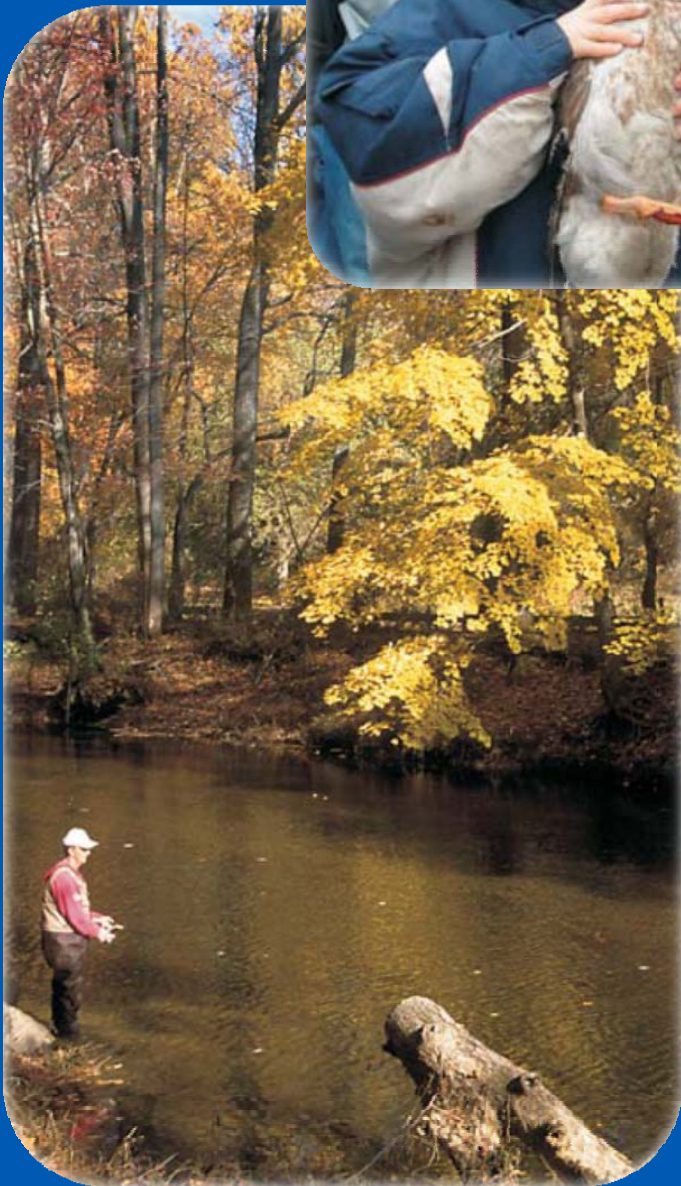




Delaware Wildlife Action Plan



**Keeping Today's Wildlife from
Becoming Tomorrow's Memory**



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Resources and Environmental Control
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Delaware Wildlife Action Plan

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Executive Summary

Despite its small size Delaware harbors a diversity of wildlife and habitats within its borders from the Atlantic Ocean coastline to the Piedmont border with Pennsylvania. More than 1,000 species of wildlife have been documented in the state, and more than 125 different types of habitat have been identified including coastal marine waters and brackish marshes, tidal and non-tidal freshwater streams and wetlands, and upland forests and meadows.

This document, the *Delaware Wildlife Action Plan* (“Plan”), represents the state’s first attempt to develop a comprehensive strategy for conserving the full array of native wildlife and habitats – common and uncommon – as vital components of the state’s natural resources. It is intended not only to be comprehensive in terms of the species, habitats, issues and actions it addresses, but also comprehensive in terms of those responsible for implementation. Though the Delaware Division of Fish and Wildlife (“DFW”) will play a lead role in its continued development and in coordinating implementation, the Plan is intended for all who are actively engaged in conservation efforts. Together with conservation partners, we aim to keep species common, and to prevent species from being listed as endangered.

The Plan was developed with the participation of key conservation partners and public input was solicited primarily through a website. The Plan identifies more than 450 Species of Greatest Conservation Need (SGCN) and 50 different types of habitat. Because this is a comprehensive plan for all wildlife, large blocks of forest and wetland habitats that support many common species are also identified. Maps depicting habitat for a full array of wildlife (“Key Habitats”) are presented to show areas of the state where conservation efforts can be focused. These maps are also intended to help guide more site-specific conservation planning efforts. A successful site-specific community-based planning effort was conducted in partnership with The Nature Conservancy as a subset of the state’s wildlife strategy development.

Recognizing all possible issues that affect species and habitats of conservation concern, whether we fully understand their impacts, is an important step in building a comprehensive plan. Nearly 90 different conservation issues affecting species or habitats of conservation concern were identified, representing 16 different categories of issues. To address this extensive list of issues and impacts on SGCN and Key Habitats, more than 230 different conservation actions were developed.

This extensive list of issues and actions were prioritized by reviewing several natural resource plans developed for Delaware over the years. As a result, a clear picture of priorities emerged; among themes represented were habitat loss and degradation, as well as institutional capacity of DFW as the lead agency for the Plan.

Implementation of the Plan will be guided by a steering committee that meets regularly and is comprised of key partners including representatives from other state agencies, conservation organizations, and stakeholder and user groups. The Plan will be updated continuously by DFW as soon as new information becomes available about species, habitats, issues or actions, and the first formal review will take place two years after approval, with subsequent reviews every five years. A database is under development to track updates of Plan components in order to facilitate the review process, and an interactive version of the Plan will be posted on the DNREC website and made widely available on CD following the Plan’s acceptance.

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SECTION 1

Introduction

1. Introduction

1.1. Purpose, Goal and Guiding Principles

1.1.1. Purpose

Delaware has a long and successful history of wildlife management. Starting in the early 1900s, the forerunner of the Division of Fish and Wildlife (“DFW”) began applying a combination of State and Federal funds first for the management of game animals and sport fish, and then for endangered species - and the habitats that sustain all of them. Animals as diverse as white-tailed deer, striped bass and bald eagle have been restored to prominence after nearly disappearing from our forests, rivers and skies.

As successful as this work has been, it is obviously no longer sufficient. The growing list of declining wildlife, the escalating pace of land development, the emergence of new threats like invasive species and climate change – all point to the urgent need to expand the scope of wildlife management. We now must work to conserve a variety of habitats across the landscape, rather than focusing on individual species. This will result in “keeping common things common” at the same time it continues to protect those species that are rare.

In recognition of this need, the Federal government has begun providing new funding to the states for truly comprehensive wildlife management. As a condition of this funding, each state must prepare a “Wildlife Action Plan” to describe its efforts to conserve “species in greatest need of conservation” while addressing the “full array of wildlife” and wildlife-related issues.

Eight elements are required in the Wildlife Action Plans, and these are covered in various parts of this plan. See Section 1.2, Road Map to the Eight Elements, for a guide to their location.

1.1.2. Goal and Guiding Principles for Conservation Actions

The goal of the Delaware Wildlife Action Plan is to provide strategic direction, and an information and logistical framework, for conserving Delaware’s native wildlife and habitats as vital components of the state’s natural resources. It is based on the following principles:

Conservation of Species vs. Habitats – Target the preservation or restoration of SGCN, but emphasize the management of ecological structure and function of key habitats over management of individual species.

Management of wildlife species in Delaware has traditionally focused on game animals and sport fish, leaving the great majority of Delaware’s wildlife entirely unmanaged. The belief that many non-game species benefit from management for game species is a largely untested assumption, and should not be substituted for direct management of SGCN and their habitats.

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DEWAP is ultimately a plan for “keeping common things common” and therefore avoiding further costly listings of wildlife species as threatened or endangered. This can only be accomplished by managing for a diversity of habitat types. Single-species management should be limited to those with unique life requirements and those requiring targeted action because they are at risk of extirpation.

Management on Conservation Lands – Direct management in state wildlife areas – and state parks and state forests in keeping with their primary missions – towards key habitats and SGCN in the Green Infrastructure Natural Resources Focus Area, in order to protect and restore habitats and species, and to abate the impacts of conservation issues. Encourage Federal and NGO land managers to focus on this same objective.

Many SGCN – and other wildlife species – are “area-sensitive,” requiring relatively large areas of mostly unbroken habitat to ensure their viability. Delaware’s Green Infrastructure Natural Resources Focus Area provides such an interconnected network of forests, uplands and wetlands. State, federal and NGO conservation lands, which generally constitute the largest parcels in this network, are particularly critical for meeting the needs of area-sensitive species. Landscape-level planning among all these agencies and organizations will be necessary to implement Green Infrastructure.

Management on Private Lands – Direct private lands management toward buffering and connecting conservation lands in the Green Infrastructure Natural Resources Focus Area, and towards protecting outlying small patch habitats and SGCN.

Private landowners can often play a role in wildlife diversity conservation, although Delaware’s highly fragmented landscape somewhat limits the scope of this contribution (the state contains more than 300,000 privately owned parcels that are often burdened by structures, roads, utilities and other habitat-fragmenting features, thus making it difficult to manage these lands for area-sensitive SGCN). Therefore, management of wildlife and habitats on private lands can often best be used to buffer and connect public and NGO conservation lands. For some wildlife species that require specialized habitat in small patches, though, most opportunities for conservation may occur on private lands.

Measuring Success – Inventory, Monitoring, Research and Adaptive Management – Establish performance indicators to measure the success of conservation actions and plan implementation. Inventory and monitor species, habitats and impacts of conservation issues, and conduct applied research, so as to facilitate adaptive management.

Too often, conservation planning and resource management suffer from a lack of measurable outcomes and the absence of a feedback loop that incorporates knowledge from earlier successes and failures. Inventory, monitoring, research and adaptive management are the components of a larger effort to measure the success of DEWAP and provide accountability for its implementation.

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Division Operations – Reorganize, revise and/or enhance DFW administrative structure, staffing, budgeting, procedures and practices as necessary to facilitate implementation of DEWAP.

DEWAP is intended for use by all conservation agencies and organizations in the state – as appropriate to their authorities and missions – and full implementation will require extensive cooperation among all parties. However, as the lead agency for the conservation of Delaware’s wildlife resources, DFW is ultimately responsible for the success of the DEWAP. It can assure this success by aligning its structure and procedures to best support Plan implementation.

Partnership Development – Strengthen partnerships with other conservation agencies and organizations to link landscapes, tie together complementary approaches, and leverage investments of time, staff and money.

Although DFW has lead responsibility for implementing DEWAP, the scope of the division’s actions is limited by specific legal authorities and finite logistical resources. Incorporating existing programs, strategies and actions of partners – government, NGO and private – into the Strategy, and coordinating new initiatives with them, greatly increases the effectiveness and efficiency of conservation. This will require a concerted effort by DFW to reach out to these partners and embrace truly collaborative management.

Data Collection and Information Management – Collect, manage and analyze data to support wildlife diversity conservation efforts with sound science.

Baseline tabular and spatial data on the abundance and distribution of many Delaware key habitats are lacking, as is data on many SGCN and conservation issues. Field surveys of key habitats, SGCN and conservation issues, and thorough management and rigorous analysis of this information, are needed to guide adaptive management and otherwise inform decision-making.

Education, Outreach and Enforcement – Increase public knowledge of wildlife conservation issues to develop an understanding of habitats, SGCN, and conservation issues and actions; foster a sense of responsibility for personal choices; actively engage citizens in conserving natural resources; and otherwise cultivate support for wildlife diversity conservation. Enforce regulations to promote responsible behavior in interactions with wildlife.

Education, outreach and enforcement efforts should emphasize that conserving a diversity of wildlife and habitats enhances the quality of life by supporting ecological services, supplying economic benefits, and providing recreational opportunities.

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1.2. Road Map to the Eight Elements

The eight elements required in the Wildlife Action Plans are listed below along with the sections in which they are discussed.

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.

Section 3

2. Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1).

Section 4

3. Descriptions of problems which may adversely affect species identified in (1) 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.

Section 5, Section 6

4. Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions.

Section 5, Section 6, Section 7

5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions.

Section 8

6. Descriptions of procedures to review the plan at intervals not to exceed ten years.

Section 9

7. Plans for coordinating 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.

Section 1.3, Section 10

8. Congress also affirmed through this legislation, that broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and

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the Species in Greatest Need of Conservation that Congress has indicated such programs and projects are intended to emphasize.

Section 1.3

1.3. Public Involvement, Partnerships and Coordination

Development of the Delaware Wildlife Action Plan was guided by a group of “key partners” that reviewed the Species of Greatest Conservation Need, Key Wildlife Habitats, and Conservation Issues and Actions. The group consisted of representatives from the following organizations and agencies:

- Bombay Hook National Wildlife Refuge
- Primehook National Wildlife Refuge
- US Fish and Wildlife Service, Delaware Bay Estuary Project
- Delaware Nature Society
- Delaware Wildlands
- The Nature Conservancy, Delaware Chapter
- Center for the Inland Bays
- Delaware Audubon Society
- Delmarva Ornithological Society
- Ducks Unlimited, Great Lakes/Atlantic Region
- National Wild Turkey Federation, Delaware Chapter
- University of Delaware, Department of Entomology and Wildlife Ecology
- Delaware State University, Agriculture and Natural Resources Department
- Delaware Division of Parks and Recreation
- Delaware Division of Fish and Wildlife

Separate meetings were also held for several key state agencies: Department of Natural Resources and Environmental Control (other than the Division of Fish and Wildlife), Office of State Planning Coordination, Department of Agriculture and Department of Transportation.

Public input was obtained primarily by means of the plan website that was created on DNREC’s home page (<http://www.dnrec.state.de.us/NHP/information/CWCS2.asp>), which provided an opportunity for visitors to review components of the plan as they were completed, and to submit comments. The website was publicized with a display at several large wildlife-related events, and by means of nearly 1000 letters sent to stakeholder and user groups, homeowners associations, civic and service organizations, and individuals who had expressed interest. Approximately 40 comments were received through the website, and suggestions were incorporated into the Plan as appropriate.

Recommendations for continuing and expanding specific partnerships are contained within many individual Conservation Actions in Section 6. Also, see Section 10 for additional information about partnering and coordination during implementation.

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SECTION 2

Planning Context

2. Planning Context

Delaware's Wildlife Action Plan fits into an existing framework of statewide strategies established to conserve and protect the state's natural resources, including habitat for wildlife. These strategies focus on different approaches to conservation (e.g., land acquisition, preservation, land use, infrastructure investments, policy), but they are all coordinated and have shared mapping elements and common goals to ensure consistency in implementation.

State Strategies for Policies and Spending (1999, updated in 2004) directs where the state will most likely allocate its resources and focus state programs to address population growth and land development issues. Although decisions concerning land-use occur at the local and county level, the state can influence the way development occurs through its spending and management policies. The Strategies are based on the premise that by making wise decisions about building and managing highways, water and sewer systems, and other public facilities (commonly called "gray infrastructure"), the state can reduce the negative effects of poorly planned, unfocused growth. To implement State Strategies, Delaware's Governor issued the Livable Delaware Agenda (Governor's Executive Order #14) in 2001, and the General Assembly established the Livable Delaware Advisory Council (LDAC) shortly thereafter.

Among the 11 goals identified in the Strategies is to "protect important farmlands and critical natural resource areas." To implement this goal, the LDAC established the "Green Infrastructure" subcommittee. As defined in the Governor's Executive Order #61, Green Infrastructure, or "GI", is "Delaware's natural life support system of parks and preserves, woodlands and wildlife areas, wetlands and waterways, productive agricultural and forest land, greenways, cultural, historic and recreational sites and other natural areas all with conservation value."

The GI subcommittee directed development of maps depicting Cropland Focus Areas, Forestland Focus Areas, and Natural Resources and Recreation Land Focus Areas (Appendix A). Methods used for delineating GI focus areas are described on the map in the Appendix. These maps were used to develop goals and strategies for preserving natural resource areas, recreational lands, and working lands. Among the strategies developed for GI was to incorporate the maps into the 2004 update of the State Strategies for Policies and Spending and use these maps to direct future state program investments and to guide local land use planning. GI data layers were incorporated into the spatial analysis used to build the Strategies maps, which classify land in three main categories: lands that are not available for development, lands for which state and local policies do not favor growth, and lands for which state and local policies do favor growth.

In 1990, before State Strategies was developed, the Delaware Land Protection Act (7 Del. Code, Chapter 75) established an Open Space Program in the state. The Open Space Program coordinates the acquisition of various state lands including parks, fish and wildlife areas, forests, nature preserves and cultural sites. The program is administered by Delaware's Department of Natural Resources and Environmental Control's Division of Parks and Recreation. A 9-member Open Space Council advises the Secretary of the Department on the implementation of the program and recommends specific land purchases. Quarterly meetings are held to review properties brought before the Council by an interagency Working Group. Recommendations to

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preserve properties are based on a rating of natural, cultural, recreational and locational attributes and a consideration of land use plans and purchase options.

The Land Protection Act also authorized the development of “State Resource Area” (SRA) maps for guiding acquisition of property or rights in real property through the Open Space Program. Twenty SRAs and specific stand alone sites have been designated to date, comprising over 250,000 acres and representing 19% of Delaware’s land base. SRAs are encompassed within the GI focus areas and are comprised of existing protected state, federal, local and private conservation organization lands, in-holdings and potential additions to already protected areas. The SRA maps were created in 1990 and updated in 2006 to incorporate new information available on the location of wildlife and habitat. SRAs include some of the finest examples of Delaware’s diverse natural and cultural heritage, unspoiled wetlands, mature forests, rare plant and animal habitats, geological and archaeological sites, open space for recreation and greenway connectors.

In 1978, before the Open Space Program was established, the State of Delaware enacted the Natural Areas Preservation System (7 Del. Code, Chapter 73) for the purpose of establishing an inventory of natural areas statewide and a system of nature preserves. A “natural area” as defined by the law is an “area of land or water, or of both land and water, whether in public or private ownership, which either retains or has reestablished its natural character (although it need not be undisturbed), or has unusual flora or fauna, or has biotic, geological, scenic or archaeological features of scientific or educational value.” “Nature preserves” are natural areas that have been formally “dedicated”, or estate, interest or rights transferred, to the Department of Natural Resources and Environmental Control, for and on behalf of the State. The state’s registry or inventory of natural areas was first created in 1978, with major updates in 1988 and minor updates since that time. The inventory is currently being updated with expected completion by December 2005. There are currently 67 natural areas identified in the state, and 19 nature dedicated nature preserves.

Regional conservation maps and strategies developed by The Nature Conservancy through ecoregional plans that encompass Delaware, and through the “Delmarva Conservation Corridor Demonstration Program” (Farm Security and Rural Investment Act of 2002), were included in analysis identifying focus areas for Green Infrastructure natural resource preservation.

SECTION 3

Species of Greatest
Conservation Need

3. Species of Greatest Conservation Need

3.1. Selection Criteria

More than 1000 species of wildlife are known to presently occur in Delaware, or to have occurred here in the past. The primary repository for this information is the Delaware Natural Heritage Program, which tracks rare species distribution and abundance using the methodologies of the international network of Natural Heritage Programs. This methodology is unique in allowing for comparison of species status across all taxa, and for this reason it was chosen as the foundation for determining Species of Greatest Conservation Need (SGCN).

Not all of Delaware's species are currently tracked by the Natural Heritage Program due to staff and funding limitations, most notably estuarine and marine fish and invertebrates. To compensate for this, other schemes for assessing species status for particular taxa were utilized. Also, several national and regional schemes were included to broaden the ecological context for determining SGCN. Ultimately, the following schemes (in alphabetical order) were used to choose SGCN because they were developed with original methods, rather than being derived from other schemes, and because they were especially relevant to Delaware:

- American Fisheries Society – Marine, Estuarine, and Diadromous Fish Stocks at Risk of Extinction in North America (Exclusive of Pacific Salmonids)
- Delaware legal status
- Delaware populations with special significance or sensitivity
- Federal legal status
- Mid-Atlantic Bird Conservation Initiative, ranks for Bird Conservation Region 30
- National Marine Fisheries Service – Highly Migratory Species Fisheries Management Plans for western Atlantic stocks
- Natural Heritage state and global ranks
- Northeast Endangered Species and Wildlife Diversity Technical Committee – Wildlife Species of Regional Conservation Concern in the Northeastern United States

These were applied according to a standard set of rules based on a species' presence, absence or priority in a particular scheme.

Other schemes were not used in the determination because they were subsumed under one of the above, they were derived from other work, or their global perspective was not relevant to Delaware:

- Atlantic States Marine Fisheries Commission – list of managed species
- Audubon Watchlist
- BirdLife International – list of globally threatened species
- Convention on International Trade in Endangered Species – Appendices I, II, III
- International Union for the Conservation of Nature – Red List
- Mid-Atlantic Fishery Management Council – list of managed species
- North American Waterbird Conservation Plan – ranks for the mid-Atlantic region

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- North American Waterfowl Management Plan – list of managed species for the Atlantic flyway
- Northern Bobwhite Conservation Initiative
- Partners in Flight – ranks for Region 44
- The Nature Conservancy North Atlantic Coast, Lower New England-Northern Piedmont, and Chesapeake Bay Lowlands ecoregional plans – conservation targets
- U.S. Shorebird Conservation Plan – ranks for the northern Atlantic region

The list of Delaware SGCN appears in Appendix B. The report includes a header that explains the specific criteria used to derive the list and footer with a key to abbreviations. In addition to the schemes used to select SGCN (under the “Criteria” heading), the report also includes most of the schemes that were not used (under “Cross-Reference”).

In a broad sense, SGCN, as defined for this Plan, are indicative of the overall diversity and health of the State’s wildlife resources. Some may be rare or declining, others may be vital components of certain habitats, and still others may have a significant portion of their population in Delaware. The SGCN list is divided into two tiers based on the criteria shown in the report header. The tiers are defined as follows:

Tier 1 species are those that are most in need of conservation action in order to sustain or restore their populations. They are the focus of the Plan, which is based on analyzing issues that impact their populations and their habitats, and on developing conservation actions to eliminate, minimize or compensate for these issues.

Tier 2 species are also in need of conservation action, although not with the urgency of Tier 1 species. Their distribution across the landscape will help determine where conservation actions will be implemented on the ground.

Subsequent to the development of this tiered approach, it became apparent that, due to current limitations in the mapping of SGCN, the original intent for the use of tiers could not be realized in this first iteration of the Plan. Thus, for now all SGCN are treated as being in equal need of conservation. As mapping capabilities improve, it will become possible to use the tiers as first envisioned. See Section 4.2.1 for more information about mapping.

Composition of the SGCN list is based on the present state of knowledge of species distribution and abundance in Delaware. Some taxa have been thoroughly studied – birds, for instance – while others less so, such as the estuarine and marine species noted earlier. In other words, in some cases inclusion on, or exclusion from, the list may be a function of knowledge limitations rather than a reflection of the actual status of a species. As knowledge about species is constantly changing, the makeup of SGCN will change also.

One particular aspect of knowledge limitations is an artifact of a recent change in the Natural Heritage methodology for state ranking of species rarity. For administrative reasons, several previous ranks that were more descriptive of status were combined into the rank of SNA, short for “not applicable.” This perhaps unfortunate choice of terms implies that, although a species

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occurs here, it has little or no conservation value in the state. This may or may not be the case, and further review of these species is needed to evaluate the appropriateness of this new rank. For now, all species ranked SNA that meet other criteria are included as SGCN.

3.2. Abundance and Distribution

The ranks assigned to species using Natural Heritage methodology are influenced by several factors, but are most often based on abundance. Therefore, the numerical state ranks in the SGCN report (Appendix B) usually indicate the abundance of species as follows (a species “occurrence” is typically a local population):

- S1 = 1-5 occurrences or fewer than 1,000 individuals in the state
- S2 = 6-20 occurrences or 1,000-3,000 individuals in the state
- S3 = 21-100 occurrences or 3,000-10,000 individuals in the state
- S4 = more than 100 occurrences or 10,000 individuals in the state
- S5 = considerably more than 100 occurrences or 10,000 individuals in the state

Other sources for abundance information exist for many SGCN, but each has significant limitations in terms of quantification, limited geographical coverage, or single-taxa focus. With their statewide application and consistency across taxa, heritage ranks remain the best gauge of statewide species abundance from a conservation standpoint.

Information on the distribution of many SGCN also resides in the Natural Heritage Program’s database. However, the software application that was used to manage the data until recently could represent SGCN locations only as points. Such data has very limited value for comprehensive wildlife conservation planning. A new application that was installed in 2004 incorporates GIS to allow the true spatial extent of distribution – based on occupied habitat – to be represented. Re-mapping of points to show actual spatial extent is a time-consuming process, though, and only a small portion of the records have been re-mapped to date.

In lieu of being able to directly map the distribution of most SGCN, species-habitat associations (Appendix C) were developed for use with habitat maps in order to show generalized potential distribution. Habitats are organized hierarchically, allowing association with varying levels of habitat detail. Note that some SGCN can be associated only with very broad habitat levels at this time. See Section 4.2.1 for more information about habitat mapping.

As with the SGCN list, species abundance and distribution information is a reflection of current knowledge. State heritage ranks are periodically updated in light of new field work showing changes in abundance. Significant portions of the State have not been systematically surveyed for rare species, so that the distribution of many SGCN is not well established. Also, continued re-mapping of point data will provide an increasingly accurate picture of distribution.

