been addressed and can be considered completed.
Unsure/Unknown	Reviewers unaware of status.
Redundant/ NA	Reviewers commented that action was redundant with other actions or had no comment.

Table 7. In addition to State & Tribal Wildlife Grant-supported projects, examples of programs and activities that have contributed to implementation of Pennsylvania's Wildlife Action Plan. Note: This is a not a comprehensive list.

Target species	Target Habitats	Agency or Organization	Program
Golden-winged Warbler	Young forests	USDA-NRCS	Working Lands for Wildlife
Bog Turtle	Wetlands, Wet Meadows, Young forests	USDA-NRCS; NFWF; USFWS	Wetlands Reserve Enhancement Program
Multiple	Multiple	PADCNR	Wild Resource Conservation Program
Eastern Brook Trout	Riparian habitats; Cold headwaters and creeks	TNC; NFWF; Trout Unlimited	NFWF-Conservation Programs; Pennsylvania Eastern Brook Trout Habitat Initiative
River Herring	Rivers	NFWF; Bring Back the Natives/More Fish	NFWF-Conservation Programs

Regional Support and Implementation

Support for, and implementation of, the Pennsylvania Wildlife Action Plan reaches beyond state boundaries to address conservation needs at landscape scales. Notably, state fish and wildlife agencies in the Northeast United States, from the Virginias to Maine, have been working collaboratively on wildlife conservation priorities for more than half a century. By the 1980s, state wildlife diversity managers coordinated to develop a regional list of priority species – now called the Regional Species of Greatest Conservation Need (RSGCN) – and to identify regional conservation needs. The current RSGCN conservation concern level is based on the number of states listing a species as a Species of Greatest Conservation Need in 2005 (Terwilliger Consulting & NEFWDTC 2013). In 2006, after the State Wildlife Action Plans had been completed, a workshop was held to work towards identifying regional conservation priorities. Forty-five people attended the meeting, representing the Northeast Association of Fish and Wildlife Agencies (NEAFWA), the Association of Fish and Wildlife Agencies (AFWA), the USFWS, and all but one state in the region. The meeting focused on identifying specific actions that reflected the collective priorities identified in the Wildlife Action Plans to further fish and wildlife conservation in the region. One of the most important outcomes of this workshop was the creation of the Regional Conservation Needs grant program. Since 2007, the 13 NEAFWA states and the District of Columbia have contributed 4% of their annual federal State Wildlife Grants Program funding to support projects of regional conservation interest. This funding is offered through an annual request for proposals administered by the NEAFWA in collaboration with the Wildlife Management Institute (WMI) and USFWS. Funds are used to address conservation priorities that are shared across multiple jurisdictions. Through 2012, 80% of projects supported by the Regional Conservation Needs grant program addressed conservation needs specific to Pennsylvania (see Appendix 1 in Terwilliger Consulting & NEFWDTC 2013).

Additionally, multi-state projects supported by the federal Competitive State Wildlife Grant program (e.g., Blanding's turtle conservation (ongoing), white nose syndrome multi-state (completed 2012) and Landscape Conservation Cooperatives (LCC) have been instrumental in developing tools, analyzing data, and fostering communication that support State Wildlife Action Plans. Three LCC regions overlap Pennsylvania; the North Atlantic, Upper Mississippi-Great Lakes, and Appalachian, with 83% of Pennsylvania covered by the Appalachian LCC (Fig. 4). Established by the U.S. Department of the Interior in 2011, LCCs are based on successful models of wildlife and habitat conservation pioneered by the USFWS. Each LCC provides opportunities for states, Native American tribes, federal agencies, non-governmental organizations, universities, and other groups to address increasing land use pressures and widespread resource threats and uncertainties amplified by a rapidly changing climate by agreeing on common goals for land, water, fish, wildlife, plant, and cultural resources and jointly developing the scientific information and tools needed to prioritize and guide more effective conservation actions by partners toward those goals.