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SECTION 4

Key Wildlife Habitats

4. Key Wildlife Habitats

4.1. Ecological Framework

The Natural Communities of Delaware, developed in 2000, served as the starting point for establishing a wildlife habitat classification. Although the vegetation communities described in that document do not always correspond directly to wildlife “habitats” in the classic sense, they are an acceptable substitute pending the creation of a more appropriate classification.

Since *The Natural Communities of Delaware* is based on the National Vegetation Classification System, it does not include aquatic habitats, which are best described by their physical characteristics. These were added, as were early successional habitats and several anthropogenic habitats. Although the community classification contains some groupings of similar types, further grouping was added to provide a more complete hierarchy of increasingly detailed habitat levels. The resulting Wildlife Habitat Classification appears in Figure 1, following page 4-2.

In the absence of maps for most SGCN (see discussion in Section 3.2), surrogates for Key Wildlife Habitats were developed from two sources. Habitats of Conservation Concern are highlighted in yellow in the Classification. These habitats are rare, have special significance in Delaware, are particularly sensitive to disturbance, and/or have a high diversity of rare plants. Because of these factors, they are known – or expected – to harbor SGCN, especially insects that are often dependent on specific host plants.

Large blocks of unfragmented forests and wetlands were also considered to be Key Wildlife Habitats because of their importance to area-sensitive species, particularly vertebrates. A minimum size of 250 acres was used for selecting these blocks. This patch size conserves viable populations of at least 80% of forest interior-dwelling bird species, based on work done in similar habitats in Maryland. The same threshold was set for wetland blocks, following the methodology used for the Delmarva Conservation Corridor Demonstration Program.

Thus, Key Wildlife Habitats in total consist of SGCN Occurrences (where spatial extent has been mapped), Habitats of Conservation Concern, and Forest Blocks and Wetland Blocks.

Again, lack of knowledge about some Delaware wildlife habitats has influenced the structure of the classification. In particular, aquatic communities have not been well studied, and the very simple characterization of them in the classification needs considerable work. Early Successional Upland Habitats are also poorly understood, and further study will probably yield more distinct types than are currently listed.

4.2. Location and Relative Condition

4.2.1. Habitat Mapping

A variety of data sources were used to develop both general wildlife habitat maps – from the “red” and “blue” levels in the Classification – and the maps of Key Wildlife Habitats. In some

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cases, maps of red and blue level habitats were developed by combining several habitats from the next lowest level. In others, they were derived from parsing larger data sets, such as state maps of wetlands, forests and land use/land cover, or by intersecting these with each other or with additional data. In the end, nearly all red and blue level habitats were successfully mapped. The blue levels under Early Successional Upland Habitats were not mapped because of inconsistencies in the attributes used to distinguish them. Also, no attempt was made to map either Nearshore or Offshore Habitats because of a lack of information.

General wildlife habitats – from the red and blue levels in the Classification – are shown in Figures 2 through 9 in Appendix D.

For Key Wildlife Habitats, SGCN Occurrences and most Habitats of Conservation Concern were digitized by Natural Heritage staff based on field surveys. Twisted Sedge Sandbar was not mapped because of the transitory nature of the habitat, nor was Sea Level Fen due to concerns about vulnerability to disturbance. Spartina Low Salt Marsh was also not mapped because of the difficulty of distinguishing it in aerial photographs; however, this habitat is entirely included within the Wetland Blocks. The Forest and Wetland Blocks were extracted from the respective state maps mentioned above.

Key Wildlife Habitats are shown in Figures 10 through 17 in Appendix E.

4.2.2. Relative Condition

The Natural Heritage Program tracks rare natural communities – equivalent to habitats in the context of the Plan – in much the same way it does species, including assigning ranks for conservation status. However, too few community occurrences are currently entered in the Natural Heritage database to make this information useful for directing conservation efforts.

For this first iteration of the Plan, relative condition was determined largely qualitatively, utilizing the expert opinion of biologists from the Key Conservation Partners. Quantitative data was taken into account in those few cases where it was available. Condition was based primarily on trends, with some consideration of the scope and severity of current impacts and inherent habitat resiliency (i.e., sensitivity to disturbance). Information on trends, impacts and resiliency were summarized in Present Condition ratings as follows:

- Good = Currently relatively stable in quantity and quality (some fluctuation possible), with only minor historical decline in quantity and/or quality. Typically subject to minor current impacts and possessing good resiliency.
- Fair = Currently experiencing moderate decline in quantity and/or quality, and/or having experienced moderate historical decline in quantity and/or quality. Typically subject to moderate current impacts and/or possessing moderate resiliency.
- Poor = Currently experiencing major decline in quantity and/or quality, and/or having experienced major historical decline in quantity and/or quality. Typically subject to major current impacts and/or possessing poor resiliency.

Present Condition is provided for each Key Wildlife Habitat in Section 6.1.

Delaware Wildlife Habitat Classification

UPLAND HABITATS

Beach and Dune Habitats

Dune Forests and Woodlands

- Coastal Loblolly Pine Upland Forest
- Pitch Pine - Heath Coastal Forest
- Maritime Red-cedar Woodland
- Pitch Pine Dune Woodland
- Loblolly Pine Dune Woodland

Dune Shrublands

- Wax-myrtle - Groundsel-tree Maritime Shrubland
- Bayberry - Beach Plum Maritime Shrubland
- Greenbrier - Poison Ivy Dune Shrubland
- Beach Heather Dune Shrubland

Dune Grasslands

- Beachgrass - Panicgrass Dune Grassland
- Overwash Dune Grassland
- Beach Foredune

Unvegetated Sandy Beach

Upland Forests

Piedmont Upland Forests

- Piedmont Oak - Beech - Mountain Laurel Forest
- Chestnut Oak - Black Birch Forest
- Tuliptree Rich Wood (Piedmont variant)
- Mesic Piedmont Mixed Hardwood Forest

Coastal Plain Upland Forests

- Mesic Coastal Plain Mixed Hardwood Forest
- Dry Oak - Heath Forest
- Chestnut Oak - Hairgrass Forest
- Tuliptree Rich Wood (Coastal Plain variant)
- Mesic Coastal Plain Oak Forest
- Loblolly Pine - Mixed Oak Upland Forest
- Ancient Sand Ridge Forest
- Red Maple - Sweetgum Upland Forest
- Loblolly Pine Plantation

Early Successional Upland Habitats

Herbaceous Early Successional Upland Habitats

Shrub/Brush Early Successional Upland Habitats

OTHER HABITATS

Impoundments

Sand/Gravel Pits

Structures

Note

Habitats of Conservation Concern are highlighted in yellow.

NON-TIDAL WETLAND HABITATS

Forested Wetlands

Forested Floodplains and Riparian Swamps

Piedmont Forested Floodplains and Riparian Swamps

- Sycamore - Green Ash Floodplain Forest
 - Pin Oak - Red Maple Floodplain Depression (also listed under CP Floodplains & Swamps)
- Coastal Plain Forested Floodplains and Riparian Swamps
- Red Maple - Green Ash Floodplain Forest
 - Black Ash Seepage Swamp

- Pin Oak - Red Maple Floodplain Depression (also listed under PD Floodplains & Swamps)
- Red Maple - Sweetgum Streamside Swamp
- Baldcypress - Red Maple - Swamp Black Gum Swamp

Atlantic White Cedar Non-tidal Wetlands

- Delmarva Atlantic White Cedar Swamp
- Atlantic White Cedar - Mixed Herb Bog
- Atlantic White Cedar Millpond Headwater Hummock and Peat Mat Woodland

Isolated Forested Wetlands

Piedmont Isolated Forested Wetlands

- Sweetgum - Red Maple Depression Swamp (also listed under CP Isolated Wetlands)

Coastal Plain Isolated Forested Wetlands

- Coastal Loblolly Pine Wetland Forest
- Wet Loblolly Pine Forest
- Sweetgum - Red Maple Depression Swamp (also listed under PD Isolated Wetlands)
- Pin Oak - Sedge Swamp
- Willow Oak - Basket Oak Swamp
- Loblolly Pine - Mixed Oak Wet Forest
- Loblolly Pine - Sweetgum - Red Maple Swamp

Non-forested Wetlands

Shrub Swamps

- Buttonbush Shrub Swamp
- Water-willow Shrub Swamp

Coastal Plain Seasonal Ponds

Coastal Plain Seasonal Pond Buttonbush Communities

- Buttonbush - Mannagrass - Smartweed Coastal Plain Seasonal Pond Vegetation
- Buttonbush - Warty Panicgrass - Eaton's Witchgrass Coastal Plain Seasonal Pond Vegetation

Coastal Plain Seasonal Pond Herbaceous Communities

- Walter's Sedge - Eaton's Witchgrass Coastal Plain Seasonal Pond Vegetation
- Cape May - Delmarva Depression Meadow
- Three-way Sedge - Canada Rush Coastal Plain Seasonal Pond Vegetation
- Creeping Rush - Boltonia Coastal Plain Seasonal Pond Vegetation
- Maidencane Coastal Plain Seasonal Pond Vegetation
- Mixed Grass Depression Meadow
- Waterlily Deepwater Coastal Plain Seasonal Pond Vegetation

Interdunal Wetlands

- Cranberry Interdunal Swale
- Twig Rush Interdunal Swale
- Round-head Rush - Common Threesquare Interdunal Swale

Piedmont Stream Valley Wetlands

- Piedmont Streamside Seepage Wetland
- Forested Seepage Slope Wetland
- Streamside Backwater Marsh
- Streamside Tussock Meadow
- Twisted Sedge Sand Bar

Streamside Herbaceous Wetlands

- Bulrush Deepwater Marsh
- Cattail Marsh
- Phragmites Marsh

Peat Wetlands

- Virginia Chainfern Swale
- Mixed Herb Deep Peat Wetland

Riverine Aquatic and Submerged Vegetation

- Water Lily Aquatic Wetland
- Riverweed Rocky Bar and Shore
- Mixed Species Submergent Vegetation
- Submerged Tapegrass Community

TIDAL WETLAND HABITATS

Freshwater Tidal Wetlands

Freshwater Tidal Forested Wetlands

- Atlantic White Cedar - Red Maple - Pumpkin Ash Freshwater Tidal Swamp

Freshwater Tidal Scrub-Shrub Wetlands

- Red Maple - Ash Tidal Swamp
- Smooth Alder - Silky Dogwood Shrub Swamp

Freshwater Tidal Marshes

- Wild Rice Freshwater Tidal Marsh
- Mixed Broadleaf Freshwater Tidal Marsh
- Broadleaf Pondlily Freshwater Tidal Marsh
- Arrow-arum - Pickerelweed Freshwater Tidal Marsh
- Sea Level Fen
- Horned Pondweed Submerged Vegetation
- Freshwater Intertidal Quillwort Flat
- Phragmites Tidal Marsh

Saltwater and Brackish Tidal Wetlands

Tidal Low Marshes

- Salt Panne (also listed under High Tidal Marsh)
- Spartina Low Salt Marsh
- Needlerush Salt Marsh (also listed under High Tidal Marsh)
- Smooth Cordgrass - Lilaepsis Brackish Marsh
- Giant Cordgrass Tidal Marsh (also listed under High Tidal Marsh)
- Smooth Cordgrass - Water Hemp Tidal Marsh
- Water-hemp Brackish Marsh
- Cattail - Rosemallow Brackish Marsh (also listed under High Tidal Marsh)
- Submerged Widgeon Grass Community
- Unvegetated Intertidal Mudflat

Tidal High Marshes

- Salt Shrub
- Salt Panne (also listed under Low Tidal Marsh)
- Beaked Spikerush Brackish Tidal Marsh
- Needlerush Salt Marsh (also listed under Low Tidal Marsh)
- Spartina High Salt Marsh
- Common Threesquare Tidal Marsh
- Giant Cordgrass Tidal Marsh (also listed under Low Tidal Marsh)
- Switchgrass Tidal Marsh
- Cattail - Rosemallow Brackish Marsh (also listed under Low Tidal Marsh)
- Bishop-weed - Mixed Species Brackish Marsh

FRESHWATER AQUATIC HABITATS

Piedmont Streams

Coastal Plain Streams

Non-tidal Coastal Plain Streams

Tidal Coastal Plain Streams

Pond, Lake and Reservoir

BRACKISH AND MARINE AQUATIC HABITATS

Nearshore Habitats

Nearshore Open Water

Oyster Reef

Tubeworm Reef

Clam Bed

Mussel Bed

Sand Bar/Sand Flat

Offshore Habitats

SECTION 5

Determining Conservation Issues and Actions

5. Determining Conservation Issues and Actions

Conservation Issues, sometimes known as “threats” or “stresses,” are human actions that adversely impact wildlife, native plants and natural communities, and the ecological processes that sustain them. Conservation Actions are the measures taken to eliminate or minimize these impacts, or to mitigate their effects. For this Plan, determination of Conservation Issues and Actions began with the preparation of standardized “taxonomies” for organizing information. Taxonomies developed by the Conservation Measures Partnership were modified to better reflect circumstances in Delaware. The initial list of issues and actions was then derived from a review of existing state, regional and national plans for relevant items:

- American Fisheries Society – Marine Stock Criteria and Policy 31b-Management of Sharks and Their Relatives
- Atlantic States Marine Fisheries Commission – Fishery Management Plans
- Bat Conservation International – Bats in Eastern Woodlands
- Delaware Green Infrastructure Initiative
- Delaware National Estuarine Research Reserve Management Plan 2004-2009
- Defenders of Wildlife – Second Nature: Improving Transportation Without Putting Nature Second and Voluntary Conservation Tools and Programs
- Delaware Invasive Species Management Plan
- DNREC – Pea Patch Island Special Area Management Plan
- Environmental Law Institute – Protecting Delaware's Nature Heritage: Tools for Biodiversity Conservation, Protecting Delaware's Forests for Biodiversity, and Innovative State Strategies for Biodiversity Conservation
- Mid-Atlantic Bird Conservation Initiative – BCR 30 Plan
- Mid-Atlantic Fishery Management Council – Fishery Management Plans
- National Audubon Society – Important Bird Areas Program
- National Marine Fisheries Service – Highly Migratory Species Fisheries Management Plans
- National Wildlife Federation – Endangered by Sprawl
- North American Bat Conservation Partnership – State Planning Guide for Bats
- North American Waterbird Conservation Plan
- North American Waterfowl Management Plan
- Northeast Endangered Species and Wildlife Diversity Technical Committee – Wildlife Species of Regional Conservation Concern in the Northeastern United States
- Partners for Amphibian and Reptile Conservation, Northeast Working Group – Habitat Management Guidelines
- Northern Bobwhite Conservation Initiative
- Our Natural Legacy – Delaware's Biodiversity Conservation Partnership
- Partners in Flight – MidAtlantic Coastal Plain, MidAtlantic Piedmont, and North American Landbird Conservation Plans
- The Nature Conservancy – North Atlantic Coast, Lower New England-Northern Piedmont, and Chesapeake Bay Lowlands Ecoregion Plans, and Blackbird-Millington Corridor Conservation Area Plan

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- U.S. Commission on Ocean Policy – "Oceans Report"
- U.S. Fish & Wildlife Service – Chesapeake Bay Nutria Control program, Draft Environmental Impact Statements for light goose and resident Canada goose management, and Endangered Species recovery plans
- U.S. Shorebird Conservation Plan
- Virginia Department of Environmental Quality – Neotropical Migratory Songbird Coastal Corridor Study

A few additional issues and actions were developed as needed.

5.1. Issues

The final suite of Conservation Issues for Delaware wildlife is grouped into the following general categories:

- Habitat Loss or Fragmentation
- Residential and Commercial Development Practices
- Agricultural and Forestry Operations
- Shoreline Protection Practices
- Industrial Operations
- Transportation and Utility Operations and Maintenance
- Invasive Species, Nuisance Animals and Wildlife Diseases
- Water Use
- Solid Waste Disposal
- Changes in Fire Regimes
- Climate Change
- Energy Production
- Recreational Activities
- Airport Operations
- Wildlife Harvesting
- Resource Management
- Resource Protection
- Information Management
- Monitoring and Adaptive Management
- Division Operations
- Private Lands Conservation
- Natural Resource Management Planning
- Education and Outreach
- Nuisance Wildlife Management

While virtually all specific Conservation Issues had their origins in the plans mentioned above, most of them were somewhat modified to make them applicable to particular circumstances in Delaware. These specific issues, arranged by category, are described in the tables below.

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5.1.1. Issues Impacting Key Habitats and SGCN

Habitat Loss or Fragmentation (impacts from the actual footprints of structures, facilities and land uses; off-site impacts are covered in other issues)
Residential and Commercial Structures
<i>Conversion of forests, early successional habitats and wetlands, destruction of buffers, and increased edge effects.</i> Residential and commercial development pressure is probably the most significant issue facing wildlife habitats in Delaware. Long confined mainly to the northern part of the state and the vicinity of a few cities and towns, it has now spread throughout the state. It is perhaps most intense in southern New Castle County, central Kent County, and eastern Sussex County. Types of impacts vary among habitats, with loss and fragmentation most significant in uplands and non-tidal wetlands, and degradation from buffer loss most significant in tidal wetlands. However, there is some incremental loss of tidal wetlands through permitted activities, the cumulative impact of which has not been assessed. See Figure 18 for a view of developed and developing areas vs. Key Wildlife Habitats.
Farmland
<i>Conversion of forests, early successional habitats and wetlands, destruction of buffers, and increased edge effects.</i> Large-scale conversion to agriculture is no longer occurring in Delaware, and, in fact, farmland is being lost to residential and commercial development. Changes in the type of agriculture – such as the construction of poultry houses – may result in some loss and fragmentation of upland habitats. However, escalating economic pressures steadily increase the intensity of crop farming, meaning that more stream and wetland buffers are cleared for crops, resulting in degradation of those habitats.
Industrial Facilities (includes all types of manufacturing, warehousing and quarrying)
<i>Conversion of forests, early successional habitats and wetlands, loss of buffers, and increased edge effects.</i> Habitat loss and fragmentation effects from industrial development are similar to residential and commercial development; however, impacts from construction and expansion of industrial facilities are not as widespread and are primarily directed toward growth areas rather than undeveloped areas distant from supporting infrastructure. Delaware's Coastal Zone Act of 1971 (7 Del. Code, Chapter 70) has helped to limit the spread of industrial facilities along the Delaware River and Bay.
Transportation Infrastructure
<i>Conversion of forests, early successional habitats and wetlands, destruction of buffers, and increased edge effects.</i> Impacts include those from the initial construction of roadways, bridges, culverts and other infrastructure, as well as from ongoing maintenance and repair. Fragmentation impacts from roads are especially widespread for some taxa, where even narrow secondary roads may present formidable barriers to insects and small vertebrates. Delaware's rapid growth forces a seemingly endless cycle of road projects of all sizes, including rerouting of major highways, expansion of many secondary roads, and frequent replacement of culverts and bridges.
Utility Corridors
<i>Conversion of forests, early successional habitats and wetlands, destruction of buffers, and increased edge effects.</i> With increased development and population growth, there has been a concurrent increase in demand for power, overloading existing capacity and causing power outages and imposed rolling blackouts. As a result, major utility corridors are created or expanded – lengthen and widened – to increase capacity for power delivery. Construction and maintenance of major regional corridors and smaller local corridors can exacerbate habitat loss and fragmentation. Though utility corridors have the potential to provide early successional habitat timing and methods of maintenance can effectively decrease habitat suitability.

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Habitat Loss or Fragmentation (impacts from the actual footprints of structures, facilities and land uses; off-site impacts are covered in other issues)
Dredge Spoil Disposal <i>Conversion of forests, early successional habitats and wetlands, and degradation of beaches and Subaqueous lands.</i> Large-scale dredging projects (e.g., Delaware Bay main channel) generate massive volumes of spoil, for which there may be insufficient existing disposal-site capacity. New disposal sites would need to be identified on land and in water, potentially smothering or converting upland, wetland and/or subaqueous lands, or causing habitat degradation if sediment quality is poor and/or contaminated with toxins.
Dams <i>Fragmentation of streams.</i> Stream habitats are effectively fragmented when migration and movement of aquatic species past a barrier is prevented. Barriers may consist of dams, weirs and other water control structures, as well as stream crossings for roads and underground utilities.
Landfill Facilities <i>Conversion of forests, early successional habitats and wetlands, destruction of buffers, and increased edge effects.</i> With increased development and population growth, there is an increasing need for landfill capacity, either through expansion of existing facilities or construction of new landfills. Landfills are often sited away from developed areas due to offensive odors, noise and high volume truck traffic. Forested areas may be preferred because they screen landfill operations from view and provide a noise buffer. Capped landfills may provide early successional habitat because trees often cannot be planted if roots can penetrate the cap.
Wind Farm Facilities <i>Conversion of forests, early successional habitats and nearshore habitats.</i> Impacts to terrestrial habitats result from construction of towers and related infrastructure, while impacts to nearshore habitats result from tower footings and cables fragment habitat and displace benthic organisms. Wind farms have been proposed for sites as far flung as Piedmont ridges in New Castle County, Coastal Plain flats in Kent County, and off Sussex County in both the Delaware Bay and Atlantic Ocean.
Residential and Commercial Development Practices
Altered Hydrology <i>Degradation of streams and wetlands from hydrologic changes caused by runoff from impervious surfaces</i> (other issues for roads are under Transportation and Utility Operations and Maintenance). In addition to increasing the size and frequency of high stream flows during storm events, impervious surfaces often decrease base flows by inhibiting recharge of groundwater. In severe cases, this may result in headwater streams changing from permanent to intermittent flow regimes. Major impacts exist in heavily developed northern Delaware, and are increasing in many other parts of the state. Even “relatively” undeveloped areas, such as the Blackbird-Millington Corridor, are approaching the 10% impervious surface threshold at which effects become noticeable.
Nutrients and Sediments (includes nutrients from fertilizers; nutrients from sewage and septic systems are covered in Industrial Development and Operations under Routine Sewage Discharges) <i>Degradation of streams, wetlands and nearshore habitats from excessive nutrients and sediments.</i> Sedimentation from land-clearing activities reduces sunlight penetration, raises water temperature, decreases the dissolved oxygen level, and alters substrate composition. In the short term, nutrient enrichment from lawn fertilizers causes algal blooms that may seriously deplete dissolved oxygen levels. Over time, nutrient enrichment may cause subtle but important changes in natural community structure and function.

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Residential and Commercial Development Practices	
Pesticides	<i>Lethal or sub-lethal effects of residential pesticides on aquatic and wetland species.</i> In general, pesticides are applied at even higher rates to residential land than to agricultural land, and they are frequently detected in surface water and groundwater at levels that are injurious to aquatic organisms. This issue has not been well studied in Delaware, where the focus has been on agricultural pesticides.
Outdoor Lighting	<i>Mortality or disturbance of sphinx moths and waterbirds from outdoor lighting.</i> Sphinx moths are strongly attracted to artificial lights, where they may become disoriented and are less able to evade predation by bats. Many waterbirds – especially young – are attracted to outdoor lights in coastal developments and on boats, ships and structures near shore, where they become disoriented and may be killed from collisions. Also, increased predation of these birds by gulls has been observed in the presence of outdoor lighting.
Buildings	<i>Mortality of migratory birds from collisions with buildings.</i> Since the widespread construction of curtain glass office buildings beginning in the 1960s, window collisions have become a major source of mortality for birds. Songbirds are most often involved, and mortality is substantially greater at night when buildings are lit, and in conditions of fog, mist or low cloud cover. Some impacts have been noted at buildings in Wilmington, although the full extent of the issue has not been assessed.
Piers and Docks	<i>Degradation of beach and dune habitats and wetlands by piers and docks.</i> Although the impacts of individual piers and docks may be minimal, the cumulative impact can be substantial.
Agricultural and Forestry Operations (includes “hobby farms” and – for land use purposes only – poultry houses and other Confined Animal Feeding Operations [CAFO]. Effluent discharges from CAFOs are covered in “Routine sewage discharges...” under Industrial Development and Operations.)	
Agricultural Harvesting Practices	<i>Mortality or disturbance of box turtles, milksnakes and early successional birds from harvesting of crops during nesting season or at other critical times.</i> Several species are known to nest in crop or hay fields, which may be harvested while these birds are on the nest. Also, box turtles sometimes nest in fields, where the adults, eggs and hatchlings may be killed during harvesting.
Livestock Grazing	<i>Degradation of upland and wetland forests from livestock grazing.</i> Long-term grazing in forests depletes herbaceous species and shrubs, and in more severe cases may inhibit regeneration of trees.
Ditching and Draining	<i>Degradation of streams and wetlands from ditching for agricultural operations.</i> Ditched streams are impacted by loss of aquatic and riparian vegetation, alteration of substrate composition, increased flow rates and elevated water temperatures. Adjacent wetlands are often drained because of the lower water surface elevation in ditched streams.
Altered Hydrology	<i>Degradation of streams and wetlands from hydrologic changes caused by increased runoff.</i> Greater runoff from cropland and cleared forests boosts the size and frequency of high stream flows during storm events.

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<p>Agricultural and Forestry Operations (includes “hobby farms” and – for land use purposes only – poultry houses and other Confined Animal Feeding Operations [CAFO]. Effluent discharges from CAFOs are covered in “Routine sewage discharges...” under Industrial Development and Operations.)</p>
<p>Nutrients and Sediments</p> <p><i>Degradation of streams, wetlands and nearshore habitats from excessive nutrients and sediments.</i> Row crop agriculture produces substantial amounts of sediments, even when no-till planting is used. Sedimentation reduces sunlight penetration, raises water temperatures and alters substrate composition. In the short term, nutrient enrichment from lawn fertilizers causes algal blooms that may seriously deplete dissolved oxygen levels. Over time, nutrient enrichment may cause subtle but important changes in natural community structure and function.</p>
<p>Pesticides</p> <p><i>Lethal or sub-lethal effects of agricultural pesticides on early successional, aquatic and wetland species.</i> Agricultural pesticides may directly impact some early successional birds at time of application, but more often they are found in surface water and groundwater at levels that are injurious to aquatic organisms.</p>
<p>Clearcutting and Other Forestry practices</p> <p><i>Loss, fragmentation or degradation of upland and wetland forests from clearcutting, selective harvest, short rotation, conversion to pine plantation and other practices.</i> Clearcutting results in at least temporary loss of natural forest structure and function. The loss becomes essentially permanent if areas are cut on a short rotation or converted to pine plantations, which have limited value as wildlife habitat. Even with selective harvest, use of heavy equipment may destroy shrub and herbaceous vegetation, compact soil, cause erosion, or facilitate colonization by invasive plants.</p>
<p>Shoreline Protection Practices</p>
<p>Jetties and Groins</p> <p><i>Degradation of beach and dune habitats by disruption of littoral drift.</i> By blocking longshore sand transport, jetties and groins decrease beach erosion in some areas while increasing it in others, which eventually impacts the natural formation of dunes.</p>
<p>Beach Renourishment</p> <p><i>Degradation of beach and nearshore habitats from sand dredging and pumping.</i> While beach and dune habitats usually benefit from renourishment in the long term, some wildlife may experience short term negative impacts. Also, many potential source sites – sand bars and flats – are important habitats, although source area impacts are also usually short term.</p>
<p>Dune Construction/Stabilization</p> <p><i>Degradation of overwash habitats from dune construction, vegetation plantings and fences.</i> Although dune construction and stabilization is often beneficial for a variety of wildlife, some species of tiger beetles and waterbirds require overwashes – unvegetated areas formed when storms breach dunes – for nesting or other life cycle stages. Constructing or stabilizing dunes causes overwashes to revegetate at an accelerated rate.</p>
<p>Artificial Shoreline Hardening (includes bay and ocean beaches, wetland shorelines and stream banks)</p> <p><i>Degradation of beaches, wetlands and streams from construction of bulkheads and other structures to prevent erosion.</i> Paradoxically, these structures often exacerbate the erosive forces of waves, tides and currents such that they are quickly undermined. Also, in streams they deflect the energy of currents rather than absorbing it, which increases erosion downstream.</p>

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Industrial Operations
Air Pollution
<p><i>Degradation of multiple natural habitats from air pollution.</i> Impacts accrue to many habitats from airborne forms – e.g. ozone damage to vegetation – as well as from precipitation onto land and water, such as acidification of soils from SO_x and nitrogen enrichment of water bodies from NO_x. Heavy metals including mercury and persistent organic pollutants (e.g., PCBs, pesticides such as DDT, chlordane and toxaphene, and by-products such as dioxins and furans) can affect wildlife and humans through bio-accumulation, and direct poisoning through the disruption of endocrine function, organ injury, increased vulnerability to stress and disease, lower reproductive success, and death.</p>
Accidental Spills of Toxins and Sewage
<p><i>Degradation of beach and dune habitats, wetlands and nearshore habitats – and wildlife mortality – from “catastrophic” releases of oil, industrial chemicals and untreated sewage.</i> The Delaware River and Bay are home to the fifth largest port complex in the United States in terms of total waterborne commerce. Every year, over 70 million tons of cargo move through the tri-state port complex, which includes the ports of Philadelphia, Pennsylvania; Camden, Gloucester City, and Salem, New Jersey; and Wilmington, Delaware. It is the second largest oil port in the United States, handling about 85% of the East Coast's oil imports. Due to this high volume of shipping, potential for catastrophic spills is high. In addition, inadequate capacity, outdated or flawed design of sewage treatment systems cause raw sewage outflow into aquatic systems degrading water quality, introducing contaminants, and creating anoxic conditions.</p>
Chronic Water Pollution
<p><i>Degradation of aquatic and wetland habitats, and lethal or sub-lethal effects on aquatic and wetland species, from routine discharges and persistent leaks of sewage and toxins.</i> Discharges and leaks may come from municipal treatment plants, industrial effluent, septic systems or Confined Animal Feeding Operations (CAFO) such as poultry houses. In the short term, nutrient enrichment from sewage causes algal blooms, and over time may change natural community structure and function. PCBs, heavy metals, dioxin and other toxins may occasionally cause direct mortality, but more often have sub-lethal impacts on growth, reproductive physiology or behavior, especially those substances that bio-accumulate.</p>
Impingement/Entrapment/Entrainment at Water Intakes
<p><i>Mortality or disturbance of estuarine fish and sea turtles from temporary or permanent capture.</i> Cooling-water intakes at industrial sites and power-generating facilities along the Delaware River and Bay, Indian River and Inland Bays pose a potential risk to fisheries and wildlife resources.</p>
Sediments from Sand and Gravel Quarrying
<p><i>Degradation of wetlands and aquatic habitats from excessive sediments.</i> Sedimentation reduces sunlight penetration, raises water temperatures and alters substrate composition.</p>
Transportation and Utility Operations and Maintenance
Altered Hydrology
<p><i>Degradation of streams and wetlands due to increased flooding from undersized culverts.</i> Although this issue is recognized as a problem in a few areas of high conservation value like the Blackbird region, the extent of impacts to habitat are not well quantified throughout the state. Problems caused by undersized culverts are often identified only when property is damaged or roads are flooded.</p>
Road Salt
<p><i>Lethal or sub-lethal effects of road salt on aquatic species.</i> Road salt can affect soil and water chemistry, vegetation composition and may cause direct mortality of vertebrates and invertebrates. However, Delaware receives less than 20 inches of snowfall annually, thus road salt application is relatively infrequent. Nonetheless, when snowfall averages higher than normal statewide or in localized areas, the effects of road salt on key habitats and species can be detrimental.</p>

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Transportation and Utility Operations and Maintenance	
Vehicles	<i>Mortality of salamanders and reptiles from collisions with vehicles.</i> Virtually every taxonomic group of wildlife is vulnerable to road mortality in Delaware. With more than 12,000 lane-miles of roads and an increasing capacity for traffic through road widening and other improvements, the risk of mortality will likely increase. Mortality can be clustered where vegetation is close to the road or where roads bisect breeding habitat.
Commercial Ships and Boats (includes cargo vessels of all types and commercial fishing boats)	<i>Degradation of streams and wetlands due to increased erosion from wakes, and mortality of estuarine fish, sea turtles and marine mammals from collisions.</i> Significant wake impacts are obvious in the Nanticoke River, but may occur elsewhere. Collision-related mortality is noted in the few carcasses that surface or wash ashore, but the full extent of the issue may be much greater.
Communications Towers and High-Tension Electric Lines	<i>Mortality of waterfowl, raptors, migratory birds and bats from collisions with towers and lines.</i> Collisions with tall towers, whether for radio, television, cellular or (formerly) telephone, may kill hundreds of birds in a single night, especially under conditions of fog, mist or low cloud cover. The degree of impacts depends on geographic location and topographic position. Raptors are especially vulnerable to electrocution from high-tension lines.
Channel Dredging	<i>Degradation of streams and nearshore habitats from dredging of shipping channels.</i> Potential impacts from dredging operations include sedimentation, re-suspension of toxic pollutants, damage to spawning or nursery habitats, direct mortality associated with dredging equipment, and altered hydrology.
Invasive Species, Nuisance Animals and Wildlife Diseases	
White-tailed Deer	<i>Degradation of dune shrublands and upland and wetland forests from excessive herbivory.</i> Intense browsing depletes – or even eliminates – herbaceous species and shrubs, and in severe cases may prevent regeneration of forest canopy and understory trees. Also, deer may exacerbate impacts of invasive plants by browsing preferentially on native species.
Nutria	<i>Degradation of tidal wetlands from excessive herbivory.</i> Impacts have been minimal to date, but enormous damage has occurred nearby in Maryland. Nutria have begun colonizing Delaware relatively recently, so impacts may increase substantially.
Gypsy Moth	<i>Degradation of upland and wetland forests from excessive herbivory.</i> Impacts to forests in Delaware have been minimal to date, but the potential exists for major problems as experienced by some surrounding states.
Snow Goose and Resident Canada Goose	<i>Degradation of tidal wetlands, streams, ponds and impoundments from excessive herbivory and eutrophication.</i> Impacts to wetlands and aquatic habitats from burgeoning populations have become so pervasive that the USFWS is proposing to substantially liberalize regulations for managing both species.
Mute Swan	<i>Degradation of wetlands from excessive herbivory and disturbance of wildlife by aggressive behavior.</i> Minimal impacts to aquatic vegetation and nesting waterfowl and waterbirds have been recorded in Delaware so far, but significant impacts have occurred nearby in Maryland.
Green Crab and Japanese Shore Crab	<i>Degradation of nearshore habitats from predation of clams and mussels.</i> Although both crabs are present in Delaware, impacts have not yet been detected. However, clam and mussel beds in New England have been decimated by these species.

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Invasive Species, Nuisance Animals and Wildlife Diseases	
Control of Mosquitoes and Forest Pests by Aerial Application of Pesticides	
<i>Mortality of non-target forest insects and reduction in the prey base for insectivorous forest birds, small mammals and bats. Non-target insects are susceptible to both biological and chemical larvicides and adulticides, depending on insect growth stage and pesticide type. This may impact wildlife either through direct mortality or by reducing the number and type of prey available to insectivorous species.</i>	
Control of Mosquitoes with Open Marsh Water Management and Impoundment Management	
<i>Degradation of tidal high marshes from changes to marsh surface water patterns, and to impoundments from manipulation of water levels. These practices have positive benefits related to mosquito control and reduction in pesticide use; however, impacts to high saltmarsh communities, as a result of altered flooding frequency, and associated SGCN including black rail require further evaluation to ensure unique natural communities and associated SGCN are not adversely affected by these practices.</i>	
Pets and Subsidized Predators (animals whose populations have increased due to food and shelter provided directly or indirectly by humans; includes native species and feral pets)	
<i>Mortality or disturbance of turtles, shorebirds, waterbirds and ground-nesting birds and bats from dogs, cats, raccoons, foxes, gulls, crows and others. Increased development, population growth, habitat fragmentation and edge effects benefit some native wild animals resulting in increasing populations that may prey upon or compete with SGCN for resources. Increasing trends in maintaining feral cat "colonies" and inappropriate or illegal release of exotic pets (e.g., snakes, turtles) in natural areas introduce sources of predation, potential for disease transmission and competition for food and other resources needed by native species.</i>	
Asiatic Clam	
<i>Mortality of freshwater mussels from competition for space and food. In some streams, populations of Asiatic clams are so high that they monopolize the substrate and filter out a substantial portion of the plankton that also serves as a food source for freshwater mussels.</i>	
European Starling	
<i>Mortality or disturbance of cavity-nesting birds from competition for nest cavities. Delaware's fragmented habitats and agricultural landscape provide ideal habitat conditions for European starlings. Breeding bird surveys in Delaware estimate a minimum of 30,000 pairs of starlings in the state. Birds that nest in open or edge habitats, including the red-headed woodpecker and eastern bluebird, are particularly susceptible to competition for nest sites.</i>	
Invasive Earthworms	
<i>Degradation of forests from depletion of the soil organic layer. Earthworm impacts are not known in Delaware. However, significant impacts have been noted in nearby Pennsylvania and through the northeast and Midwest.</i>	
Infectious Diseases	
<i>Mortality of waterfowl and shorebirds from botulism, oysters from Dermo and MSX, raptors from West Nile virus, and others from emerging diseases. Delaware hosts significant concentrations of migratory shorebirds and waterfowl, with significant proportions of some species' populations using Delaware Bay as a stopover site. High densities of birds increase the risk of disease transmission, and long-distance migrants can transport disease organisms globally.</i>	
Invasive Plants	
<i>Degradation of multiple natural habitats. A wide variety of invasive grasses, forbs, shrubs, trees and vines proliferate in virtually all habitats. Impacts range from depletion of native plants to changes in habitat structure and function.</i>	

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Water Use
Dam Operations
<i>Degradation of streams and wetlands.</i> Water impounded upstream of dams degrades pre-existing stream and wetland habitats, and water releases from dams can alter the hydrology of downstream habitats and increase sedimentation.
Dam Removal
<i>Degradation of streams and wetlands from release of sediments.</i> Sediments that accumulate behind dams are released upon removal of the structure, leading to downstream siltation, nutrient enrichment and possibly pollution by toxins.
Groundwater Withdrawals
<i>Degradation of wetlands and streams from lowering of the water table.</i> Excessive withdrawals for drinking water, irrigation and industrial processes reduce base flows of streams and dewater groundwater-fed wetlands. Excessive withdrawals over an extended period may eventually cause saltwater intrusion into aquifers in coastal areas.
Surface Water Withdrawals
<i>Degradation of wetlands and streams from decreased stream flows.</i> Excessive withdrawals for drinking water, irrigation and industrial processes during dry periods may drop stream flows below the minimum required to sustain aquatic organisms. This in turn may dewater adjacent surface water-fed wetlands.

Solid Waste Disposal
Trash Ingestion
<i>Mortality of aquatic life from ingestion of trash.</i> Careless or intentional trash disposal in and near aquatic, especially marine, habitats pose a risk to sea turtles, marine mammals and birds that may accidentally ingest or become entangled in the debris. Helium balloons, plastic bags, 6-pack rings and pelletized plastic persist in the environment and continue to cause problems for aquatic wildlife.
Beach Cleanup Activities (raking, events)
<i>Degradation of beach and dune habitats and mortality or disturbance of shorebirds and waterbirds from regular or episodic mechanical or manual cleanup.</i> Equipment used to remove debris (natural or unnatural) from sandy beaches can cause disturbance to migratory or resident nesting birds. Compaction of sand and removal of wrack vegetation by heavy equipment can cause a reduction in food for birds, invertebrates, and other animals in foredune and beach habitats. Seeds trapped in the wrack line and sand may also be removed thus changing vegetation patterns in these habitats as well.

Changes in Fire Regimes
Fire Suppression
<i>Degradation of early successional habitats and forests from suppression of regular fires.</i> Early successional habitats require frequent “disturbance” – historically provided by wildfires and intentional burning by Native Americans – to prevent them from reverting to forests. Also, most upland forests in Delaware depend on regular, although less frequent, fire to maintain the dominance of oak species. Fire suppression practices that stem from public safety concerns, and from misunderstandings about the role of fire in natural systems, cause the degradation of both of these habitat types.
Firefighting Practices
<i>Degradation of forests, early successional habitats and wetlands from efforts to control unplanned fires.</i> Clearing of firebreaks and other uses of heavy equipment for controlling wildfires may cause structural and functional changes to habitats from soil compaction or erosion and loss of vegetation.

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Climate Change

Sea Level Rise

Degradation of beaches and dunes, tidal wetlands and coastal forests from inundation. Estimates of sea-level rise along the U.S. coastline over the next century range from inches to several feet. Hardening of the shoreline and construction along beaches and marsh fringes allow little room for natural landward migration of these habitats.

Energy Production

Wind Farm Towers

Mortality of waterfowl, raptors, shorebirds, waterbirds, migratory songbirds and bats from collisions with tower blades and masts. Demands for alternative renewable energy sources have lead to an increased interest in developing wind farms in Delaware. Placement of wind farms in areas used regularly by large numbers of migratory birds and bats, including the Delaware Bay, nearshore Atlantic Ocean, coastal terrestrial habitats increases the risk of mass mortality.

Tidal Turbines

Mortality of estuarine and marine fish and sea turtles from collisions with turbine blades. As with wind power, interest in harnessing strong tidal currents as a renewable energy source has lead to consideration of placing tidal turbines in Indian River Inlet. However, impacts on local fisheries, including SGCN, are not clearly understood.

Thermal Pollution from Power Plants

Degradation of nearshore open water habitat from discharge of heated effluent. Large inputs of heated water can have harmful effects on aquatic life by causing sharp changes in water temperature, particularly when volumes of effluent fluctuate over short periods. Warmer temperatures lower dissolved oxygen in the water, increase respiration rates of organisms, and increases fish and wildlife susceptibility to disease, parasites, and toxic chemicals. Discharge of heated water into shallow areas near the shore may impact spawning and kill young fish.

Recreational Activities

Recreational Use on Foot

Degradation of beach and dune habitats and mortality or disturbance of shorebirds and waterbirds from beach users, birders, fishers, and others on foot. Increased participation in hiking, birding, fishing, and walking brings people into sensitive natural areas. Areas without designated or well marked trails or access points expose resources to increased levels of disturbance and degradation.

Pleasure Boats and Personal Watercraft

Degradation of tidal marshes and streams from pollution and wakes, mortality of estuarine fish, sea turtles and terrapins from collisions, and disturbance of shorebirds and waterbirds from harassment. Increased popularity of personal watercraft and pleasure boating has resulted in a larger number of watercraft in relatively small areas like the Inland Bays, Nanticoke River, millponds and other water bodies throughout the state. Boaters seeking less crowded areas to anchor, fish, sunbath or swim are increasingly using shallow water areas and marsh islands for recreational use, potentially causing increases in turbidity, bottom scouring, pollution, and disturbance to wildlife.

Off-Road Vehicles

Degradation of forests and early successional habitats from erosion, and disturbance of tiger beetles, shorebirds and waterbirds, from legal and illegal use. Legal and illegal use of off road vehicles causes compaction of soils, destruction of vegetation, disturbance to and direct mortality of wildlife, and increases in air and noise pollution.

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Airport Operations
Overflights
<i>Disturbance of waterfowl, shorebirds and waterbirds from aircraft overflights.</i> Aircraft from Dover Air Force Base and other regional military facilities, planes towing advertising banners, aerobatic planes and helicopters often fly at low altitudes over beaches, marshes and coastal impoundments causing large flocks of birds to flush repeatedly, particularly during critical migratory period.
Bird Strike Hazard Management
<i>Degradation of early successional habitats from frequent mowing.</i> Collisions between birds and planes can result in costly damage to aircraft and loss of human life. As a result, airports manage vegetation around runways to limit bird populations to the greatest extent possible (including mowing throughout breeding and migration).
Wildlife Harvesting
Inappropriate Hunting and Fishing
<i>Mortality of game species and sportfish from illegal or inadequately managed harvest.</i> Poaching, insufficient enforcement and setting harvest levels with inadequate data on population dynamics increases the risk of serious decline, and local or regional species extirpation.
Inappropriate Collection for the Pet Trade or for Bait
<i>Mortality of fish, amphibians and reptiles from illegal or inadequately managed collection.</i> Poaching, insufficient enforcement and setting harvest levels with inadequate data on population dynamics increases the risk of serious decline, and local or regional species extirpation.
Lead Shot Ingestion
<i>Mortality of waterfowl, raptors and early successional birds from primary or secondary ingestion of shot.</i> Although it is illegal to use lead shot while hunting waterfowl, small-sized lead shot may be used for upland game. Spent lead shot can accumulate in soils and vegetation and may be ingested by upland birds causing poisoning or death. Secondary poisoning of raptors or others predators may result from feeding on birds containing lead shot.
Commercial Shellfish Dredging
<i>Degradation of nearshore habitats from dredging gear.</i> Substantial impacts to the structure of oyster reefs, clam beds, and sand bars and flats can occur from repeated dredging.
Fishing Gear Entanglement
<i>Mortality of estuarine fish, sea turtles and osprey from lost or discarded nets, lines and traps.</i> Impacts from commercial and recreational fishing gear (including pot gear, gill nets and hook and line fisheries) operating in Delaware waters are not well documented due to lack of monitoring, coordination, under-reporting, or the absence of reporting requirements.
Fisheries Bycatch
<i>Mortality of estuarine and marine fish, sea turtles and terrapins from unintended capture by fishing gear.</i> 'Bycatch' is discarded or retained incidental catch due to a direct encounter with fishing gear. In general, bycatch impacts to non-target species are not well documented, except for diamondback terrapin, due to lack of monitoring, under-reporting or the absence of reporting requirements.
Nuisance Wildlife Management
<i>Mortality of snakes and bats as a result of nuisance control.</i> Among wildlife that are considered "pests" by the general public, there are many native species that are harmless and / or beneficial. Because of the sense of fear they instill, large numbers of snakes, bats and other native wildlife are destroyed by homeowners and business owners.

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Resource Management
Habitat/Wildlife Management
<i>Degradation of early successional habitats, forests, freshwater and tidal marshes, streams and impoundments from manipulations to benefit particular habitats or species. Active management of habitats or wildlife invariably leads to trade-offs among the particular needs of different resources. The potential for conflict is greatest when conducting single-species management, such as for game animals, sport fish or endangered species, although it can never be entirely avoided even when managing for broad habitat types on a landscape level. Historically, most management in Delaware has focused on individual species that are hunted and fished, and the impacts of this on key habitats and SGCN has not been assessed.</i>
Facility and Program Operations
<i>Degradation of early successional habitats, upland forests, tidal marshes, streams and impoundments, and disturbance of wildlife, from facilities and operations unrelated to habitat/wildlife management. Public lands are managed for a variety of purposes, and therefore are subject to impacts from uses that are incompatible with conservation of key habitats and SGCN. Most prominent among these are visitors centers, active recreation facilities, roads, trails and related amenities.</i>

5.1.2. Issues Affecting Institutional Capacity

Resource Protection
Funding for open space acquisition to protect key habitats and SGCN
State planning staff has estimated that the total cost for permanently protecting the recommended 258,000 acres of “green infrastructure” – natural resources, recreational lands and working lands that contain the majority of key habitats and SGCN – is \$554 million. Currently, the Open Space Program for acquisition is funded at \$9 million/year for 17 years. At this rate of funding, the targeted acreage will never be reached because of the rapid pace of land development.
Enforcement capacity
Additional enforcement capacity is needed to focus on specific areas where SGCN and key habitats are especially vulnerable to disturbance, and to address general collection, possession and sale of native wildlife species.

Information Management
Information management for SGCN, key habitat, conservation issue and conservation action data to support adaptive management
The state currently lacks a comprehensive spatial and tabular data management system for all wildlife, habitat, issue and action data and information. In addition, resources are lacking to ensure such a system is readily available to land managers, planners, and other decision makers, both within the state government and among conservation partners.

Monitoring and Adaptive Management
Monitoring of SGCN, key habitats, impacts from conservation issues and outcomes of conservation actions
Existing monitoring protocols and procedures are often limited to game animals, sportfish, endangered species and a few SGCN, and yet even these efforts are not adequate, primarily due to lack of staff and funding. Monitoring of key habitats is also limited, and the impacts of only a few conservation issues are monitored. Some “direct threat” issues, like pollution from point source wastewater discharges, are monitored extensively, but many others are not monitored at all. There is also limited monitoring of the results of species and habitat management and other conservation actions.

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Monitoring and Adaptive Management

Quantitative measures of success for assessing DEWAP implementation

Most existing measures of success consist of population targets or “bag limits” for harvested species, such as waterfowl and sportfish. No measures exist for the great majority of species and for virtually all habitats. Measures must also be developed to gauge the success of DEWAP implementation itself in order to maximize accountability.

Adaptive management framework for modifying conservation actions

Although sometimes practiced informally, there is no systematic employment of adaptive management to improve the results obtained from conservation actions. A formal approach to adaptive management is critical to taking maximum advantage of limited staff, time and funding to achieve conservation goals.

Division Operations

DFW funding, staffing, administrative structure and/or procedures for DEWAP implementation

Historically, fish and wildlife agencies were established primarily to address conservation and management of harvested species, and agency structure typically reflects an administrative configuration that addresses “game” and “nongame” issues separately. As described in this plan, there is increasing overlap of conservation issues affecting both aquatic and terrestrial harvested and non-harvested species. Greater coordination among staff, programs, projects, and information management is necessary to fully and successfully implement DEWAP.

Private Lands Conservation

Incentives for landowners

Although new programs like the Landowner Incentive Program and Farm Bill programs are providing funding to work with private landowners on wildlife restoration and enhancement projects, more flexibility and additional options for program application are needed to entice landowners to participate.

Coordination among private lands conservation programs

With increasing funds available for private lands conservation, and a variety of agencies and organizations implementing private lands programs, there is a need to improve communication and coordination to ensure appropriate activities are recommended to landowners, funding is efficiently and effectively invested, and landowner confusion is avoided.