Northeast region LCCs recognized the importance of complementing existing partnerships and the value of collaborating closely with the NEAFWA. The NALCC, in particular, has aligned its activities closely with NEAFWA, including collocation of meetings, synchronization of annual timelines for the LCC and the RCN grants process, consolidated grants administration through the WMI, joint development of projects at a Northeast region scale, and joint efforts to develop regional information for State Wildlife Action Plan updates. The NALCC has supported more than 16 projects; of which over 80% include Pennsylvania Wildlife Action Plan priorities (Appendix 1 in Terwilliger Consulting & NEFWDTC 2013), North Atlantic Landscape Conservation Cooperative (NALCC 2015). Additionally, partnerships within the Appalachian LCC have targeted critical projects directly linked to species and habitat priorities in Pennsylvania, such as developing forest management guidelines for the cerulean warbler (*Setophaga cerulea*) and assessment of eastern brook trout (*Salvelinus fontinalis*) habitat to inform restoration and expansion activities. Only a small percentage of Pennsylvania lies within the Upper Mississippi-Great Lakes LCC (UMGL LCC) geography; however linkages, particularly for aquatic species, are made through this important partnership. In addition to supporting conservation research projects, the UMGL LCC hosted 12 webinars in 2014 for state Wildlife Action Plan Coordinators to enhance collaboration during the 2015 Wildlife Action Plan revision process. Unrestrained by political boundaries, the maintenance of our shared fish and wildlife resources is dependent on these multi-state, and often international, collaborations.

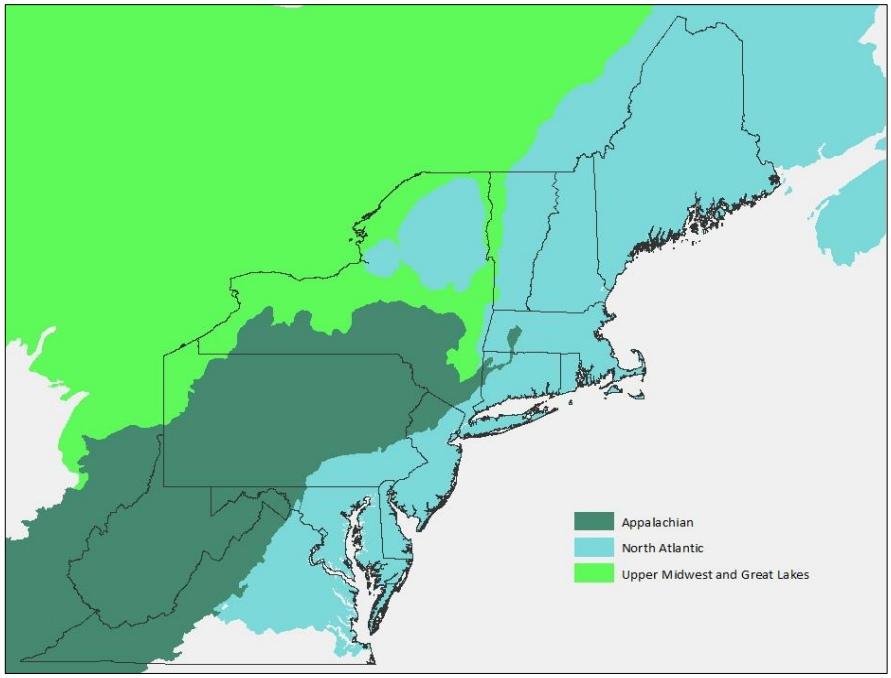


Fig. 4. Landscape Conservation Cooperative boundaries in the Northeast region of the United States.

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Summary and Future

This review of State & Tribal Wildlife Grant-funded work, directed toward implementing the 2005 Pennsylvania Wildlife Action Plan, documents a strong foundation of data, knowledge and partnerships on which to build and implement the 2015 Pennsylvania Wildlife Action Plan. It is expected that advancing technologies will increase data-sharing capabilities. In Pennsylvania, this data collaboration is already occurring through projects with websites that allow volunteers to report observations and provide digital image documentation (e.g., Pennsylvania Amphibian and Reptile Survey-PARS, Pennsylvania eBird). As illustrated by Goal 5, expanding and improving coordination among public agencies and other conservation partners will be necessary for ongoing plan implementation and these types of projects will enhance data maintenance for species.

In addition to these significant accomplishments, based on personal communication with partners, we fully expect that additional substantive progress has been achieved, beyond that which has been conducted specifically through the Commission's State & Tribal Wildlife Grant-funded projects. Tracking such activities poses particular challenges, yet, in recent years, increasing data-sharing interests in the Northeast region, coupled with more readily accessible technology for tracking State Wildlife Action Plan actions, have provided an impetus for a regional State Wildlife Action Plan database. This regional database, with data provided by each state, is expected to capture activities that are not State Wildlife Grant-funded. The topic of tracking conservation actions not specifically funded by State Wildlife Grants has been discussed by the Pennsylvania Wildlife Action Plan Advisory Committee and, with implementation of the 2015 Pennsylvania Wildlife Action Plan, increasing emphasis on documenting these efforts is anticipated.