Natural Resource Management Planning

Baseline information

Despite considerable work with many rare species and most harvested species, much remains to be learned about the status and distribution of Delaware’s wildlife. Certain groups of species and many key habitats remain poorly understood, which hampers efforts to plan for comprehensive conservation.

Conservation planning process

DEWAP represents a major milestone in Delaware’s comprehensive planning for wildlife diversity. However, much work remains to refine this plan, and the state still lacks a coordinated, standardized process for strategic planning – prioritizing the conservation actions in DEWAP; “stepping down” the broader plan to species, habitat and managed area plans; and allocating staff, funding and other logistical resources to the highest priorities. This process is essential to ensure the long-term success of wildlife diversity conservation in Delaware.

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Education and Outreach

Training, education and outreach programs

Division program topics are currently limited in scope and audiences targeted, including hunter education, boating safety, fishing programs and aquatic resource education. Although all of these programs are beneficial and necessary, additional training, education and outreach is needed for a broad audience of professionals (state and local governments, private business community), schools, and the general public on key habitat ecology, SGCN biology, and conservation issues and actions.

Nuisance Wildlife Management

Dedicated response staff

The Division does not currently have the capacity to respond to complaints about nuisance wildlife, real or perceived, by the public. As development continues to increase and loss of habitat displaces a variety of native wildlife, the general public is coming into closer proximity with injurious and injured wildlife as well as harmless wildlife in and around their homes, businesses and communities. A structured system for responding to the public's concerns can help identify and address issues related to SGCN and habitat as well as educate the public on how to co-exist with wildlife thus reducing some types of complaints over time.

5.2. Actions

Conservation Actions to address these issues can be grouped as follows (note that this grouping was used only for generating a list of actions, not for the format of the Plan, which is organized according to issues rather than actions):

- Land and Water Protection
 - Publicly-Owned Protected Areas
 - Privately-Owned Protected Areas
 - Easements
- Land, Water and Species Management
 - Protected Area Management
 - Compatible Resource Use
 - Invasive Species Control and Prevention
 - Habitat Restoration
 - Natural Processes Restoration
 - Species Restoration
 - Ex-Situ Conservation
- Law and Policy
 - Legislation
 - Regulations, Policies and Procedures
 - Natural Resource Management Planning
 - Land Use Planning and Zoning
 - Standards
 - Compliance and Enforcement
- Research and Monitoring
 - Research
 - Monitoring
- Education and Outreach

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- Formal Education
- Training, Workshops, Learning Networks, etc.
- Lifelong Learning
- Awareness Raising and Communications
- Moral Confrontation
- Economic and Other Incentives
 - Linked Enterprises
 - Substitution
 - Market Forces
 - Conservation Payments
 - Non-Monetary Values
- Capacity Building
 - Institutional Development
 - Alliance Development
 - Conservation Finance

Because specific Conservation Actions are self-explanatory, they are not described here. They can be found with their corresponding issues in Section 6.

SECTION 6

Conservation Issues and Actions

6. Conservation Issues and Actions

Some Conservation Issues impact only one or a few key habitats, some impact a broad array of habitats, and a few are independent of habitat. In addition, there are other issues that affect key habitats or SGCN indirectly by impacting resource management capacity. This section examines Conservation Issues and Actions in those four groups: individual key habitats, multiple key habitats, habitat-independent, and institutional capacity.

6.1. Key Wildlife Habitats: Descriptions and Conservation Issues and Actions

For each key habitat, the following pages contain a brief Description, Vital Statistics, Present Condition, Habitats of Conservation Concern, Associated Species of Greatest Conservation Need, and Conservation Issues and Actions that are specific to only one or a few key habitats. Additional issues and actions that pertain to many key habitats are in Section 6.2.

Attributes of Habitats of Conservation Concern and SGCN are presented in Vital Statistics tables for each key habitat. In these tables, “Protected” is defined as GAP Stewardship Status 2 or 3, which are lands that are permanently protected from habitat conversion and managed to some extent to maintain a natural state. Section 3.2 discusses the basis for the species-habitat associations that are summarized under “SGCN Species associated with HCC” in the tables and listed in detail in Appendix C; these numbers include species with known occurrences. The number of associated species may be a more accurate representation of the importance of a habitat to SGCN than is the number of known species or occurrences, since the latter may reflect insufficient inventory. Also, the typically high percentage of known SGCN species and occurrences that are protected is a function of most inventories having been conducted on conservation lands, where landowner permission is not an issue.

See Section 4.2.2 for a description of Present Condition categories.

Assignment of Conservation Issues to individual Habitats of Conservation Concern was not practical because of insufficient knowledge of impacts at that level of detail. Instead, Habitats of Conservation Concern were rolled up into the next highest level of the Wildlife Habitat Classification, typically the “blue” level (Section 4.1), for consideration of issues.

More information about many of Delaware’s wildlife habitats and SGCN can be found in *The Natural Communities of Delaware* (from which the descriptions below were largely taken), which contains detailed characterizations of Habitats of Conservation Concern. Other sources include the Whole Basin Management reports and various Natural Heritage Program reports on state wildlife areas, parks, forests and natural communities.

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6.1.1. SGCN Occurrences

Issues and actions are not listed for SGCN Occurrences since these species are included under the appropriate habitats.

6.1.2. Beach and Dune Habitats

Description

These coastal habitats are adapted to the dynamic conditions of shifting sands, strong winds and salt spray unique to the narrow zone along the Atlantic Ocean and Delaware Bay. They range from the beach – covered and exposed by the twice-daily tides – to the first grassy dunes and overwashes, to a complex of shrub-dominated back dunes.

Vital Statistics

Beach and Dune Habitats		
Attribute	Total	Protected
HCC* Acreage	3,375	1,905 (56%)
HCC Occurrences	227	169 (74%)
Known SGCN Species / Occurrences in HCC	14 / 37	12 / 34 (86% / 92%)
SGCN Species associated with HCC	26	

*HCC = *Habitats of Conservation Concern*.

Present Condition

Fair. These habitats have declined significantly in extent and quality during historical times primarily because of residential development and associated infrastructure, particularly artificial shoreline hardening and jetties and groins. In recent decades, this decline has greatly slowed on the Atlantic Coast, where most remaining habitats are on public land. Losses continue, albeit more slowly, along the shorelines of the Delaware Bay and Inland Bays. All of these habitats are subjected to on-going impacts from recreational activities, and Delaware Bay beaches in particular are occasionally impacted by oil spills. The long term prospect for beaches and dunes is potentially poor given predicted sea level rise, even though these disturbance-dependent habitats might be expected to accommodate sea level rise reasonably well by migrating inland. However, onshore and offshore coastal processes that would facilitate such a shift, especially sand transport, may have already been irreversibly compromised by the issues noted above. Efforts to stabilize dunes may also further disrupt these processes in the future, despite their seeming benefits at present. Beach

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replenishment is a potential solution to the loss of natural sand transport, but costs are very high and nearshore habitats that serve as a sand source may be adversely impacted.

Habitats of Conservation Concern

- Unvegetated Sandy Beach
- Beach Foredune
- Overwash Dune Grassland
- Beachgrass – Panicgrass Dune Grassland
- Wax-myrtle - Groundsel-tree Maritime Shrubland
- Bayberry - Beach Plum Maritime Shrubland
- Greenbrier - Poison Ivy Dune Shrubland
- Beach Heather Dune Shrubland

Associated Species of Greatest Conservation Need

Beach and Dune Habitats			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Cicindela dorsalis media</i>	white tiger beetle
		<i>Cicindela lepida</i>	little white tiger beetle
	Reptiles	<i>Malaclemys terrapin terrapin</i>	Northern diamondback terrapin
	Birds	<i>Charadrius melodus</i>	pipin plover
		<i>Haematopus palliatus</i>	American oystercatcher
		<i>Arenaria interpres</i>	ruddy turnstone
		<i>Calidris canutus</i>	red knot
		<i>Calidris alba</i>	sanderling
		<i>Sterna hirundo</i>	common tern
		<i>Sterna antillarum</i>	least tern
		<i>Rynchops niger</i>	black skimmer
		<i>Chordeiles minor</i>	common nighthawk

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Beach and Dune Habitats		
Tier	Class	Scientific Name
2	Insects	<i>Cicindela dorsalis</i>
		Eastern beach tiger beetle
		<i>Cicindela hirticollis</i>
		beach-dune tiger beetle
		<i>Melittara prodenialis</i>
		a snout-moth
	Birds	<i>Drasteria graphica atlantica</i>
		Atlantic graphic moth
		<i>Schinia spinosae</i>
		a noctuid moth
		<i>Falco peregrinus</i>
		peregrine falcon
		<i>Pluvialis squatarola</i>
		black-bellied plover
		<i>Catoptrophorus semipalmatus</i>
		willet
		<i>Calidris pusilla</i>
		sempalmated sandpiper
		<i>Calidris maritima</i>
		purple sandpiper
		<i>Calidris alpina</i>
		dunlin
		<i>Larus marinus</i>
		great black-backed gull
		<i>Pipilo erythrophthalmus</i>
		Eastern towhee
		<i>Passerculus sandwichensis</i>
		savannah sparrow

Conservation Issues and Actions

Beach and Dune Habitats		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Piers and Docks	See Section 6.2.2
Shoreline Protection Practices	Loss of Natural Beach Dynamics from Jetties and Groins	Work with the Division of Soil and Water Conservation to assess and monitor the environmental and economic costs and benefits of individual jetties and groins, and remove those that are ineffective or obsolete.

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Beach and Dune Habitats		
Issue Category	Specific Issue	Specific Action
		Work with the Division of Soil and Water Conservation to identify new materials and methods that use jetties and groins to protect, create or restore key habitats.
		Work with the Division of Soil and Water Conservation to develop a source of funding for using beach renourishment to mitigate the impacts of jetties and groins on key habitats.
	Beach Renourishment	Work with the Division of Soil and Water Conservation to develop state policies for the timing of beach renourishment, and standards for composition and placement of materials, to minimize short-term impacts to nesting sites, roosts and other critical areas.
	Dune Construction/Stabilization	Work with the Division of Soil and Water Conservation to assess needs of beach-nesting birds for overwash habitat, and work with public and private landowners to adapt stabilization projects to allow for this need.
	Artificial Shoreline Hardening	Work with the Division of Soil and Water Conservation to develop education and outreach, incentives, partnerships and/or regulations as necessary to include private landowners in beach renourishment projects, in place of installing bulkheads and revetments, to minimize impacts to key habitats.
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Utility Corridors	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	White-tailed Deer	Work with hunters to increase deer harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase deer harvest as necessary to reduce impacts to key habitats.

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Beach and Dune Habitats		
Issue Category	Specific Issue	Specific Action
Solid Waste Disposal		Develop education and outreach encouraging landowners to increase deer harvest on private lands as necessary to reduce impacts to key habitats.
		Continue to evaluate Quality Deer Management as a long-term strategy for minimizing impacts to key habitats.
	Invasive Plants	See Section 6.2.6
	Beach Cleanup Activities (raking, events)	Schedule beach cleanup events to avoid nesting periods, peak migration and other critical times for SGCN.
		Develop education and outreach for beach cleanup participants about minimizing impacts to SGCN.
		Develop state policies for beach raking on state lands to modify or suspend activities during nesting periods, peak migration and other critical times for SGCN.
Climate Change	Sea Level Rise	Encourage municipalities to modify or suspend beach raking during nesting periods, peak migration and other critical times for SGCN.
Recreational Activities	Recreational Use On Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See Section 6.2.7
Airport Operations	Overflights	See Section 0
Resource Management	Habitat/Wildlife Management	Continue/expand studies of disturbance of SGCN from overflights, and work with Dover Air Force Base to mitigate disturbance.
		Implement the Piping Plover Recovery Plan.
		See Section 0 for more actions.

6.1.3. Early Successional Upland Habitats

Description

Early successional upland habitats typically result from the abandonment of agricultural fields, pastures or other cleared land. Over several decades, pioneering grasses and forbs gradually give way to shrubs and tree seedlings. If left alone, these habitats will

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eventually succeed into forests. Some areas, usually on state or NGO conservation lands, are managed to maintain this habitat by means of periodic mowing, grazing or burning. Mapping of many Early Successional Upland Habitats was accomplished through habitat modeling based on species-habitat associations, and these sites require field verification.

Vital Statistics

Early Successional Upland Habitats			
Attribute	Total	Protected	
HCC* Acreage	25,198	7,755 (31%)	
HCC Occurrences	1,486	714 (48%)	
Known SGCN Species / Occurrences in HCC	20 / 24	14 / 15 (70% / 63%)	
Associated SGCN Species	48		

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Fallow agricultural fields and weedy field borders were once a fairly common site in Delaware, yet they have dwindled in recent decades with more intensive farming practices as well as from natural succession on abandoned agricultural lands. Incentive programs to reduce tillage are on the rise, but their effect so far has been modest. Also, the relentless conversion of farms to residential development threatens the long-term effectiveness of these efforts. There are numerous small occurrences of this habitat on roadsides, utility corridors and the like, although maintenance regimes on these areas may compromise their ecological value. Several public agencies and private conservation organizations are actively managing for early successional habitat, but whether or not this will ensure sufficient extent and distribution is uncertain. In addition, perpetual management is required to thwart natural succession, and costs for controlling invasive exotic plants may be especially high.

Habitats of Conservation Concern

- Herbaceous Early Successional Upland Habitats
- Shrub/Brush Early Successional Upland Habitats

Associated Species of Greatest Conservation Need

Early Successional Upland Habitats			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Nicrophorus americanus</i>	American burying beetle

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Early Successional Upland Habitats			
Tier	Class	Scientific Name	Common Name
		<i>Callophrys irus</i>	frosted elfin
		<i>Papaipema maritima</i>	maritime sunflower borer moth
	Reptiles	<i>Terrapene carolina</i>	Eastern box turtle
		<i>Lampropeltis triangulum</i>	milk snake
	Birds	<i>Branta canadensis</i>	Canada goose (migratory)
		<i>Circus cyaneus</i>	Northern harrier
		<i>Bartamia longicauda</i>	upland sandpiper
		<i>Scolopax minor</i>	American woodcock
		<i>Asio flammeus</i>	short-eared owl
		<i>Chordeiles minor</i>	common nighthawk
		<i>Lanius ludovicianus</i>	loggerhead shrike
		<i>Dendroica discolor</i>	prairie warbler
		<i>Ammodramus henslowii</i>	Henslow's sparrow
		<i>Cicindela scutellaris</i>	festive tiger beetle
		<i>Atrytonopsis hianna</i>	dusted skipper
		<i>Satyrrium liparops</i>	striped hairstreak
2	Insects	<i>Satyrrium liparops strigosum</i>	striped hairstreak
		<i>Callophrys gryneus</i>	juniper hairstreak
		<i>Speyeria aphrodite</i>	aphrodite fritillary
		<i>Speyeria idalia</i>	regal fritillary
		<i>Boloria bellona</i>	meadow fritillary
		<i>Paratrea plebeja</i>	trumpet vine sphinx
		<i>Calyptra canadensis</i>	Canadian owlet

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Early Successional Upland Habitats			
Tier	Class	Scientific Name	Common Name
		<i>Acronicta rubricoma</i>	a dagger moth
		<i>Papaipema rigida</i>	rigid sunflower borer moth
		<i>Cirrhophanus triangulifer</i>	a noctuid moth
		<i>Schinia septentrionalis</i>	a noctuid moth
	Birds	<i>Plegadis falcinellus</i>	glossy ibis
		<i>Cygnus columbianus</i>	tundra swan
		<i>Coragyps atratus</i>	black vulture
		<i>Colinus virginianus</i>	Northern bobwhite
		<i>Pluvialis squatarola</i>	black-bellied plover
		<i>Coccyzus erythrophthalmus</i>	black-billed cuckoo
		<i>Chaetura pelagica</i>	chimney swift
		<i>Colaptes auratus</i>	Northern flicker
		<i>Empidonax minimus</i>	least flycatcher
		<i>Tyrannus tyrannus</i>	Eastern kingbird
		<i>Toxostoma rufum</i>	brown thrasher
		<i>Dendroica pensylvanica</i>	chestnut-sided warbler
		<i>Icteria virens</i>	yellow-breasted chat
		<i>Pipilo erythrophthalmus</i>	Eastern towhee
		<i>Spizella pusilla</i>	field sparrow
		<i>Poocetes gramineus</i>	vesper sparrow
		<i>Passerculus sandwichensis</i>	savannah sparrow
		<i>Ammodramus savannarum</i>	grasshopper sparrow
		<i>Dolichonyx oryzivorus</i>	bobolink

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Early Successional Upland Habitats		
Tier	Class	Scientific Name
	Mammals	<i>Cryptotis parva</i>
		least shrew

Conservation Issues and Actions

Early Successional Upland Habitats		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
	Agricultural Harvesting Practices	Work with the Delaware Department of Agriculture and the agricultural community to provide incentives for private landowners to modify harvest methods and timing to minimize impacts to SGCN.
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1
	Air Pollution	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Utility Corridors	See Section 6.2.1
	Dredge Spoil Disposal	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Solid Waste Disposal	Landfill Facilities	See Section 6.2.1
Changes in Fire Regimes	Fire Suppression	Integrate prescribed burning into management of early successional habitats as appropriate.
		Provide staff training on prescribed burning practices for early successional habitats.
		Evaluate the need for an inter-agency "burn team" to leverage resources and expertise.

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Early Successional Upland Habitats		
Issue Category	Specific Issue	Specific Action
		Develop education and outreach for landowners adjacent to areas targeted for burning.
		Provide incentives and/or technical support for private landowners to conduct prescribed burns of early successional habitats.
	Firefighting Practices	Work with the Delaware State Fire School to integrate conservation of key habitats and SGCN into practices for fighting wildfires.
Energy Production	Wind Farm Facilities	Work with energy companies to develop standards for the location of wind farms to minimize loss and fragmentation of key habitats.
Recreational Activities	Off-Road Vehicles	See <i>Section 0</i>
Airport Operations	Bird Strike Hazard Management	Work with airports to integrate early successional habitat into bird strike management.
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.
Resource Management	Habitat/Wildlife Management	See <i>Section 0</i>

6.1.4. Coastal Plain Upland Forests

Description

Found on dry or moist, but not wet, soils, Coastal Plain upland forests vary from mixed deciduous types – mostly oaks and hickories – in central Delaware, to pure stands of loblolly pine in the south. Likewise, vegetation on the forest floor may range from sparse heaths on dry sites to impenetrable thickets of sweet pepperbush in moist areas. Mapping of many Ancient Sand Ridge Forests was accomplished through habitat modeling based on topography, and these sites require field verification.

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Vital Statistics

Coastal Plain Upland Forests		
Attribute	Total	Protected
HCC* Acreage	3,462	476 (14%)
HCC Occurrences	709	105 (15%)
Known SGCN Species / Occurrences in HCC	5 / 6	4 / 5 (80% / 83%)
SGCN Species associated with HCC	48	

*HCC = Habitats of Conservation Concern.

Present Condition

Poor. Although data is not available for specific forest types, Coastal Plain Upland Forests are believed to have followed the trend of all upland forest types in Delaware, that of a long-term severe decline that continues to this day. See the discussion of Present Condition under Forest Blocks (Section 6.1.19) for more information. Compared to some other key habitats, relatively little upland forest is protected by conservation ownership, and regulatory protection is weak. Reforestation is possible but labor-intensive and time-consuming, and requires a lengthy commitment to managing impacts from deer browse, invasive exotic plants and other issues. Also, most of the state's upland forest types benefit from periodic fires that maintain oak dominance, and use of prescribed fire becomes increasingly difficult with greater residential development.

Habitats of Conservation Concern

- Chestnut Oak – Hairgrass Forest
- Tuliptree Rich Wood (Coastal Plain variant)
- Ancient Sand Ridge Forest

Associated Species of Greatest Conservation Need

Coastal Plain Upland Forests			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Cicindela patruela consentanea</i>	Northern barrens tiger beetle
		<i>Callophrys irus</i>	frosted elfin
		<i>Catocala antinympha</i>	sweetfern underwing
	Reptiles	<i>Catocala lacrymosa</i>	tearful underwing
		<i>Terrapene carolina</i>	Eastern box turtle

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Coastal Plain Upland Forests			
Tier	Class	Scientific Name	Common Name
		<i>Eumeces laticeps</i>	broadhead skink
		<i>Cemophora coccinea</i>	scarlet snake
		<i>Elaphe guttata</i>	corn snake
		<i>Lampropeltis triangulum</i>	milk snake
	Birds	<i>Haliaeetus leucocephalus</i>	bald eagle
		<i>Accipiter cooperii</i>	Cooper's hawk
		<i>Buteo platypterus</i>	broad-winged hawk
		<i>Asio otus</i>	long-eared owl
		<i>Melanerpes erythrocephalus</i>	red-headed woodpecker
		<i>Certhia americana</i>	brown creeper
		<i>Hylocichla mustelina</i>	wood thrush
		<i>Wilsonia citrina</i>	hooded warbler
		<i>Sciurus niger cinereus</i>	Delmarva fox squirrel
2	Gastropods	<i>Discus catskillensis</i>	angular disc
	Insects	<i>Cicindela patruela</i>	Northern barrens tiger beetle
		<i>Cicindela unipunctata</i>	one-spotted tiger beetle
		<i>Photuris frontalis</i>	a firefly
		<i>Erynnis martialis</i>	mottled duskywing
		<i>Erynnis baptisiae</i>	wild indigo duskywing
		<i>Battus philenor</i>	pipevine swallowtail
		<i>Polygonia progne</i>	gray comma
		<i>Caripeta aretaria</i>	a geometer moth
		<i>Tolype notialis</i>	a lasiocampid moth
		<i>Hemileuca maia maia</i>	the buckmoth
		<i>Cisthene kentuckiensis</i>	Kentucky lichen moth
		<i>Cisthene tenuifascia</i>	a lichen moth
		<i>Grammia phyllira</i>	phyllira tiger moth
		<i>Zale metata</i>	a noctuid moth

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Coastal Plain Upland Forests			
Tier	Class	Scientific Name	Common Name
		<i>Catocala flebilis</i>	mournful underwing
		<i>Catocala residua</i>	residua underwing
		<i>Catocala cerogama</i>	yellow banded underwing
		<i>Acronicta exilis</i>	exiled dagger moth
		<i>Acronicta lithospila</i>	streaked dagger moth
		<i>Papaipema araliae</i>	aralia shoot borer moth
		<i>Papaipema baptisiae</i>	wild indigo borer moth
		<i>Lepipolys perscripta</i>	a noctuid moth
		<i>Scincella lateralis</i>	ground skink
Reptiles		<i>Heterodon platirhinos</i>	Eastern hognose snake
		<i>Lampropeltis getula</i>	common kingsnake
		<i>Storeria occipitomaculata</i>	redbelly snake
		<i>Virginia valeriae</i>	smooth earth snake
		<i>Agkistrodon contortrix</i>	copperhead
		<i>Coragyps atratus</i>	black vulture
Birds		<i>Strix varia</i>	barred owl
		<i>Caprimulgus vociferus</i>	whip-poor-will
		<i>Colaptes auratus</i>	Northern flicker
		<i>Myiarchus crinitus</i>	great crested flycatcher
		<i>Sitta pusilla</i>	brown-headed nuthatch
		<i>Vireo flavifrons</i>	yellow-throated vireo
		<i>Dendroica dominica</i>	yellow-throated warbler
		<i>Mniotilta varia</i>	black-and-white warbler
		<i>Seiurus motacilla</i>	Louisiana waterthrush
		<i>Oporornis formosus</i>	Kentucky warbler
		<i>Piranga olivacea</i>	scarlet tanager
		<i>Pipilo erythrophthalmus</i>	Eastern towhee
		<i>Icterus galbula</i>	Baltimore oriole

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Coastal Plain Upland Forests			
Tier	Class	Scientific Name	Common Name
	Mammals	<i>Lasionycteris noctivagans</i>	silver-haired bat
		<i>Lasiurus borealis</i>	Eastern red bat
		<i>Lasiurus cinereus</i>	hoary bat
		<i>Canis latrans</i>	coyote

Conservation Issues and Actions

Coastal Plain Upland Forests			
Issue Category	Specific Issue		Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures		Evaluate mechanisms for protecting key upland forest habitats on private property by means of education and outreach, partnerships, voluntary guidelines, incentives and/or regulation, as necessary.
Agricultural and Forestry Operations	Farmland		Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
			See <i>Section 6.2.1 for additional actions</i>
			Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
			Work with the Delaware Forest Service and the Landowner Incentives Program to develop incentives for forest owners that prepare management plans specifically promoting conservation of key habitats and SGCN.
			See <i>Section 6.2.1 for additional actions</i>
	Livestock Grazing		Work with the Delaware Department of Agriculture and the Landowner Incentives Program to provide incentives to private landowners to exclude livestock from key habitats.
	Clearcutting and Other Forestry Practices		Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.

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Coastal Plain Upland Forests		
Issue Category	Specific Issue	Specific Action
		Encourage the Delaware Department of Agriculture to revise the scoring system of the Agricultural Lands Preservation Act to give increased weight to conservation of key habitats and SGCN.
		See Section 6.2.3 for additional actions
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1 for additional actions
	Air Pollution	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Utility Corridors	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	White-Tailed Deer	Work with hunters to increase deer harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase deer harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase deer harvest on private lands as necessary to reduce impacts to key habitats.
		Continue to evaluate Quality Deer Management as a long-term strategy for minimizing impacts to key habitats.
		Support continued gypsy moth monitoring by the Delaware Department of Agriculture.
	Gypsy Moth	Work with the Delaware Department of Agriculture to provide incentives to landowners for gypsy moth control in key habitats on private lands.
		Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.

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Coastal Plain Upland Forests		
Issue Category	Specific Issue	Specific Action
	European Starling	Assess and monitor the effectiveness of nest boxes, snag creation and other practices to enhance the success of cavity-nesting SGCN.
	Invasive Earthworms	Assess the impacts of invasive earthworms on forests and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts as necessary.
	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Solid Waste Disposal	Landfill Facilities	See Section 6.2.1
Changes in Fire Regimes	Fire Suppression	Integrate prescribed burning into management of upland forests as appropriate.
		Provide staff training on prescribed burning practices for upland forests.
		Evaluate the need for an inter-agency "burn team" to leverage resources and expertise.
		Develop education and outreach for landowners adjacent to areas targeted for burning.
	Firefighting Practices	Provide incentives and/or technical support for private landowners to conduct prescribed burns of upland forests.
		Work with the Delaware State Fire School to integrate conservation of key habitats and SGCN into practices for fighting wildfires.
Climate Change	Sea Level Rise	See Section 6.2.7
Energy Production	Wind Farm Facilities	Work with energy companies to develop standards for the location of wind farms to minimize loss and fragmentation of key habitats.
Recreational Activities	Off-Road Vehicles	See Section 0
Wildlife Harvesting	Inappropriate Hunting and Fishing	Develop education and outreach for hunters about the Delmarva fox squirrel to minimize impacts from accidental killing.

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Coastal Plain Upland Forests		
Issue Category	Specific Issue	Specific Action
		Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.
Resource Management	Habitat/Wildlife Management	Implement the Delmarva Fox Squirrel Recovery Plan.
		See Section 0 for more actions.

6.1.5. Coastal Plain Forested Floodplains and Riparian Swamps

Description

These forests are found upstream of the head of tidal influence on seasonally inundated floodplains, and in floodplain depressions having saturated soils. Red maple is found throughout in association with several other canopy species, most notably bald cypress in certain types. The herbaceous layer is often very diverse.

Vital Statistics

Coastal Plain Forested Floodplains and Riparian Swamps		
Attribute	Total	Protected
HCC* Acreage	818	522 (64%)
HCC Occurrences	37	17 (46%)
Known SGCN Species / Occurrences in HCC	8 / 8	6 / 6 (75% / 75%)
SGCN Species associated with HCC	53	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Wetland forests have generally fared better than upland forests because they typically can not be developed and are difficult to log; still, many are cut in dry years (see the discussion of forest loss under the previous habitat). Also, substantially more of these

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forests are protected – either through conservation ownership or regulation – than are their upland counterparts, although many lack adequate buffers to prevent degradation from sediment and nutrient runoff. Nonetheless, forecasted sea level rise may greatly impact these habitats over the long run. Since clearing for agriculture and development has eliminated or substantially reduced buffers around many wetland forests, there is limited opportunity for upslope migration in the face of rising water levels.

Habitats of Conservation Concern

- Black Ash Seepage Swamp
- Baldcypress – Red Maple – Swamp Black Gum Swamp

Associated Species of Greatest Conservation Need

Coastal Plain Forested Floodplains and Riparian Swamps			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Satyrium kingi</i>	King's hairstreak
	Reptiles	<i>Clemmys guttata</i>	spotted turtle
		<i>Terrapene carolina</i>	Eastern box turtle
		<i>Nerodia erythrogaster</i>	plainbelly water snake
	Birds	<i>Nycticorax nycticorax</i>	black-crowned night-heron
		<i>Nyctanassa violacea</i>	yellow-crowned night-heron
		<i>Buteo platypterus</i>	broad-winged hawk
		<i>Melanerpes erythrocephalus</i>	red-headed woodpecker
		<i>Hylocichla mustelina</i>	wood thrush
		<i>Parula americana</i>	Northern parula
		<i>Setophaga ruticilla</i>	American redstart
		<i>Limnothlypis swainsonii</i>	Swainson's warbler
2	Insects	<i>Amblyscirtes aesculapius</i>	lace-winged roadside-skipper
		<i>Amblyscirtes carolina</i>	Carolina roadside-skipper
		<i>Libytheana carinenta</i>	American snout
		<i>Anacampodes pergracilis</i>	cypress looper
		<i>Chloropteryx tepperaria</i>	angle winged emerald moth
		<i>Manduca jasmineearum</i>	ash sphinx
		<i>Dolba hylaeus</i>	black alder or pawpaw sphinx

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Coastal Plain Forested Floodplains and Riparian Swamps			
Tier	Class	Scientific Name	Common Name
		<i>Haploa colona</i>	a tiger moth
		<i>Orgyia detrita</i>	a tussock moth
		<i>Catocala unijuga</i>	once-married underwing
		<i>Catocala praeclara</i>	praeclara underwing
		<i>Parapamea buffaloensis</i>	a borer moth
		<i>Papaipema stenocelis</i>	chain fern borer moth
		<i>Gomphaeschna antilope</i>	taper-tailed damer
		<i>Gomphaeschna furcillata</i>	harlequin darter
		<i>Sympetrum ambiguum</i>	blue-faced meadowhawk
		<i>Enallagma weewa</i>	blackwater bluet
Amphibians		<i>Hemidactylium scutatum</i>	four-toed salamander
		<i>Pseudotriton montanus montanus</i>	mud salamander
		<i>Hyla chrysoscelis</i>	Cope's gray treefrog
		<i>Rana virgatipes</i>	carpenter frog
Reptiles		<i>Opheodrys aestivus</i>	rough green snake
		<i>Thamnophis sauritus</i>	Eastern ribbon snake
		<i>Agkistrodon contortrix</i>	copperhead
		<i>Ardea herodias</i>	great blue heron
Birds		<i>Casmerodius albus</i>	great egret
		<i>Egretta thula</i>	snowy egret
		<i>Egretta caerulea</i>	little blue heron
		<i>Egretta tricolor</i>	tricolored heron
		<i>Bubulcus ibis</i>	cattle egret
		<i>Plegadis falcinellus</i>	glossy ibis
		<i>Buteo lineatus</i>	red-shouldered hawk
		<i>Strix varia</i>	barred owl
		<i>Vireo flavifrons</i>	yellow-throated vireo
		<i>Protonotaria citrea</i>	prothonotary warbler

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Coastal Plain Forested Floodplains and Riparian Swamps		
Tier	Class	Scientific Name
		<i>Helmitheros vermivorus</i>
		<i>Oporornis formosus</i>
		<i>Piranga olivacea</i>
		<i>Icterus galbula</i>
	Mammals	<i>Lasionycteris noctivagans</i>
		<i>Nycticeius humeralis</i>
		evening bat

Conservation Issues and Actions

Coastal Plain Forested Floodplains and Riparian Swamps		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Altered Hydrology	Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
	Nutrients and Sediments	See Section 6.2.2
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
	Livestock Grazing	Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
	Ditching and Draining	Work with the Delaware Department of Agriculture to provide incentives to private landowners to exclude livestock from key habitats.
	Altered Hydrology	Work with the Division of Soil and Water Conservation to provide incentives to tax ditch associations to implement BMPs that minimize impacts to key habitats.
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3

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Coastal Plain Forested Floodplains and Riparian Swamps		
Issue Category	Specific Issue	Specific Action
	Clearcutting and Other Forestry Practices	Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
		Encourage the Delaware Department of Agriculture to revise the scoring system of the Agricultural Lands Preservation Act to give increased weight to conservation of key habitats and SGCN.
		See Section 6.2.3 for additional actions
		See Section 6.2.1
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1
	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0
	Utility Corridors	See Section 6.2.1
	Dredge Spoil Disposal	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	White-Tailed Deer	Work with hunters to increase deer harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase deer harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase deer harvest on private lands as necessary to reduce impacts to key habitats.
		Continue to evaluate Quality Deer Management as a long-term strategy for minimizing impacts to key habitats.
	Gypsy Moth	Support continued gypsy moth monitoring by the Delaware Department of Agriculture.
		Work with the Delaware Department of Agriculture to provide incentives to landowners for gypsy moth control in key habitats on private lands.

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Coastal Plain Forested Floodplains and Riparian Swamps		
Issue Category	Specific Issue	Specific Action
	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
	European Starling	Assess and monitor the effectiveness of nest boxes, snag creation and other practices to enhance the success of cavity-nesting SGCN.
	Invasive Earthworms	Assess the impacts of invasive earthworms on forests and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts as necessary.
	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Water Use	Dam Operations	Work with the Division of Water Resources and water utilities to evaluate the application of "ecologically sustainable water management" practices to dam operations to minimize impacts to key habitats and SGCN.
Solid Waste Disposal	Landfill Facilities	See Section 6.2.1
Climate Change	Sea Level Rise	See Section 6.2.7
Wildlife Harvesting	Inappropriate Hunting and Fishing	Develop education and outreach for hunters about the Delmarva fox squirrel to minimize impacts from accidental killing.
		Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.

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Coastal Plain Forested Floodplains and Riparian Swamps		
Issue Category	Specific Issue	Specific Action
Resource Management	Habitat/Wildlife Management	Implement the Delmarva Fox Squirrel Recovery Plan. See Section 0 for more actions.

6.1.6. Atlantic White Cedar Non-tidal Wetlands

Description

Known only from southern Delaware, these wetlands are characterized by stands of Atlantic white cedar on poorly drained, mucky soils along slow-flowing streams. Numerous rare plant species, such as swamp pink, may be found in the herbaceous layer of some types.

Vital Statistics

Atlantic White Cedar Non-tidal Wetlands		
Attribute	Total	Protected
HCC* Acreage	4,272	2,246 (53%)
HCC Occurrences	121	60 (50%)
Known SGCN Species / Occurrences in HCC	17 / 26	10 / 12 (59% / 46%)
SGCN Species associated with HCC	13	

*HCC = *Habitats of Conservation Concern*.

Present Condition

Fair. Historically, these wetlands were much more extensive in the state, covering thousands of acres in the Great Cypress Swamp alone. Beginning more than 200 years ago, timber harvest and wetland draining for agriculture eliminated most of these swamps. With the near-cessation of Atlantic white cedar logging in the last century, this habitat is in relatively stable condition at present. However, natural regeneration of white cedar is often inhibited by competition from red maple, which is presently more common than in the past, probably due to fire suppression. Also, as with other forested wetlands discussed above, loss of buffers is resulting in some short term impacts from sediment and nutrient runoff, and will exacerbate long term impacts from sea level rise.

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Habitats of Conservation Concern

- Delmarva Atlantic White Cedar Swamp
- Atlantic White Cedar – Mixed Herb Bog
- Atlantic White Cedar Millpond Headwater Hummock and Peat Mat Woodland

Associated Species of Greatest Conservation Need

Atlantic White Cedar Non-tidal Wetlands			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Callophrys hesseli</i>	Hessel's hairstreak
		<i>Exyra fax</i>	pitcher plant moth
		<i>Papaipema appassionata</i>	pitcher plant borer moth
		<i>Manduca jasmineearum</i>	ash sphinx
2	Insects	<i>Dolba hylaeus</i>	black alder or pawpaw sphinx
		<i>Papaipema stenocelis</i>	chain fern borer moth
		<i>Xestia youngii</i>	Young blueberry dart
		<i>Gomphaeschna furcillata</i>	harlequin darter
		<i>Argia bipunctulata</i>	seepage dancer
		<i>Enallagma weewa</i>	blackwater bluet
		<i>Nehalennia gracilis</i>	sphagnum sprite
		<i>Hemidactylium scutatum</i>	four-toed salamander
	Amphibians	<i>Pseudotriton montanus montanus</i>	mud salamander

Conservation Issues and Actions

Pending further assessment of specific impacts, Conservation Issues and Actions for Atlantic White Cedar Non-tidal Wetlands are considered to be the same as those listed for Coastal Plain Forested Floodplains and Riparian Swamps above.

6.1.7. Coastal Plain Seasonal Ponds

Description

More than 1,000 of these small depressional wetlands, usually flooded by groundwater and precipitation in the winter and spring but dry in the summer and fall, are scattered throughout the state. They often occur in groups or complexes that may share a common

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groundwater source and among which pond-dwelling organisms freely travel. Although the ponds naturally occur imbedded in a forest matrix, they contain only herbaceous and shrub vegetation within their boundaries. They are important breeding locations – sometimes the only locations – for a number of frogs and salamanders that inhabit the surrounding forest. Also, over 30 rare plant species are found in these ponds, including five that are globally rare. Mapping of many Coastal Plain Seasonal Ponds was accomplished through habitat modeling based on aerial photograph interpretation, and these sites require field verification. Recent surveys of some sites have shown that the modeling incorrectly classified some depressional wetlands as Coastal Plain ponds, and failed to correctly identify other wetlands as ponds.

Vital Statistics

Coastal Plain Seasonal Ponds			
Attribute	Total	Protected	
HCC* Acreage	1,014	185 (18%)	
HCC Occurrences	1,591	303 (19%)	
Known SGCN Species / Occurrences in HCC	7 / 9	3 / 3 (43% / 33%)	
SGCN Species associated with HCC	28		

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. A recent status assessment of this habitat in the Blackbird-Millington corridor determined that many pond complexes in this area – which has the largest concentration of ponds in the state – are in relatively good condition, based on pond density and forest buffer. This is due, at least in part, to the protection of some ponds on state forest lands. However, hundreds of other ponds elsewhere are not in conservation ownership and have been significantly impacted by draining, tilling, loss of forest buffers and invasive plant species. A statewide analysis of Coastal Plain ponds found that about 25% of pond habitat is surrounded half or less by a forested buffer adequate for the conservation of typical pond-breeding salamanders; less than 20% is completely surrounded by such a buffer. Also, the effect on pond hydrology of groundwater withdrawals for drinking water and crop irrigation is uncertain, although there is substantial pumping for irrigation in the vicinity of many ponds. Even in locations where hydrology is intact, the need to conserve ponds in large complexes interconnected by extensive forests complicates protection efforts on both public and private property.

Habitats of Conservation Concern

- Buttonbush - Mannagrass - Smartweed Coastal Plain Seasonal Pond Vegetation
- Buttonbush - Warty Panicgrass - Eaton's Witchgrass Coastal Plain Pond Vegetation
- Walter's Sedge - Eaton's Witchgrass Coastal Plain Seasonal Pond Vegetation

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- Cape May - Delmarva Depression Meadow
- Three-way Sedge - Canada Rush Coastal Plain Seasonal Pond Vegetation
- Creeping Rush - Boltonia Coastal Plain Seasonal Pond Vegetation
- Maidencane Coastal Plain Seasonal Pond Vegetation
- Mixed Grass Depression Meadow
- Waterlily Deepwater Coastal Plain Seasonal Pond Vegetation

Associated Species of Greatest Conservation Need

Coastal Plain Seasonal Ponds			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Poanes massasoit</i>	mulberry wing
	Amphibians	<i>Ambystoma tigrinum tigrinum</i>	tiger salamander
		<i>Hyla gratiosa</i>	barking treefrog
	Reptiles	<i>Clemmys guttata</i>	spotted turtle
2	Insects	<i>Euphyes dion</i>	dion skipper
		<i>Aeshna tuberculifera</i>	black-tipped darner
		<i>Aeshna verticalis</i>	green-striped darner
		<i>Anax longipes</i>	comet darner
		<i>Gomphaeschna antilope</i>	taper-tailed darner
		<i>Tetragoneuria costalis</i>	stripe-winged baskettail
		<i>Celithemis verna</i>	double-ringed pennant
		<i>Leucorrhinia intacta</i>	dot-tailed whiteface
		<i>Libellula axilena</i>	bar-winged skimmer
		<i>Libellula deplanata</i>	blue corporal
		<i>Sympetrum ambiguum</i>	blue-faced meadowhawk
		<i>Sympetrum semicinctum</i>	band-winged meadowhawk
		<i>Lestes eurinus</i>	amber-winged spreadwing
		<i>Enallagma dubium</i>	burgundy bluet
		<i>Enallagma durum</i>	big bluet
		<i>Enallagma pallidum</i>	pale bluet

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Coastal Plain Seasonal Ponds		
Tier	Class	Scientific Name
		<i>Enallagma vesperum</i>
		<i>Nehalennia irene</i>
		<i>Gomphus villosipes</i>
	Amphibians	<i>Ambystoma maculatum</i>
		<i>Hemidactylium scutatum</i>
		<i>Hyla chrysoscelis</i>
	Reptiles	<i>Scaphiopus holbrookii</i>
		<i>Thamnophis sauritus</i>
		Eastern ribbon snake

Conservation Issues and Actions

Coastal Plain Seasonal Ponds		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives to tax ditch associations to implement BMPs that minimize impacts to key habitats.
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
	Clearcutting and Other Forestry Practices	See Section 6.2.3
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1
	Air Pollution	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1

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Coastal Plain Seasonal Ponds		
Issue Category	Specific Issue	Specific Action
Invasive Species, Nuisance Animals and Wildlife Diseases	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
	Invasive Plants	Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
	Control of Invasive Plants	See Section 6.2.6
Water Use	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of "excellent groundwater recharge areas."
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See Section 0
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.8. Interdunal Wetlands

Description

These small wetlands are found only among maritime dunes along the Atlantic Coast. Despite their proximity to the ocean, their seasonal flooding is driven by groundwater and precipitation. As dynamic as many other beach and dune habitats, these swales are periodically created or destroyed by major storms. Some types have purely herbaceous vegetation, while others are dominated by shrubs. More than 20 types of rare plants are found in these wetlands.

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Vital Statistics

Interdunal Wetlands		
Attribute	Total	Protected
HCC* Acreage	72	61 (85%)
HCC Occurrences	81	73 (90%)
Known SGCN Species / Occurrences in HCC	1 / 2	1 / 1 (100% / 50%)
SGCN Species associated with HCC	2	

*HCC = Habitats of Conservation Concern.

Present Condition

Good. At present most of these habitats are relatively stable, and the great majority are protected on state parkland. Most of those not on state land have been degraded by loss of upland buffers, changes in hydrology and invasive plants, all of which result from encroaching residential development. Impacts from predicted sea level rise, made worse by disturbance of normal coastal processes, could be substantial. See the discussion of Condition under Beach and Dune Habitats for more information on these processes. Note that although interdunal wetlands are part of a very dynamic coastal ecosystem, their recovery from disturbance – including sea level rise – is believed to be fairly slow, given the need for a thin layer of peat to develop on the substrate.

Habitats of Conservation Concern

- Cranberry Interdunal Swale
- Twig Rush Interdunal Swale
- Round-head Rush - Common Threesquare Interdunal Swale

Associated Species of Greatest Conservation Need

Interdunal Wetlands		
Tier	Class	Scientific Name
1	Insects	<i>Photuris bethaniensis</i>
2	Insects	<i>Cicindela hirticollis</i>
		beach-dune tiger beetle

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Conservation Issues and Actions

Interdunal Wetlands		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Industrial Development and Operations	Air Pollution	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Water Use	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of "excellent groundwater recharge areas."
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.9. Piedmont Stream Valley Wetlands

Description

This is a somewhat artificial grouping of wetlands that is in need of further definition. Some types result from the emergence of groundwater on, or at the base of, forested slopes above streams, while others are in or adjacent to the stream channel where they are subject to occasional flooding. Vegetation is dominated by sedges and rushes in most types, although some support a variety of forbs.

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Vital Statistics

Piedmont Stream Valley Wetlands		
Attribute	Total	Protected
HCC* Acreage	104	56 (54%)
HCC Occurrences	85	39 (46%)
Known SGCN Species / Occurrences in HCC	8 / 8	8 / 8 (100% / 100%)
SGCN Species associated with HCC	18	

*HCC = Habitats of Conservation Concern.

Present Condition

Good. Most of these habitats occur on either steep slopes (seepage wetlands) or river floodplains (streamside wetlands) where they are generally immune from direct loss as a result of residential development or other habitat conversion. Impacts to seepage wetlands from groundwater withdrawal, to streamside wetlands from changes in flow regimes, and to both types from nutrient enrichment are of concern over the long term. A number of streamside wetlands are presently affected by invasive plants, which in some cases could accelerate eutrophication.

Habitats of Conservation Concern

- Piedmont Streamside Seepage Wetland
- Forested Seepage Slope Wetland
- Streamside Backwater Marsh
- Streamside Tussock Meadow
- Twisted Sedge Sand Bar

Associated Species of Greatest Conservation Need

Piedmont Stream Valley Wetlands			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Poanes massasoit</i>	mulberry wing
		<i>Euphyes conspicua</i>	black dash
		<i>Papaipema eupatorii</i>	eupatorium borer moth
2	Reptiles	<i>Glyptemys muhlenbergii</i>	bog turtle
	Insects	<i>Euphyes dion</i>	dion skipper

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Piedmont Stream Valley Wetlands				
Tier	Class	Scientific Name	Common Name	
		<i>Boloria selene</i>	silver-bordered fritillary	
		<i>Boloria selene myrina</i>	myrina fritillary	
		<i>Euphydryas phaeton</i>	Baltimore checkerspot	
		<i>Satyrodes eurydice</i>	eyed brown	
		<i>Acronicta connecta</i>	a noctuid moth	
		<i>Parapamea buffaloensis</i>	a borer moth	
		<i>Cordulegaster erronea</i>	tiger spiketail	
		<i>Cordulegaster bilineata</i>	brown spiketail	
		<i>Libellula flavida</i>	yellow-sided skimmer	
		<i>Sympetrum semicinctum</i>	band-winged meadowhawk	
		Amphibians		longtail salamander
		Reptiles	<i>Regina septemvittata</i>	queen snake
			<i>Thamnophis sauritus</i>	Eastern ribbon snake

Conservation Issues and Actions

Piedmont Stream Valley Wetlands		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0

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Piedmont Stream Valley Wetlands		
Issue Category	Specific Issue	Specific Action
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
	Dam Operations	Work with the Division of Water Resources and water utilities to evaluate the application of "ecologically sustainable water management" practices to dam operations to minimize impacts to key habitats and SGCN.
Water Use	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of "excellent groundwater recharge areas."
Resource Management	Habitat/Wildlife Management	Implement the Bog Turtle Recovery Plan.
		See Section 0 for more actions.

6.1.10. Peat Wetlands

Description

These herbaceous wetlands occur on deep, mucky peat that forms in open-water depressions, impoundments, and seeps within a shrub-dominated swamp matrix. They are found along only a few creeks in southern Delaware. Several rare plants occur here, including sundews and purple pitcher plant.

Vital Statistics

Peat Wetlands		
Attribute	Total	Protected
HCC* Acreage	41	10 (24%)
HCC Occurrences	8	5 (63%)
Known SGCN Species / Occurrences in HCC	1 / 1	0 / 0
SGCN Species associated with HCC	7	

*HCC = Habitats of Conservation Concern.

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Present Condition

Good. The lengthy process required to form the deep peat substrate of this habitat indicates a long absence of disturbance, a trend which will continue in the near future – given their location towards the interior of larger wetland complexes along streams, these habitats are well protected from direct loss due to habitat conversion. Common reed invasion has impacted some peat wetlands, and natural succession may ultimately replace these habitats with another type of community, although succession appears to proceed extremely slowly. The effect of sea level rise may be substantial, since the slow development of these wetlands may be overwhelmed by rising water levels.

Habitats of Conservation Concern

- Mixed Herb Deep Peat Wetland

Associated Species of Greatest Conservation Need

Peat Wetlands			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Exyra fax</i>	pitcher plant moth
		<i>Papaipema appassianata</i>	pitcher plant borer moth
2	Insects	<i>Papaipema stenocelis</i>	chain fern borer moth
		<i>Xestia youngii</i>	Young blueberry dart
		<i>Gomphaeschna antilope</i>	taper-tailed damer
		<i>Argia bipunctulata</i>	seepage dancer
		<i>Nehalennia gracilis</i>	sphagnum sprite

Conservation Issues and Actions

Peat Wetlands		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives to tax ditch associations to implement BMPs that minimize impacts to key habitats.

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Peat Wetlands		
Issue Category	Specific Issue	Specific Action
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
	Air Pollution	See Section 6.2.4
Industrial Development and Operations	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
	Transportation Infrastructure	See Section 6.2.1
Transportation and Utility Operations and Maintenance	Altered Hydrology	See Section 0
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.11. Riverine Aquatic and Submerged Vegetation

Description

These habitats are characterized by plants that are either entirely submerged or that float on the water surface in stream channels and backwaters. They are found throughout the Coastal Plain, most extensively in the Nanticoke watershed.

Vital Statistics

Riverine Aquatic and Submerged Vegetation		
Attribute	Total	Protected
HCC* Acreage	75	10 (13%)
HCC Occurrences	8	4 (50%)
Known SGCN Species / Occurrences in HCC	0 / 0	--
SGCN Species associated with HCC	1	

*HCC = Habitats of Conservation Concern.

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Present Condition

Poor. Even though substantial beds of aquatic vegetation remain in two river systems, this is thought to represent a significant loss within historic times from channelization, sedimentation, nutrient enrichment and stream flow changes. The current situation is no better, with gains in recent decades from point source water pollution controls probably offset by more intensive row crop farming and increased application of poultry wastes to agricultural fields in Coastal Plain sites. Non-point source pollution and changes in stream flows from expanding residential development are expected to further degrade and/or diminish these habitats in the future. See Section 6.1.16 for more information about the condition of non-tidal Coastal Plain streams.

Habitats of Conservation Concern

- Mixed Species Submergent Vegetation
- Submerged Tapegrass Community

Associated Species of Greatest Conservation Need

Riverine Aquatic and Submerged Vegetation			
Tier	Class	Scientific Name	Common Name
2	Insects	<i>Ischnura kellicotti</i>	lilypad forktail

Conservation Issues and Actions

Riverine Aquatic and Submerged Vegetation		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives for tax ditch associations to implement BMPs that minimize impacts to key habitats.
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4

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Riverine Aquatic and Submerged Vegetation		
Issue Category	Specific Issue	Specific Action
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0
	Channel Dredging	Work with the Division of Water Resources and the US Army Corps of Engineers to integrate key habitat and SGCN conservation into dredging plans.
Invasive Species, Nuisance Animals and Wildlife Diseases	Mute Swan	Continue implementation of the DFW mute swan management plan.
	Invasive Plants	See Section 6.2.6
Water Use	Dam Operations	Work with the Division of Water Resources and water utilities to evaluate the application of "ecologically sustainable water management" practices to dam operations to minimize impacts to key habitats and SGCN.
	Surface Water Withdrawals	Work with the Division of Water Resources to integrate key habitat and SGCN conservation into state water quality standards for low flows.
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See Section 0
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.12. Freshwater Tidal Forested and Scrub-Shrub Wetlands

Description

This group of wetlands ranges from thinly forested types to those dominated by small trees and shrubs. They are typically found at the head of tide or along the fringes of tidal creeks, where tidal flooding is irregular.

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Vital Statistics

Freshwater Tidal Forested and Scrub-Shrub Wetlands			
Attribute	Total	Protected	
HCC* Acreage	3,095	1,187 (38%)	
HCC Occurrences	501	117 (23%)	
Known SGCN Species / Occurrences in HCC	13 / 16	5 / 6 (38% / 38%)	
SGCN Species associated with HCC	4		

*HCC = *Habitats of Conservation Concern*.

Present Condition

Fair. Although seldom destroyed outright, these habitats have been somewhat impacted by ditching, dredging and channelization. They also have long been subject to incremental degradation arising from incompatible land use practices upslope, often magnified by the frequent loss of adjacent buffers. Where these buffers no longer exist, opportunities for migration inland in the face of sea level rise will be limited.

Habitats of Conservation Concern

- Atlantic White Cedar - Red Maple - Pumpkin Ash Freshwater Tidal Swamp
- Red Maple - Ash Tidal Swamp
- Smooth Alder - Silky Dogwood Shrub Swamp

Associated Species of Greatest Conservation Need

Freshwater Tidal Forested and Scrub-Shrub Wetlands			
Tier	Class	Scientific Name	Common Name
2	Insects	<i>Atlides halesus</i>	great purple hairstreak
		<i>Manduca jasmineearum</i>	ash sphinx
		<i>Acronicta connecta</i>	a noctuid moth
		<i>Papaipema stenocelis</i>	chain fern borer moth

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Conservation Issues and Actions

Freshwater Tidal Forested and Scrub-Shrub Wetlands		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
	Piers and Docks	See Section 6.2.2
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
	Clearcutting and Other Forestry Practices	See Section 6.2.3
Shoreline Protection Practices	Artificial Shoreline Hardening	Provide incentives for private landowners to restore wetlands, in place of installing bulkheads and revetments, to minimize impacts to key habitats.
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1
	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Utility Corridors	See Section 6.2.1
	Dredge Spoil Disposal	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
Solid Waste Disposal	Landfill Facilities	See Section 6.2.1
Climate Change	Sea Level Rise	See Section 6.2.7
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.13. Freshwater Tidal Marshes

Description

These are wetlands of the intertidal zone above the reach of saline waters, characterized by the complete absence of woody plants. Vegetation is sparse in some types (e.g. quillwort flat) but extremely dense in others (e.g. mixed broadleaf marsh). The mixed broadleaf marsh is found throughout the Coastal Plain, from the Christina to the Nanticoke, while the others have more restricted distributions.

Vital Statistics

Freshwater Tidal Marshes		
Attribute	Total	Protected
HCC* Acreage	5,976	2,933 (49%)
HCC Occurrences	325	89 (27%)
Known SGCN Species / Occurrences in HCC	24 / 25	12 / 12 (50% / 48%)
SGCN Species associated with HCC	24	

*HCC = *Habitats of Conservation Concern*.

Present Condition

Fair. As with the forested wetlands above, these marshes have suffered relatively little outright destruction from habitat conversion, but have been subjected to the same impacts from offsite sources. However, there has been substantial contraction of these marshes from saltwater intrusion, especially along streams draining into Delaware Bay. Some have also experienced invasion by common reed. Even though non-forested wetlands such as these might be expected to migrate landward with little trouble in response to rising sea levels, they may in fact be significantly reduced by the accompanying saltwater intrusion. In some areas, migration may also be impeded by dams or steep stream valley slopes.

Habitats of Conservation Concern

- Mixed Broadleaf Freshwater Tidal Marsh
- Sea Level Fen
- Freshwater Intertidal Quillwort Flat

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Associated Species of Greatest Conservation Need

Freshwater Tidal Marshes			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Poanes massasoit chermocki</i>	Chermock's mulberry wing
		<i>Nannothemis bella</i>	elfin skimmer
	Reptiles	<i>Clemmys guttata</i>	spotted turtle
	Birds	<i>Podilymbus podiceps</i>	pied-billed grebe
		<i>Nycticorax nycticorax</i>	black-crowned night-heron
		<i>Nyctanassa violacea</i>	yellow-crowned night-heron
		<i>Pandion haliaetus</i>	osprey
2	Insects	<i>Lycaena hyllus</i>	bronze copper
		<i>Papaipema birdi</i>	umbellifer borer moth
		<i>Libellula axilena</i>	bar-winged skimmer
		<i>Argia bipunctulata</i>	seepage dancer
		<i>Nehalennia gracilis</i>	sphagnum sprite
	Birds	<i>Botaurus lentiginosus</i>	American bittern
		<i>Ixobrychus exilis</i>	least bittern
		<i>Ardea herodias</i>	great blue heron
		<i>Casmerodius albus</i>	great egret
		<i>Egretta thula</i>	snowy egret
		<i>Egretta caerulea</i>	little blue heron
		<i>Egretta tricolor</i>	tricolored heron
		<i>Bubulcus ibis</i>	cattle egret
		<i>Anas platyrhynchos</i>	mallard
		<i>Rallus elegans</i>	king rail
		<i>Porzana carolina</i>	sora
		<i>Dolichonyx oryzivorus</i>	bobolink

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Conservation Issues and Actions

Freshwater Tidal Marshes		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
	Piers and Docks	See Section 6.2.2
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
	Clearcutting and Other Forestry Practices	See Section 6.2.3
Shoreline Protection Practices	Artificial Shoreline Hardening	Provide incentives for private landowners to restore wetlands, in place of installing bulkheads and revetments, to minimize impacts to key habitats.
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1
	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Dredge Spoil Disposal	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Solid Waste Disposal	Landfill Facilities	See Section 6.2.1
Climate Change	Sea Level Rise	See Section 6.2.7
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.14. Tidal High Marshes

Description

These are usually the more landward of the coastal salt marshes, occurring at a slightly higher elevation where they are subjected to a shorter period of tidal inundation. Most types consist almost entirely of grasses, sedges and rushes, but a few (e.g. bishop-weed marsh) are composed primarily of broadleaf plants. Mapping of many Spartina High Salt Marshes was accomplished through habitat modeling based on aerial photograph interpretation, and these sites require field verification.

Vital Statistics

Tidal High Marshes		
Attribute	Total	Protected
HCC* Acreage	8,087	5,740 (71%)
HCC Occurrences	277	140 (51%)
Known SGCN Species / Occurrences in HCC	5 / 5	5 / 5 (100% / 100%)
SGCN Species associated with HCC	26	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Even though the majority of these habitats are protected on state land, they have been subjected to a number of significant impacts in historic times, especially harvesting of “salt marsh hay,” conversion to impoundments and management for mosquito control. The first two have largely ceased, but mosquito control efforts continue today by use of Open Marsh Water Management (OMWM). Published reports indicate few effects from this management on an array of species and habitat measures. However, there was sufficient concern about OMWM impacts on black rail – a possible indicator species for Tidal High Marsh – to lead to a cessation of this practice in Maryland in the early 1990s. Circumstantial evidence from at least one site in Delaware supports this concern, and the issue warrants further study. The particular topographic setting of these marshes, adjacent to uplands, makes landward migration in the face of sea level rise highly problematic.

Habitats of Conservation Concern

- Spartina High Salt Marsh
- Bishop-weed – Mixed Species Brackish Marsh

Delaware Wildlife Action Plan

Associated Species of Greatest Conservation Need

Tidal High Marshes			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Problema bulenta</i>	rare skipper
	Birds	<i>Nycticorax nycticorax</i>	black-crowned night-heron
		<i>Nyctanassa violacea</i>	yellow-crowned night-heron
		<i>Anas rubripes</i>	American black duck
		<i>Circus cyaneus</i>	Northern harrier
		<i>Laterallus jamaicensis</i>	black rail
		<i>Asio flammeus</i>	short-eared owl
		<i>Cistothorus platensis</i>	sedge wren
		<i>Ammodramus caudacutus</i>	saltmarsh sharp-tailed sparrow
		<i>Ammodramus maritimus</i>	seaside sparrow
		<i>Melospiza georgiana nigrescens</i>	Coastal Plain swamp sparrow
2	Insects	<i>Pero zalissaria</i>	a geometer moth
		<i>Acontia delecta</i>	a noctuid moth
		<i>Papaipema birdi</i>	umbellifer borer moth
		<i>Brachymesia gravida</i>	four-spotted pennant
	Birds	<i>Botaurus lentiginosus</i>	American bittern
		<i>Ixobrychus exilis</i>	least bittern
		<i>Ardea herodias</i>	great blue heron
		<i>Casmerodius albus</i>	great egret
		<i>Egretta thula</i>	snowy egret
		<i>Egretta caerulea</i>	little blue heron
		<i>Egretta tricolor</i>	tricolored heron
		<i>Bubulcus ibis</i>	cattle egret
		<i>Porzana carolina</i>	sora
		<i>Fulica americana</i>	American coot
		<i>Tyto alba</i>	barn owl
		<i>Cistothorus palustris</i>	marsh wren

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Conservation Issues and Actions

Tidal High Marshes		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
	Piers and Docks	See Section 6.2.2
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
	Clearcutting and Other Forestry Practices	See Section 6.2.3
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1
	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Utility Corridors	See Section 6.2.1
	Dredge Spoil Disposal	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	Nutria	Assess the potential for impacts to key habitats, monitor populations, and develop adaptive management strategies if necessary.
	Snow Goose and Resident Canada Goose	Increase goose harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase goose harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase goose harvest on private lands as necessary to reduce impacts to key habitats.

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Tidal High Marshes		
Issue Category	Specific Issue	Specific Action
	Mute Swan	Continue implementation of the DFW mute swan management plan.
	Control of Mosquitoes and Forest Pests By Aerial Application	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
	Control of Mosquitoes with Open Marsh Water Management and Impoundment Management	Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
		Work with the Mosquito Control Section to assess and monitor the impacts of Open Marsh Water Management on key habitats and SGCN.
		Work with the Mosquito Control Section to adapt Open Marsh Water Management practices for conservation of key habitats and SGCN, as necessary.
Solid Waste Disposal	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
	Landfill Facilities	See Section 6.2.1
Climate Change	Sea Level Rise	See Section 6.2.7
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See Section 0
Airport Operations	Overflights	Continue/expand studies of disturbance of SGCN from overflights, and work with Dover Air Force Base to mitigate disturbance.
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.

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Tidal High Marshes		
Issue Category	Specific Issue	Specific Action
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.15. Tidal Low Marshes

Description

The more seaward of the coastal salt marshes, these habitats are flooded for longer periods of time during daily tidal cycles. Again, most types are dominated by grasses and grass-like plants, although mudflats may be largely devoid of vascular plants.

Vital Statistics

Tidal Low Marshes		
Attribute	Total	Protected
HCC* Acreage	48,533	28,956 (60%)
HCC Occurrences	904	386 (43%)
Known SGCN Species / Occurrences in HCC	31 / 55	24 / 31 (77% / 56%)
SGCN Species associated with HCC	42	

*HCC = *Habitats of Conservation Concern*.

Present Condition

Fair. Much of the vast acreage of spartina low marshes is in conservation ownership, and that which is not enjoys substantial protection from state regulation of tidal wetlands. Nonetheless, this habitat was significantly altered through ditching, draining, dredging and filling until just a few decades ago. Extensive portions of spartina low marsh have been invaded by monotypic stands of common reed, and control efforts have been limited both in scope and duration. Also, “eat outs” from burgeoning snow goose populations have substantially degraded some low marshes in the last 20 years. Intertidal flats face threats from sea level rise, rapping, bulk heading and associated development issues. Low marsh should be capable of migrating landward in response to sea level rise – in part at the expense of Tidal High Marshes – although many marshes lack sufficient buffers to accommodate this shift.

Habitats of Conservation Concern

- Spartina Low Salt Marsh
- Unvegetated Intertidal Mudflat

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Associated Species of Greatest Conservation Need

Tidal Low Marshes			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Problema bulenta</i>	rare skipper
	Reptiles	<i>Malaclemys terrapin terrapin</i>	Northern diamondback terrapin
	Birds	<i>Podilymbus podiceps</i>	pied-billed grebe
		<i>Nycticorax nycticorax</i>	black-crowned night-heron
		<i>Nyctanassa violacea</i>	yellow-crowned night-heron
		<i>Branta canadensis</i>	Canada goose (migratory)
		<i>Anas rubripes</i>	American black duck
		<i>Circus cyaneus</i>	Northern harrier
		<i>Arenaria interpres</i>	ruddy turnstone
		<i>Calidris canutus</i>	red knot
		<i>Sterna hirundo</i>	common tern
		<i>Sterna forsteri</i>	Forster's tern
		<i>Rynchops niger</i>	black skimmer
		<i>Asio flammeus</i>	short-eared owl
		<i>Ammodramus caudacutus</i>	saltmarsh sharp-tailed sparrow
		<i>Ammodramus maritimus</i>	seaside sparrow
2	Insects	<i>Cicindela marginata</i>	marginated tiger beetle
		<i>Pero zalissaria</i>	a geometer moth
		<i>Acontia delecta</i>	a noctuid moth
		<i>Brachymesia gravida</i>	four-spotted pennant
	Birds	<i>Pelecanus occidentalis</i>	brown pelican
		<i>Phalacrocorax carbo</i>	great cormorant
		<i>Phalacrocorax auritus</i>	double-crested cormorant
		<i>Ardea herodias</i>	great blue heron
		<i>Casmerodius albus</i>	great egret
		<i>Egretta thula</i>	snowy egret
		<i>Egretta caerulea</i>	little blue heron

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Tidal Low Marshes		
Tier	Class	Scientific Name
		<i>Egretta tricolor</i>
		<i>Bubulcus ibis</i>
		<i>Plegadis falcinellus</i>
		<i>Anas platyrhynchos</i>
		<i>Falco peregrinus</i>
		<i>Rallus elegans</i>
		<i>Fulica americana</i>
		<i>Pluvialis squatarola</i>
		<i>Himantopus mexicanus</i>
		<i>Catoptrophorus semipalmatus</i>
		<i>Calidris pusilla</i>
		<i>Calidris alpina</i>
		<i>Sterna nilotica</i>
		<i>Tyto alba</i>
		<i>Cistothorus palustris</i>
		Common Name
		tricolored heron
		cattle egret
		glossy ibis
		mallard
		peregrine falcon
		king rail
		American coot
		black-bellied plover
		black-necked stilt
		willet
		semipalmated sandpiper
		dunlin
		gull-billed tern
		barn owl
		marsh wren

Conservation Issues and Actions

Tidal Low Marshes		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
	Piers and Docks	See Section 6.2.2
Agricultural and Forestry Operations	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Shoreline Protection Practices	Artificial Shoreline Hardening	Provide incentives for private landowners to restore wetlands, in place of installing bulkheads and revetments, to minimize impacts to key habitats.

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Tidal Low Marshes		
Issue Category	Specific Issue	Specific Action
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Utility Corridors	See Section 6.2.1
	Commercial Ships and Boats	Develop education and outreach for ship and boat operators about the impacts of wakes on shorelines.
	Dredge Spoil Disposal	Post and enforce "no wake" zones to protect key habitats. See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	Nutria	Assess the potential for impacts to key habitats, monitor populations, and develop adaptive management strategies if necessary.
	Snow Goose and Resident Canada Goose	Work with hunters to increase goose harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase goose harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase goose harvest on private lands as necessary to reduce impacts to key habitats.
	Mute Swan	Continue implementation of the DFW mute swan management plan.
	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
	Invasive Plants	See Section 6.2.6

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Tidal Low Marshes		
Issue Category	Specific Issue	Specific Action
	Control of Invasive Plants	See Section 6.2.6
Climate Change	Sea Level Rise	See Section 6.2.7
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See Section 0
Airport Operations	Overflights	Continue/expand studies of disturbance of SGCN from overflights, and work with Dover Air Force Base to mitigate disturbance.
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.16. Non-tidal Coastal Plain Streams

Description

These are the upper reaches of streams that originate in the Coastal Plain. Most drain to the Delaware River or Bay, but some head west towards the Chesapeake Bay. Generally, stream gradients are low, current velocity is slow and substrate consists of sand and silt. Many of these streams have been ditched in order to lower water tables in adjacent areas for agriculture.

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Vital Statistics

Non-tidal Coastal Plain Streams		
Attribute	Total	Protected
HCC* Acreage	8,915	778 (9%)
HCC Occurrences	362	90 (25%)
Known SGCN Species / Occurrences in HCC	12 / 12	4 / 4 (100% / 100%)
SGCN Species associated with habitat***	54	

*HCC = Habitats of Conservation Concern.

Present Condition

Poor. The condition of non-tidal Coastal Plain streams is believed to mirror the overall condition of streams in the state as described in DNREC's bi-annual water quality assessment reports to EPA. These reports show significant improvements in water quality from the late-1970s to the mid-1990s as a result of control of point source pollution discharges. However, in the last decade water quality has decreased slightly, and as of 2004, 65% of state streams still did not fully meet criteria for fish and wildlife habitat. Most current problems stem from non-point source pollution such as nutrients from agricultural fields and septic systems; hydrocarbon pollutants from streets and parking lots; and sediment from land that has been cleared for development. The hydrology of many streams has also been impacted by the increase in impervious surfaces that accompanies residential and commercial development, such that base flows have decreased and storm flows have increased. Recent surveys of fish and mussel communities in non-tidal streams provide further indication of the condition of these habitats – species abundance was skewed toward types that are more tolerant of degraded habitat. Although water quality issues are being actively addressed, the tremendous rate of land development in Delaware will make long term improvements in stream habitat condition difficult to obtain.

Habitats of Conservation Concern

- None described at this time.

Associated Species of Greatest Conservation Need

Non-tidal Coastal Plain Streams		
Tier	Class	Scientific Name
1	Bivalves	<i>Alasmidonta heterodon</i>
		<i>Alasmidonta undulata</i>
		<i>Lampsilis cariosa</i>
		Common Name
		dwarf wedgemussel
		triangle floater
		yellow lampmussel

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Non-tidal Coastal Plain Streams			
Tier	Class	Scientific Name	Common Name
2		<i>Lampsilis radiata</i>	Eastern lampmussel
		<i>Leptodea ochracea</i>	tidewater mucket
		<i>Ligumia nasuta</i>	Eastern pondmussel
		<i>Gomphus fraternus</i>	midland clubtail
	Insects	<i>Cottus caeruleomentum</i>	Blueridge sculpin
		<i>Acipenser brevirostrum</i>	shortnose sturgeon
		<i>Acipenser oxyrinchus</i>	Atlantic sturgeon
		<i>Notropis bifrenatus</i>	bridle shiner
	Fishes	<i>Notropis chalybaeus</i>	ironcolor shiner
		<i>Moxostoma macrolepidotum</i>	shorthead redhorse
		<i>Ictalurus natalis</i>	yellow bullhead
		<i>Acantharchus pomotis</i>	mud sunfish
		<i>Percina peltata</i>	shield darter
		<i>Actitis macularia</i>	spotted sandpiper
	Birds		
	Bivalves	<i>Anodonta implanata</i>	alewife floater
		<i>Elliptio fisheriana</i>	Northern lance
		<i>Strophitus undulatus</i>	creeper
		<i>Photuris pensylvanica</i>	a firefly
	Insects	<i>Photuris hebes</i>	a firefly
		<i>Cordulegaster bilineata</i>	brown spiketail
		<i>Dromogomphus spinosus</i>	black-shouldered spinyleg
		<i>Gomphus rogersi</i>	sable clubtail
		<i>Gomphus apomyius</i>	banner clubtail
		<i>Macromia taeniolata</i>	royal river cruiser
		<i>Tetragoneuria costalis</i>	stripe-winged baskettail
		<i>Helocordulia selysii</i>	Selys' sundragon
		<i>Somatochlora filosa</i>	fine-lined emerald

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Non-tidal Coastal Plain Streams			
Tier	Class	Scientific Name	Common Name
		<i>Somatochlora provocans</i>	treetop emerald
		<i>Celithemis ornata</i>	faded pennant
		<i>Enallagma dubium</i>	burgundy bluet
		<i>Enallagma durum</i>	big bluet
		<i>Enallagma pallidum</i>	pale bluet
		<i>Enallagma weewa</i>	blackwater bluet
		<i>Nehalennia integricollis</i>	Southern sprite
		<i>Archilestes grandis</i>	great spreadingwing
		<i>Gomphus plagiatus</i>	russet-tipped clubtail
		<i>Gomphus villosipes</i>	unicorn clubtail
	Fishes	<i>Lampetra aepyptera</i>	least brook lamprey
		<i>Lampetra appendix</i>	American brook lamprey
		<i>Anguilla rostrata</i>	American eel
		<i>Alosa mediocris</i>	hickory shad
		<i>Notropis amoenus</i>	comely shiner
		<i>Noturus insignis</i>	marginated madtom
		<i>Apeltes quadracus</i>	fourspine stickleback
		<i>Enneacanthus chaetodon</i>	blackbanded sunfish
		<i>Enneacanthus obesus</i>	banded sunfish
		<i>Etheostoma vitreum</i>	glassy darter
		<i>Pseudemys rubriventris</i>	redbelly turtle
		<i>Regina septemvittata</i>	queen snake
	Reptiles		
	Birds	<i>Anas platyrhynchos</i>	mallard
		<i>Lophodytes cucullatus</i>	hooded merganser

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Conservation Issues and Actions

Non-tidal Coastal Plain Streams		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives for tax ditch associations to implement BMPs that minimize impacts to key habitats.
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Shoreline Protection Practices	Artificial Shoreline Hardening	Provide incentives for private landowners to restore stream banks, in place of installing bulkheads and revetments, to minimize impacts to key habitats.
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Impingement / Entrapment / Entrainment at Water Intakes	Work with utilities and industry to assess impacts to SGCN from impingement / entrapment / entrainment, and adapt the design and operation of water intakes as necessary for SGCN conservation.
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0
	Road Salt	Work with the Delaware Department of Transportation to assess and monitor impacts to SGCN from road salt, adapt salt application practices as practicable for SGCN conservation, and evaluate alternatives to salt use as necessary.

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Non-tidal Coastal Plain Streams		
Issue Category	Specific Issue	Specific Action
Invasive Species, Nuisance Animals and Wildlife Diseases	Commercial Ships and Boats	Assess impacts to SGCN from collisions and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts as necessary.
		Work with the shipping and commercial fishing industries to develop education and outreach for boat operators about minimizing impacts to key habitats and SGCN.
		Post and enforce "no wake" zones to protect key habitats and SGCN.
	Channel Dredging	Work with the Division of Water Resources and US Army Corps of Engineers to integrate key habitat and SGCN conservation into dredging plans.
	Snow Goose and Resident Canada Goose	Increase goose harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase goose harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase goose harvest on private lands as necessary to reduce impacts to key habitats.
	Asiatic Clam	Assess the impacts of clams on SGCN and use this assessment and long-term monitoring to guide adaptive management, education and outreach efforts as necessary.
		Develop education and outreach for boaters, like the "Stop Aquatic Hitchhikers" campaign of the Aquatic Nuisance Species Task Force, to minimize the spread of clams.
	Invasive Plants	See <i>Section 6.2.6</i>
Water Use	Dams	Work with utilities to assess the impacts of dams and other barriers on fragmentation of key habitats, and use this assessment and long-term monitoring to guide adaptive management, including barrier removal and installation of passage structures as necessary.

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Non-tidal Coastal Plain Streams		
Issue Category	Specific Issue	Specific Action
	Dam Operations	Work with the Division of Water Resources and water utilities to evaluate the application of "ecologically sustainable water management" practices to dam operations to minimize impacts to key habitats and SGCN.
	Dam Removal	Assess the impacts of dam removal on key habitats and SGCN, and use this assessment and long-term monitoring to guide adaptive management, including control of sediments and associated toxins as necessary.
	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat and SGCN conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of "excellent groundwater recharge areas."
	Surface Water Withdrawals	Work with the Division of Water Resources to integrate key habitat and SGCN conservation into state water quality standards for low flows.
		Work with the Division of Water Resources to integrate key habitat and SGCN conservation into long-range water supply planning.
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See <i>Section 0</i>
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing recreational and commercial fishing regulations.
		Integrate SGCN conservation into fishing regulations.
		Incorporate information about SGCN conservation into the Fishing Guide.
		Maintain compliance with interstate management agreements.
Resource Management	Habitat/Wildlife Management	See <i>Section 0</i>

6.1.17. Nearshore Habitats

Description

Nearshore habitats consist of open water and benthic features in the Delaware Bay, the Inland Bays, and the Atlantic Ocean out to a distance of three miles from the coast. Though the typical nearshore habitat is a rather featureless area of sand and mud, there are also many smaller areas of diverse nearshore marine habitats such as oyster beds, *Sabellaria* (tubeworm) reefs, sulfur sponge reefs, mussel beds, shoal and flat areas, and artificial reefs. The shell habitat that oyster beds provide is being augmented and expanded through the placement of surf clam shell. As one of the estuary’s most common invertebrates, the tubes created by *Sabellaria* provide important reef habitat in the bay. *Sabellaria* beds are currently being identified and delineated in the Delaware Estuary. Large areas of sulfur sponge in the lower bay provide an important habitat for numerous species. Blue mussel beds also provide valuable nearshore habitat, though they tend to be ephemeral in the estuary and are probably limited by high summer water temperatures. Sand/mud shoal areas are common in the estuary. Artificial reefs, primarily in the form of concrete structures, have become a prominent nearshore habitat in recent years. Currently, eight sites in the estuary have been approved for the placement of artificial reef materials which are closely monitored. Because nearshore habitat classification is poorly defined, these habitats have not been mapped.

Vital Statistics

Nearshore Habitats		
Attribute	Total	Protected
HCC* Acreage	not mapped	not mapped
HCC Occurrences	not mapped	not mapped
Known SGCN Species / Occurrences in HCC	not mapped	not mapped
SGCN Species associated with HCC	35	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair – Good. Generally, nearshore habitat in the Delaware Estuary has experienced an improvement since the 1930’s and 40’s when pollution blocks degraded habitat, particularly in the upper estuary. Oyster beds serve as an important habitat type which suffered a drastic decline in the 1950’s due to overfishing and disease (MSX). The current status of the oyster population is low but relatively stable and is sufficient to support a limited commercial fishery. Though several areas in the estuary were previously identified as important for *Sabellaria* and associated wildlife, only minimal protection has been offered (e.g. limiting suction dredging for beach nourishment projects) and little information is available on their long-term abundance/distribution. Whereas areas of heavy *Sabellaria* concentrations tend to be avoided by the commercial dredge fisheries, sulfur sponge beds are sometimes targeted by the commercial

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blue crab dredge fishery, which may pose a threat to this habitat. Sand/mud shoals are disturbed by scallop and toothbar dredge activity associated with the commercial fisheries. The extent of the impact is not well known, but it has been suggested that disturbance is spatially patchy. Threatening all of these habitats is the fact that the estuary is one of the nation's largest petrochemical centers, and spills are an ever-present danger. In addition, invasive species are a continued concern.

Habitats of Conservation Concern

- Open Water
- Oyster Reef
- Tubeworm Reef
- Clam Bed
- Mussel Bed
- Sand Bar/Sand Flat

Associated Species of Greatest Conservation Need

Nearshore Habitats			
Tier	Class	Scientific Name	Common Name
1	Crustaceans	<i>Callinectes sapidus</i>	blue crab
	Arachnids	<i>Limulus polyphemus</i>	horseshoe crab
	Fishes	<i>Pristis pectinata</i>	smalltooth sawfish
		<i>Acipenser brevirostrum</i>	shortnose sturgeon
		<i>Acipenser oxyrinchus</i>	Atlantic sturgeon
	Reptiles	<i>Caretta caretta</i>	loggerhead sea turtle
		<i>Chelonia mydas</i>	Atlantic green turtle
		<i>Lepidochelys kempii</i>	Kemp's Ridley sea turtle
	Birds	<i>Branta canadensis</i>	Canada goose (migratory)
		<i>Pandion haliaetus</i>	osprey
		<i>Phocoena phocoena</i>	harbor porpoise
	Mammals	<i>Balaenoptera physalus</i>	fin whale
		<i>Megaptera novaeangliae</i>	humpback whale
		<i>Balaena glacialis</i>	Northern right whale
2	Fishes	<i>Cetorhinus maximus</i>	basking shark

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Nearshore Habitats		
Tier	Class	Scientific Name
		<i>Carcharodon carcharias</i>
		<i>Carcharhinus obscurus</i>
		<i>Squatina dumeril</i>
		<i>Alosa mediocris</i>
		<i>Apeltes quadracus</i>
	Reptiles	<i>Eretmochelys imbricata imbricata</i>
Birds		<i>Pelecanus occidentalis</i>
		<i>Phalacrocorax carbo</i>
		<i>Phalacrocorax auritus</i>
		<i>Cygnus columbianus</i>
		<i>Branta bernicla</i>
		<i>Aythya valisineria</i>
		<i>Aythya americana</i>
		<i>Aythya marila</i>
		<i>Aythya affinis</i>
		<i>Clangula hyemalis</i>
		<i>Melanitta nigra</i>
		<i>Melanitta perspicillata</i>
		<i>Melanitta fusca</i>
		<i>Bucephala albeola</i>

Conservation Issues and Actions

Nearshore Habitats		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3

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Nearshore Habitats		
Issue Category	Specific Issue	Specific Action
Shoreline Protection Practices	Beach Renourishment	Work with the Division of Soil and Water Conservation to integrate key habitat and SGCN conservation into selection of nearshore borrow areas.
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Impingement/Entrapment/Entrainment at Water Intakes	Work with utilities and industry to assess impacts to SGCN from impingement / entrapment / entrainment, and adapt the design and operation of water intakes for SGCN conservation, as necessary.
Transportation and Utility Operations and Maintenance	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
	Channel Dredging	Work with the Division of Water Resources and the US Army Corps of Engineers to integrate key habitat and SGCN conservation into dredging plans.
	Commercial Ships and Boats	Assess impacts from collisions on SGCN and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.
		Work with the shipping and commercial fishing industries to develop education and outreach for boat operators about minimizing the impacts to key habitats and SGCN.
Invasive Species, Nuisance Animals and Wildlife Diseases	Green Crab and Japanese Shore Crab	Post "no wake" zones to protect key habitats and SGCN, and enforce them. Assess impacts of crabs on key habitats and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.
Solid Waste Disposal	Trash Ingestion	Assess impacts to SGCN and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.

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Nearshore Habitats		
Issue Category	Specific Issue	Specific Action
Energy Production	Wind Farm Facilities	Work with energy companies to develop standards for the location of wind farms to minimize loss and fragmentation of key habitats.
	Tidal Turbines	Work with energy companies to develop standards for the location of tidal turbines to minimize impacts to SGCN.
		Support research on improving the design of turbines to minimize impacts to SGCN.
	Thermal Pollution from Power Plants	Support research on minimizing impacts to SGCN.
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See <i>Section 0</i>
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing recreational and commercial fishing regulations.
		Integrate SGCN conservation into fishing regulations.
		Incorporate information about SGCN conservation into the Fishing Guide.
		Maintain compliance with interstate management agreements.
	Fishing Gear Entanglement	Incorporate information about reducing the impacts of entanglement on SGCN into the Fishing Guide.
		Develop education and outreach about reducing the impacts of entanglement on SGCN for distribution with commercial fishing licenses.
		Expand efforts to recover and recycle fishing line and gill nets using Florida's "Monofilament Recovery & Recycling Program" or a similar strategy.
		Evaluate expanding International Coastal Cleanup Day to include recovery of submerged lost or abandoned fishing gear.
	Fisheries Bycatch	Assess impacts to SGCN and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.

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Nearshore Habitats		
Issue Category	Specific Issue	Specific Action
Resource Management		Support research on designing fishing gear and techniques that minimize impacts to SGCN.
	Commercial Fisheries Dredging	Assess impacts to key habitats and SGCN and use this assessment and long-term monitoring to guide adaptive management, including restrictions on frequency and timing, and the designation of "no dredge zones" if necessary.
		Support research on designing fisheries dredging gear and techniques that minimize impacts to key habitats and SGCN.
	Habitat/Wildlife Management	See <i>Section 0</i>

6.1.18. Impoundments

Description

Impoundments are man-made coastal habitats where water levels can be manipulated by some sort of control structure. Some are freshwater environments that may be groundwater-dependent. Many are brackish and are connected to tidal streams.

Vital Statistics

Impoundments		
Attribute	Total	Protected
HCC* Acreage	6,385	3,551 (56%)
HCC Occurrences	61	31 (51%)
Known SGCN Species / Occurrences in HCC	14 / 18	9 / 10 (64% / 56%)
SGCN Species associated with habitat***	19	

*HCC = *Habitats of Conservation Concern*.

Present Condition

Good. Very few new impoundments are currently being created, but existing ones are maintained in a relatively stable condition by active management. Some are impacted by nutrification and overbrowsing by geese and others suffer from common reed invasion.

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Presumably, sea level rise will not be an issue for this habitat, since dikes can be elevated and water control structures modified to accommodate higher water levels.

Habitats of Conservation Concern

None described at this time.

Associated Species of Greatest Conservation Need

Impoundments		
Tier	Class	Scientific Name Common Name
1	Birds	<i>Podilymbus podiceps</i> pied-billed grebe
		<i>Branta canadensis</i> Canada goose (migratory)
		<i>Anas rubripes</i> American black duck
		<i>Pandion haliaetus</i> osprey
		<i>Actitis macularia</i> spotted sandpiper
2	Birds	<i>Cygnus columbianus</i> tundra swan
		<i>Anas platyrhynchos</i> mallard
		<i>Anas clypeata</i> Northern shoveler
		<i>Aythya valisineria</i> canvasback
		<i>Aythya marila</i> greater scaup
		<i>Aythya affinis</i> lesser scaup
		<i>Bucephala albeola</i> bufflehead
		<i>Lophodytes cucullatus</i> hooded merganser
		<i>Fulica americana</i> American coot
		<i>Pluvialis squatarola</i> black-bellied plover
		<i>Himantopus mexicanus</i> black-necked stilt
		<i>Catoptrophorus semipalmatus</i> willet
		<i>Calidris pusilla</i> semipalmated sandpiper
		<i>Calidris alpina</i> dunlin

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Conservation Issues and Actions

Impoundments		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0
Invasive Species, Nuisance Animals and Wildlife Diseases	Snow Goose and Resident Canada Goose	Increase goose harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase goose harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase goose harvest on private lands as necessary to reduce impacts to key habitats.
	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
	Control of Mosquitoes with Open Marsh Water Management and Impoundment Management	Work with the Mosquito Control Section to evaluate the impacts of impoundment management on key habitats.
		Work with the Mosquito Control Section to adapt impoundment management for conservation of key habitats, as necessary.
	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6

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Impoundments		
Issue Category	Specific Issue	Specific Action
Water Use	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of "excellent groundwater recharge areas."
Climate Change	Sea Level Rise	See Section 6.2.7
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See Section 0
Airport Operations	Overflights	Continue/expand studies of disturbance of SGCN from overflights, and work with Dover Air Force Base to mitigate disturbance.
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.19. Forest Blocks

Description

Forest Blocks may include upland forests and/or wetland forests. These constituent habitats are described above, as are the relevant Associated Species of Greatest Conservation Need and Conservation Issues and Actions. Additional issues and actions that pertain to Forest Blocks are in Section 6.2.

Vital Statistics

Forest Blocks		
Attribute	Total	Protected
Acreage	119,268	35,058 (29%)
Occurrences	263	96 (37%)
Known SGCN Species / Occurrences	96 / 259	71 / 158 (74% / 61%)

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Present Condition

Poor. Most of Delaware was forested at the time of European settlement. The amount of forest loss since then is difficult to determine with much accuracy, but it has been estimated at 50-75% (since some existing forest represents second growth that has occurred on abandoned farmland, especially in the northern part of the state, the loss was probably greater than this at its peak in the 19th century). More recently, calculations of forest loss in the state range from 35,000 acres from 1984-1992 and 20,000 acres from 1986-1999; in 2005 alone, loss was estimated to be as high as 4,500 acres. Historically, this loss stemmed from conversion to agriculture, but is now mostly the result of residential and commercial development and associated infrastructure.

As striking as the overall loss of forest is the fragmentation of that which remains. Mapping of tree cover in the state completed in 2004 delineated about 4,150 separate wooded patches larger than 10 acres. The median size among those patches is only 34 acres, and just 6% are larger than 250 acres. An examination of patch “thickness,” which accounts for size and shape, reveals only a few (<0.1%) that have sufficient interior habitat to sustain area-sensitive species like cerulean warbler, Northern parula and black-and-white warbler for the long term. Additional analysis indicates that the patches are highly isolated from each other, with less than 10% meeting the isolation thresholds for hooded warbler, American redstart, red-shouldered hawk and brown creeper. Finally, calculation of perimeter/area ratio for the forest blocks highlights their very irregular shapes. Almost 90% have a ratio greater than that of a 10:1 rectangle, a configuration that produces major edge effects.

Recent field surveys of nearly 100 Coastal Plain forest blocks found about half of them to be in “Good” or “Very Good” condition, but this rating was based on vegetative characteristics, not on spatial attributes or wildlife habitat.

See the discussion of Present Condition under Coastal Plain Upland Forests (Section 6.1.4) for more information about forest condition.

6.1.20. Wetland Blocks

Description

Wetland Blocks may contain non-tidal wetlands, freshwater tidal wetlands, and/or saltwater and brackish tidal wetlands. These constituent habitats are described above, as are the relevant Associated Species of Greatest Conservation Need and Conservation Issues and Actions. Additional issues and actions that pertain to Wetland Blocks are in Section 6.2.

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Vital Statistics

Wetland Blocks		
Attribute	Total	Protected
Acreage	168,368	71,937 (43%)
Occurrences	127	70 (55%)
Known SGCN Species / Occurrences	107 / 289	81 / 156 (76% / 54%)

Present Condition

Fair. Delaware is estimated to have lost over 50% of its wetlands since the arrival of European colonists. The majority of these were freshwater wetlands that were lost to ditching, stream channelization, conversion to ponds and filling for development. Tidal wetlands were also lost to filling for development, shoreline hardening, conversion to impoundments and ditching for mosquito control. Fortunately, wetland regulations at both the state and federal levels have greatly curtailed these losses in the last several decades – according to the most recent estimate, as little as 10 acres of tidal wetlands are now lost each year – although protection of isolated freshwater wetlands remains insufficient. Problems remain with most wetlands, however, from degradation caused by sedimentation, nutrient enrichment and invasive plant species. These problems are exacerbated by insufficient natural buffer around many wetland blocks. Also, the ultimate fate of tidal wetlands, which constitute the great bulk of wetland blocks, remains uncertain in light of predicted sea level rise, especially given the lack of buffers to accommodate migration. Although it could not be completed in time for inclusion in this plan, a GIS analysis of wetland buffers should be performed to quantify the extent of this issue.

6.2. Conservation Issues and Actions for Multiple Key Habitats

Certain of these issues affect key habitat structure or function, while others cause direct mortality or disturbance of SGCN. These broad issues, the habitats that they impact, and their corresponding actions appear in the tables below.

Habitats of Conservation Concern are again lumped under broader key habitat types for the reasons discussed in Section 6.1.

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6.2.1. Habitat Loss and Fragmentation

Habitat Loss and Fragmentation		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Beach and Dune Habitats • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds • Interdunal Wetlands • Piedmont Stream Valley Wetlands • Peat Wetlands • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Tidal Low Marshes • Forest Blocks 	Residential and Commercial Structures	<p>Coordinate with partners to acquire title to, or easements on, sites that are critical to the conservation of key habitats and SGCN within the Green Infrastructure Natural Resources Focus Area, for management by public agencies or NGOs.</p> <p>Improve federal/state/local coordination of environmental review to ensure that potential impacts to key habitats and SGCN are minimized for all major projects.</p> <p>Support rigorous implementation of the State Strategies for Policies and Spending to restrict major development to Levels 1-3.</p> <p>Develop state policies to require incorporation of Key Wildlife Habitats into the Green Infrastructure Natural Resources Focus Area. See Figure 19 for a comparison of the GI focus area with key habitats.</p> <p>Encourage Kent and Sussex counties to adopt overlay zoning ordinances for the Green Infrastructure Natural Resources Focus Area.</p> <p>Encourage all counties to adopt environmental design standards for development projects in order to protect key wildlife habitats and SGCN.</p> <p>Work with conservation partners, state and county planning officials, and developers to create certification for environmentally-friendly developments, including an associated media campaign with awards.</p>

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Habitat Loss and Fragmentation		
Key Habitats	Specific Issue	Specific Action
		<p>Work with developers to design BMPs that minimize impacts to key habitats and SGCN by preserving and restoring buffers and by reducing edge effect.</p> <p>Evaluate means of protecting isolated freshwater wetland key habitats on private property, including education and outreach, voluntary guidelines, incentives and regulations, as necessary.</p> <p>Evaluate means of protecting forested key habitats on private property, including education and outreach, voluntary guidelines, incentives and regulations, as necessary.</p>
<ul style="list-style-type: none"> • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Forest Blocks 	Farmland	<p>Coordinate with partners to acquire title to, or easements on, sites that are critical to the conservation of key habitats and SGCN within the Green Infrastructure Natural Resources Focus Area, for management by public agencies or NGOs. See Figure 19 for a comparison of the GI focus area with key habitats.</p> <p>Support the Agricultural Lands Preservation Program to protect land from irreversible conversion to other uses.</p> <p>Work with the Delaware Department of Agriculture, the agriculture industry and the Landowner Incentives Program to develop BMPs, and corresponding incentives, that minimize impacts to key habitats, preserve and restore buffers, and reduce edge effects for area-sensitive SGCN.</p>

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Habitat Loss and Fragmentation		
Key Habitats	Specific Issue	Specific Action
		<p>Evaluate means of protecting isolated freshwater wetland key habitats on private property, including education and outreach, voluntary guidelines, incentives and regulations, as necessary.</p> <p>Evaluate means of protecting forested key habitats on private property, including education and outreach, voluntary guidelines, incentives and regulations, as necessary.</p>
<ul style="list-style-type: none"> • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Forest Blocks 	Industrial Facilities	<p>Support rigorous implementation of the State Strategies for Policies and Spending to restrict major development to Levels 1-3.</p> <p>Evaluate the use of education and outreach, incentives, partnerships, and/or regulations, as necessary, for restoring key habitats and SGCN on closed sand and gravel quarries.</p>
<ul style="list-style-type: none"> • Beach and Dune Habitats • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds 	Transportation Infrastructure	<p>Work with the Delaware Department of Transportation to integrate key habitat and SGCN conservation into long-range transportation planning.</p> <p>Work with the Delaware Department of Transportation to integrate key habitat and SGCN conservation into wetland and forest mitigation.</p>

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Habitat Loss and Fragmentation		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Interdunal Wetlands • Piedmont Stream Valley Wetlands • Peat Wetlands • Riverine Aquatic and Submerged Vegetation • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Tidal Low Marshes • Non-tidal Coastal Plain Streams • Impoundments • Forest Blocks • Wetland Blocks 		<p>Work with the Delaware Department of Transportation to develop BMPs to integrate key habitat and SGCN conservation into landscaping, mowing, invasive plant control and other road maintenance, including preserving and restoring buffers and reducing edge effects.</p>
<ul style="list-style-type: none"> • Beach and Dune Habitats • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Tidal High Marshes • Tidal Low Marshes • Forest Blocks • Wetland Blocks 	Utility Corridors	<p>Work with utilities and state and local planning officials to integrate key habitat and SGCN conservation into long-range planning for electric, water, sewer, natural gas and petroleum lines.</p> <p>Work with utilities to develop BMPs to integrate key habitat and SGCN conservation into corridor maintenance, including controlling invasive species, preserving and restoring buffers and reducing edge effects.</p>
<ul style="list-style-type: none"> • Early Successional Upland Habitats • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Tidal High Marshes • Tidal Low Marshes • Nearshore Habitats 	Dredge Spoil Disposal	<p>Work with the Division of Soil and Water Conservation and the US Army Corps of Engineers to incorporate key habitat and SGCN conservation into spoil disposal plans.</p> <p>Work with the Division of Soil and Water Conservation and the US Army Corps of Engineers to mitigate contaminant impacts to SGCN.</p>

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Habitat Loss and Fragmentation		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Forest Blocks 	Landfill Facilities	<p>Work with the Division of Soil and Water Conservation and the US Army Corps of Engineers to identify sites for use of dredge spoils to create/restore key habitats.</p> <p>Support rigorous implementation of the State Strategies for Policies and Spending to restrict major development to Levels 1-3.</p>

6.2.2. Residential and Commercial Development Practices

Residential and Commercial Development Practices		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds • Intertidal Wetlands • Piedmont Stream Valley Wetlands • Peat Wetlands • Riverine Aquatic and Submerged Vegetation • Non-tidal Coastal Plain Streams • Impoundments 	Altered Hydrology	<p>Encourage the counties to strengthen enforcement of stormwater management regulations.</p> <p>Work with the Division of Soil and Water Conservation and the Tributary Action Teams to promote the implementation of BMPs for stormwater management.</p> <p>Work with the Division of Soil and Water Conservation and the Tributary Action Teams to ensure integration of key habitat and SGCN conservation and monitoring into all Pollution Control Strategies.</p>

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Residential and Commercial Development Practices		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> Coastal Plain Forested Floodplains and Riparian Swamps Atlantic White Cedar Non-Tidal Wetlands Coastal Plain Seasonal Ponds Intertidal Wetlands Piedmont Stream Valley Wetlands Peat Wetlands Riverine Aquatic and Submerged Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands Freshwater Tidal Marshes Tidal High Marshes Tidal Low Marshes Non-Tidal Coastal Plain Streams Nearshore Habitats Impoundments 	Nutrients and Sediments	<p>Encourage the counties to strengthen enforcement of erosion and sediment control regulations.</p> <p>Work with the Division of Soil and Water Conservation and the Tributary Action Teams to promote the implementation of BMPs for erosion and sediment control.</p> <p>Work with the Division of Soil and Water Conservation and the Tributary Action Teams to ensure integration of key habitat and SGCN conservation and monitoring into all Pollution Control Strategies.</p> <p>Work with the Division of Soil and Water Conservation to integrate key habitat and SGCN conservation into state water quality standards for nutrients and sediments.</p>
<ul style="list-style-type: none"> Coastal Plain Seasonal Ponds Intertidal Wetlands Piedmont Stream Valley Wetlands Peat Wetlands Riverine Aquatic and Submerged Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands Freshwater Tidal Marshes 	Pesticides	<p>Work with Cooperative Extension to promote IPM implementation to minimize impacts of residential and commercial pesticides on SGCN. Work also with the Landowner Incentives Program to develop incentives for IPM implementation on private golf courses, recreational facilities and common areas.</p> <p>Work with Cooperative Extension to integrate key habitat and SGCN conservation into pesticide applicator training.</p>

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Residential and Commercial Development Practices		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Tidal High Marshes • Tidal Low Marshes • Non-tidal Coastal Plain Streams • Nearshore Habitats • Impoundments 		Work with Cooperative Extension to develop education and outreach for landowners about the impacts of residential pesticides on SGCN.
<ul style="list-style-type: none"> • Beach and Dune Habitats • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Tidal Low Marshes 	Piers and Docks	<p>Work with developers to create design standards for piers and docks that minimize habitat loss or fragmentation.</p> <p>Work with county building officials to encourage developers to construct community piers and docks in subdivisions, in place of individual structures.</p>

6.2.3. Agricultural and Forestry Operations

Agricultural and Forestry Operations		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds • Peat Wetlands • Riverine Aquatic and Submerged Vegetation • Non-Tidal Coastal Plain Streams • Impoundments 	Altered Hydrology	<p>Work with the Delaware Department of Agriculture and the Tributary Action Teams to promote the implementation of BMPs for stormwater management.</p> <p>Work with the Division of Soil and Water Conservation and the Tributary Action Teams to ensure integration of key habitat and SGCN conservation and monitoring into all Pollution Control Strategies.</p>
<ul style="list-style-type: none"> • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds • Peat Wetlands • Riverine Aquatic and Submerged 	Nutrients and Sediments	Work with the Delaware Department of Agriculture and the Tributary Action Teams to promote the implementation of BMPs for erosion and sediment control.

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Agricultural and Forestry Operations		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands Freshwater Tidal Marshes Tidal High Marshes Tidal Low Marshes Non-Tidal Coastal Plain Streams Impoundments 		<p>Work with the Division of Soil and Water Conservation and the Tributary Action Teams to ensure integration of key habitat and SGCN conservation and monitoring into all Pollution Control Strategies.</p> <p>Work with the Division of Soil and Water Conservation to integrate key habitat and SGCN conservation into state water quality standards for nutrients and sediments.</p>
<ul style="list-style-type: none"> Coastal Plain Forested Floodplains and Riparian Swamps Atlantic White Cedar Non-tidal Wetlands Coastal Plain Seasonal Ponds Peat Wetlands Riverine Aquatic and Submerged Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands Freshwater Tidal Marshes Tidal High Marshes Tidal Low Marshes Non-tidal Coastal Plain Streams Nearshore Habitats Impoundments 	Pesticides	<p>Work with the Delaware Department of Agriculture and the agricultural community to promote implementation of IPM to minimize impacts of agricultural pesticides on SGCN. Work also with the Landowner Incentives Program to develop incentives for IPM implementation on farmland.</p>
<ul style="list-style-type: none"> Coastal Plain Upland Forests Coastal Plain Forested Floodplains and Riparian Swamps Atlantic White Cedar Non-tidal Wetlands Coastal Plain Seasonal Ponds Freshwater Tidal Forested and Scrub-Shrub Wetlands 	Clearcutting and Other Forestry Practices	<p>Coordinate with partners to acquire title to, or easements on, sites that are critical to the conservation of key habitats and SGCN within the Green Infrastructure Natural Resources Focus Area, for management by public agencies or NGOs. See Figure 19 for a comparison of the GI focus area with key habitats.</p>

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Agricultural and Forestry Operations		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Freshwater Tidal Marshes • Tidal High Marshes • Forest Blocks • Wetland Blocks 		<p>Work with the Delaware Forest Service to integrate key habitat and SGCN conservation into forest management planning.</p> <p>Work with the Delaware Forest Service, the forestry industry and the Landowner Incentives Program to develop BMPs and corresponding incentives to preserve or restore key habitat buffers and reduce edge effects for area-sensitive SGCN.</p> <p>Work with the Delaware Forest Service and the forestry industry to implement a Master Logger program to encourage landowners to work with loggers who harvest forests sustainably.</p>

6.2.4. Industrial Operations

Industrial Operations		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Beach and Dune Habitats • Early Successional Upland Habitats 	Air Pollution	Support research to assess and monitor impacts of airborne pollutants on key habitats.

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Industrial Operations		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> Coastal Plain Upland Forests Coastal Plain Forested Floodplains and Riparian Swamps Atlantic White Cedar Non-tidal Wetlands Coastal Plain Seasonal Ponds Interdunal Wetlands Piedmont Stream Valley Wetlands Peat Wetlands Riverine Aquatic and Submerged Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands Freshwater Tidal Marshes Tidal High Marshes Tidal Low Marshes Non-tidal Coastal Plain Streams Nearshore Habitats 		Enforce existing limits on releases of airborne pollutants.
<ul style="list-style-type: none"> Beach and Dune Habitats Coastal Plain Forested Floodplains and Riparian Swamps Atlantic White Cedar Non-tidal Wetlands Piedmont Stream Valley Wetlands Peat Wetlands Riverine Aquatic and Submerged Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands Freshwater Tidal Marshes Tidal High Marshes Tidal Low Marshes Non-tidal Coastal Plain Streams Nearshore Habitats 	Accidental Spills of Toxins and Sewage	<p>Work with the Emergency Response Branch to integrate key habitat and SGCN protection into emergency response planning.</p> <p>Provide training for DFW staff, such as incident management, hazardous materials handling and wildlife rescue, to facilitate involvement in emergency response actions.</p> <p>Maintain DFW involvement in the Natural Resource Damage Assessment process.</p>

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Industrial Operations		
Key Habitats	Specific Issue	Specific Action
		Develop/enhance partnerships with Tri-State Bird Rescue and other wildlife rehabilitators to improve emergency response.
<ul style="list-style-type: none"> Piedmont Stream Valley Wetlands Peat Wetlands Riverine Aquatic and Submerged Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands Freshwater Tidal Marshes Tidal High Marshes Tidal Low Marshes Non-tidal Coastal Plain Streams Nearshore Habitats 	Chronic Water Pollution	<p>Assess and monitor the impacts of water pollution on key habitats and SGCN.</p> <p>Support the Division of Water Resources enforcement of existing limits on releases of water pollution.</p>
<ul style="list-style-type: none"> Coastal Plain Forested Floodplains and Riparian Swamps Atlantic White Cedar Non-tidal Wetlands Peat Wetlands Riverine Aquatic and Submerged Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands Freshwater Tidal Marshes Tidal High Marshes Tidal Low Marshes Non-tidal Coastal Plain Streams Nearshore Habitats 	Sediments from Sand and Gravel Quarrying	Work with the Division of Soil and Water Conservation and the Landowner Incentives Program to develop BMPs, and corresponding incentives, for quarries to minimize impacts of sediments on key habitats.

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6.2.5. Transportation and Utility Operations and Maintenance

Transportation and Utility Operations and Maintenance		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> Coastal Plain Forested Floodplains and Riparian Swamps Piedmont Stream Valley Wetlands Peat Wetlands Riverine Aquatic and Submerged Vegetation Non-tidal Coastal Plain Streams Impoundments 	Altered Hydrology	Work with the Delaware Department of Transportation to integrate key habitat and SGCN conservation into stormwater management design.

6.2.6. Invasive Species, Nuisance Animals and Wildlife Diseases

Invasive Species, Nuisance Animals and Wildlife Diseases		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> Beach and Dune Habitats Early Successional Upland Habitats Coastal Plain Upland Forests Coastal Plain Forested Floodplains and Riparian Swamps Atlantic White Cedar Non-tidal Wetlands Coastal Plain Seasonal Ponds Interdunal Wetlands Piedmont Stream Valley Wetlands Peat Wetlands Riverine Aquatic and Submerged Vegetation Freshwater Tidal Forested and Scrub-Shrub Wetlands 	Invasive Plants	<p>Work with the Delaware Invasive Species Council to establish an interagency early detection and rapid response system to react to new invasions.</p> <p>Work with the Delaware Invasive Species Council and conservation land managers to assess and monitor impacts of invasive plants using the Delaware Alien Plant Invasiveness Risk Assessment protocol, and prioritize control efforts based on degree of risk.</p> <p>Work with the Delaware Invasive Species Council and conservation land managers to conduct quantitative invasive plant surveys of key habitats.</p>

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Invasive Species, Nuisance Animals and Wildlife Diseases		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> Freshwater Tidal Marshes Tidal High Marshes Tidal Low Marshes Non-tidal Coastal Plain Streams Impoundments 		Work with the Delaware Invasive Species Council and conservation land managers to develop and implement adaptive management plans for control of invasive species.
		Develop education and outreach, partnerships, voluntary guidelines, incentives, and/or regulations, as necessary, for controlling invasive plants on private property and in private commerce, to minimize impacts to key habitats.
		Require use of native species for new plantings or replantings on lands managed by the state, similar to the Native Plants Policy of the Division of Parks and Recreation.
		Work with the Delaware Department of Transportation, Delaware Center for Horticulture and Cooperative Extension to enhance transportation construction and maintenance practices such as requiring the planting of native species, and limiting mowing during breeding, migration or other critical times for SGCN.
		Support implementation of the Delaware Invasive Species Management Plan, as appropriate, to reduce the impacts of invasive species on key habitats and SGCN.

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Invasive Species, Nuisance Animals and Wildlife Diseases		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds • Intertidal Wetlands • Piedmont Stream Valley Wetlands • Peat Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Tidal Low Marshes • Impoundments 	Control of Invasive Plants	Partner with the Delaware Invasive Species Council and land management agencies to integrate key habitat and SGCN conservation into invasives control practices.

6.2.7. Climate Change

Climate Change		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Beach and Dune Habitats • Coastal Plain Upland Forests • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Tidal Low Marshes • Impoundments • Forest Blocks • Wetland Blocks 	Sea Level Rise	<p>Work with the Division of Soil and Water Conservation to integrate key habitat and SGCN conservation into long-range planning for sea level rise.</p> <p>Incorporate sea level rise scenarios in all relevant area, habitat and species management plans.</p> <p>Support implementation of the Delaware Climate Change Action Plan, as appropriate, to reduce greenhouse gas emissions and increase carbon sequestration.</p>

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6.2.8. Recreational Activities

Recreational Activities		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Beach and Dune Habitats • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Coastal Plain Seasonal Ponds • Riverine Aquatic and Submerged Vegetation • Tidal High Marshes • Tidal Low Marshes • Non-tidal Coastal Plain Streams • Nearshore Habitats • Impoundments 	<p>Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles</p>	<p>Assess the impacts of ORVs on beach and dune, early successional and forested habitats, and use this assessment and long-term monitoring to adapt management as necessary.</p> <p>Work with manufacturers and retailers to develop education and outreach for beach users, boaters, and PWC and ORV users about minimizing impacts to SGCN.</p> <p>Post and/or fence nesting sites, breeding concentrations or other critical areas on public property to protect SGCN, and enforce restrictions.</p> <p>Strengthen enforcement of regulations for off-road vehicles on managed areas to protect key habitats and SGCN.</p> <p>Strengthen enforcement of surf fishing permit regulations on public property to protect SGCN.</p> <p>Work with private landowners to limit access to nesting sites, breeding concentrations or other critical areas to protect SGCN.</p> <p>Post “no wake” zones to protect key habitats and enforce them.</p> <p>Support expansion of the Division of Soil and Water Conservation’s Clean Marinas Program to reduce pollution impacts to key habitats and SGCN.</p>

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6.2.9. Resource Management

Resource Management		
Key Habitats	Specific Issue	Specific Action
<ul style="list-style-type: none"> • Beach and Dune Habitats • Early Successional Upland Habitats • Coastal Plain Upland Forests • Coastal Plain Forested Floodplains and Riparian Swamps • Atlantic White Cedar Non-tidal Wetlands • Coastal Plain Seasonal Ponds • Interdunal Wetlands • Piedmont Stream Valley Wetlands • Peat Wetlands • Riverine Aquatic and Submerged Vegetation • Freshwater Tidal Forested and Scrub-Shrub Wetlands • Freshwater Tidal Marshes • Tidal High Marshes • Tidal Low Marshes • Non-tidal Coastal Plain Streams • Nearshore Habitats • Impoundments • Forest Blocks • Wetland Blocks 	Habitat/Wildlife Management	<p>Analyze species and habitat management on state conservation lands – Wildlife Areas, Parks, and Forests – and adapt management as necessary to increase key habitat patch size and reduce edge effects on SGCN.</p> <p>Encourage Federal and NGO conservation lands managers to adapt species and habitat management to increase key habitat patch size and reduce edge effects on SGCN.</p> <p>Evaluate means of managing for SGCN and key habitats on private property, including education and outreach, voluntary guidelines, incentives and regulations, as necessary.</p>
	Facility and Program Operations	<p>Review facility and program operations on state conservation lands – Wildlife Areas, Parks, and Forests – and develop state policies for minimizing impacts to key habitats and SGCN. Establish MOUs with DPR and the State Forest Service about consultation with DFW on issues impacting key habitats and SGCN in State Parks and State Forests.</p> <p>Encourage Federal and NGO conservation lands managers to develop policies for minimizing impacts from facility and program operations to key habitats and SGCN.</p>

6.3. Habitat-independent Conservation Issues and Actions for SGCN

Some issues cause direct mortality or disturbance of wildlife independently of habitat, such as migratory birds that may be impacted anywhere along their migration route. These issues and their corresponding actions are described below.

6.3.1. Residential and Commercial Development Practices

Residential and Commercial Development Practices		
Species/Species Group	Specific Issue	Specific Action
sphinx moths	Outdoor Lighting	Work with electric utilities to develop education and outreach for homeowners, business owners and municipalities to promote reduced use of outdoor lighting during nesting, peak migration and other critical times.
waterbirds		Work with electric utilities and building code and public safety officials to develop design standards for outdoor lighting that minimize stray light.
songbirds	Buildings	Work with electric utilities and building code officials to develop education and outreach for building owners and managers to minimize the impacts of building lights on SGCN, modeled after the "Lights Out," FLAP, WINGS or "Project Safe Flight" programs.
		Work with architects, building owners and managers, and building code officials to develop design standards to minimize the impacts of window glass on SGCN, utilizing the resources of the Building and Birds Forum and others.

6.3.2. Transportation and Utility Operations and Maintenance

Transportation and Utility Operations and Maintenance		
Species/Species Group	Specific Issue	Specific Action
ambystomid salamanders	Vehicles	Work with the Delaware Department of Transportation to identify key habitats, and gate non-essential roads, close roads temporarily, reduce speed limits, and add cautionary signage to minimize impacts to SGCN during breeding,

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terrapin and turtles		migration and other critical times. Work with the Delaware Department of Transportation to develop standards for directional fencing and underpasses for new or existing roads to protect SGCN.
raptors	Communications Towers and High-Tension Electric Lines	Work with utilities to develop standards for the placement of towers and lines to minimize impacts to SGCN nesting colonies, roosts, migration routes, movement corridors, and other critical areas. Support research on improving the design of towers and lines to minimize impacts to SGCN.
songbirds		
bats		

6.3.3. Invasive Species, Nuisance Animals and Wildlife Diseases

Invasive Species, Nuisance Animals and Wildlife Diseases		
Species/Species Group	Specific Issue	Specific Action
turtles	Pets and Subsidized Predators	Work with retailers and NGOs to develop education and outreach for pet owners to minimize the impacts of pets on SGCN, such as "Cats Indoors."
shorebirds		Strengthen enforcement of leash laws for dogs to protect SGCN.
waterbirds		Develop education and outreach for the general public about the impacts of subsidized predators on SGCN.
ground-nesting birds		Work with conservation partners to control subsidized predators on public and NGO conservation lands by reducing subsidies (refuges, food sources), erecting exclosures, or by removal of individuals.
bats		Provide incentives for landowners to control subsidized predators on private property by reducing subsidies (refuges, food sources), erecting exclosures, or by removal of individuals.
Eastern oyster	Infectious Diseases	Establish an early detection and rapid response system to react to new invasions.
waterfowl		Provide training for DFW staff in procedures for responding
raptors		

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shorebirds		to disease outbreaks.
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6.3.4. Energy Production

Energy Production		
Species/Species Group	Specific Issue	Specific Action
waterfowl	Wind Farm Towers	Work with energy companies to develop standards for the placement of wind energy towers to avoid SGCN nesting colonies, roosts, migration routes, movement corridors, and other critical areas.
raptors		
waterbirds		
shorebirds		
songbirds		
bats		Support research for improving the design of wind energy towers to minimize impacts to SGCN.

6.3.5. Wildlife Harvesting

Wildlife Harvesting		
Species/Species Group	Specific Issue	Specific Action
ambystomid salamanders	Inappropriate Collection for the Pet Trade or for Bait	Strengthen enforcement of existing regulations on collecting.
terrapin and turtles		Evaluate the need for additional means of protecting SGCN from collecting, including voluntary guidelines and regulations, as necessary.
snakes		Develop education and outreach for the public and the pet trade about impacts on SGCN.
early successional habitat birds	Lead Shot Ingestion	Assess impacts to SGCN and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.
snakes	Nuisance Wildlife Management	Develop education and outreach for the public about impacts on SGCN.
bats		Develop training for pest control companies to minimize impacts on SGCN.

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6.4. Institutional Capacity Issues and Actions

Institutional Capacity Issues and Actions		
Issue Type	Specific Issue	Specific Action
Division Operations	DFW funding, staffing, administrative structure and/or procedures for DEWAP implementation	Integrate SGCN and Key Wildlife Habitat conservation into DFW responsibilities so as to merge game, sportfish, non-game and endangered species management. Fully fund and staff responsibilities for data collection and information management; natural resource management planning; monitoring and adaptive management; research; coordination of partnerships; and education, outreach and enforcement.
		Ensure balanced representation for all division responsibilities on the Fish and Wildlife Advisory Council.
		Transfer non-wildlife related responsibilities out of DFW in order to better focus staff and fiscal resources on wildlife diversity conservation.
		Provide sufficient DFW "match" to receive the full allocation of available Federal funding from programs such as State Wildlife Grants, Pittman-Robertson, Dingell-Johnson, etc.
		Secure additional state funding for DFW by establishing a universal fishing license, increasing the cost of a hunting license, establishing a "conservation stamp" for access to wildlife areas, more aggressively advertising the tax checkoff, and/or other means.

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Institutional Capacity Issues and Actions		
Issue Type	Specific Issue	Specific Action
Natural Resource Management Planning	Baseline information	Establish Natural Heritage ranks for all SGCN and key habitats not currently tracked by the Natural Heritage program, and use the results to update SGCN and key habitat lists as necessary. Develop protocols for timely review and revision of all Natural Heritage ranks to maintain currency of SGCN and key habitat lists.
		Conduct surveys to more fully document the current distribution and status of SGCN, especially in Key Wildlife Habitats.
		Conduct surveys to more fully document the current distribution and condition of key habitats.
		Conduct research to better characterize the biology of SGCN and the ecology of key habitats as necessary to support adaptive management.
	Conservation planning process	Develop standardized classifications systems (species, habitats, issues, actions) and data formats, or at least compatible systems and formats, that will facilitate cooperative planning among DFW and conservation partners.
		Refine the DEWAP wildlife habitat maps to better inform resource management planning, and develop a protocol for periodic updates. This should include incorporating new information such as the recently completed Gap Analysis Project mapping, and updating existing resource maps such as wetlands, forests and land use/land cover.

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Institutional Capacity Issues and Actions		
Issue Type	Specific Issue	Specific Action
		<p>Develop quantitative or semi-quantitative risk assessment protocols for all “direct threat” conservation issues where they do not already exist, and utilize risk assessment results to prioritize conservation issues.</p> <p>Conduct research on the extent and severity of impacts from “direct threat” conservation issues to key habitats and SGCN as needed to support adaptive management.</p> <p>Develop a strategic planning process to “step down” DEWAP into prioritized management prescriptions for SGCN, key habitats, and resolution of “direct threat” conservation issues on public and private lands. Include all relevant conservation actions from existing national, regional, state and site plans. Incorporate information and actions from these prescriptions into resource management plans as appropriate.</p>
Monitoring and Adaptive Management	Monitoring of SGCN, key habitats, impacts from conservation issues and outcomes of conservation actions	Monitor SGCN and key habitats to determine trends in the distribution and status of SGCN and the distribution and condition of key habitats.
		Monitor abatement of impacts to SGCN and key habitats from “direct threat” conservation issues.
		Monitor outcomes of conservation actions for SGCN and key habitats.
		Develop standardized monitoring protocols that incorporate existing state, regional and national monitoring schemes where they exist, and include these protocols in all conservation programs and projects.

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Institutional Capacity Issues and Actions		
Issue Type	Specific Issue	Specific Action
	Quantitative measures of success for assessing DEWAP implementation	Develop a quantitative or semi-quantitative scoring system for representing key habitat condition.
		Develop performance indicators that measure the success of SGCN and key habitat management by monitoring trends in distribution and status of SGCN, and distribution and condition of key habitats.
		Develop performance indicators that measure the success of conservation actions for abatement of "direct threat" conservation issues by monitoring changes in the extent and severity of impacts from these issues.
		Develop performance indicators that measure the success of conservation actions that resolve "indirect threat" conservation issues by monitoring appropriate metrics.
		Combine performance indicators into an annual "scorecard" of DEWAP implementation. Provide this scorecard to conservation partners, stakeholders, elected officials, media and the general public in order to enhance accountability.
Information Management	Adaptive management framework for modifying conservation actions	Create an adaptive management framework that utilizes monitoring to adapt planning and implementation of conservation actions to account for unsatisfactory results, changing conditions and new information.
	Information management for SGCN, key habitat, conservation issue and conservation action data to support adaptive management	Create, implement and/or update spatial computer applications for data management and decision support – e.g. Biotics, Vista, Delaware Invasive Species Tracking System – throughout DFW and other agencies/organizations as appropriate.

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Institutional Capacity Issues and Actions		
Issue Type	Specific Issue	Specific Action
Resource Protection		Develop state policies to require the integration of SGCN and key habitat data into all State agencies' decision-making, including long-range planning, development of acquisition strategies, targeting of cost-share and incentive programs, and making adaptive management decisions on state-owned land.
		Develop incentives for non-state agencies, organizations, and individuals to utilize SGCN and key habitat information in their operations. Market the benefits of using this information such as saving time or funds, or minimizing the potential for legal conflict. Provide these entities with greater access to SGCN and key habitat information.
	Funding for open space acquisition to protect SGCN and key habitats	Provide sufficient funding for the Open Space Program to meet land acquisition objectives designated in the Green Infrastructure Natural Resources Focus Area.
	Enforcement capacity	Provide training on existing and future laws and regulations for protection of SGCN and key habitats, and additional staff resources, as needed, to handle enforcement of those regulations.
Nuisance Wildlife Management	Dedicated response staff	Provide additional staff resources to respond to nuisance wildlife complaints.
Private Lands Conservation	Incentives for landowners	Develop incentives for maintaining existing key habitats or SGCN on private lands (as opposed to current incentives for restoring key habitats or SGCN).
		Develop additional incentives for landowners in the Green Infrastructure Natural Resources Focus Area.

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Institutional Capacity Issues and Actions		
Issue Type	Specific Issue	Specific Action
Education and Outreach		Develop additional incentives for exceptional management of key habitats or SGCN (similar to the Conservation Security Program).
		Support creation of federal and state income tax exemptions for conservation incentive payments.
		Develop more turnkey services for implementing and managing habitat projects, including providing equipment and staff or contractual services.
	Coordination among private lands conservation programs	Encourage all private lands conservation providers to coordinate with DFW to ensure protection of key habitats and SGCN.
		Encourage all private lands conservation providers to target education and outreach to landowners in or adjacent to core reserves and connecting corridors.
	Training, education and outreach programs on key habitat ecology, SGCN biology, and conservation issues and actions	Provide training for state staff on key habitat ecology, SGCN biology, and conservation issues and actions.
Develop education and outreach for the general public, such as "profile brochures" for key habitats and SGCN, and "citizen's guides" for issues and actions.		
Develop wildlife viewing guides for selected species and/or sites and promote responsible ecotourism.		
Expand DFW's Adopt-a-Wetland program and the Delaware Nature Society's "Backyard Wildlife Habitat" program to promote greater citizen involvement in habitat enhancement and stewardship.		

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Institutional Capacity Issues and Actions		
Issue Type	Specific Issue	Specific Action
		Implement "Leave No Trace" programs such as "The Frontcountry Program" and "PEAK," to promote greater responsibility for personal choices.
		Implement the Certified Citizen Naturalist program to provide for volunteer monitoring, wardening and stewardship of key habitats and SGCN. Recruit and train people to conduct surveys, protect resources, and manage habitats and species. Implement systems for volunteer reporting of results.
		Expand use of Eco-Explorers, WADE (Wetland Activities for Delaware Educators), Project WILD, Project WET and other existing school programs, and develop opportunities to integrate key habitat and SGCN conservation content into the above and other existing programs/curricula.
		Support efforts to develop schoolyard habitats and training for teachers on integrating habitat enhancement/conservation activities and projects into the classroom curriculum.
		Partner with the state Department of Education to develop a Delaware-specific biodiversity unit for the high school level that emphasizes key habitat ecology and SGCN biology.

SECTION 7

Priority Conservation Issues and Actions

7. Priority Conservation Issues and Actions

The Conservation Issues and Actions in Section 6 have not been subjected to formal strategic planning to determine their priority; the need for such a process is in fact one of the proposed actions. However, much has been written over the years about the many issues that impact Delaware's natural resources. A careful reading of these reports and plans – Whole Basin Management reports, The Nature Conservancy's ecoregional plans, Natural Heritage Program documents, the Environmental Law Institute's reports, Delaware Invasive Species Management Plan, and others – coupled with the analysis contained in this Plan, provides a picture of the most important Conservation Issues and Actions, listed below.

Issue Type: Division Operations

Specific Issue: DFW funding, staffing, administrative structure and/or procedures for DEWAP implementation

- **Action:** Integrate SGCN and Key Wildlife Habitat conservation into DFW responsibilities so as to merge game, sportfish, non-game and endangered species management. Fully fund and staff responsibilities for data collection and information management; natural resource management planning; monitoring and adaptive management; research; coordination of partnerships; and education, outreach and enforcement.

Issue Type: Natural Resource Management Planning

Specific Issue: Conservation planning process

- **Action:** Develop a strategic planning process to “step down” DEWAP into prioritized management prescriptions for SGCN, key habitats, and resolution of “direct threat” conservation issues on public and private lands. Include all relevant conservation actions from existing national, regional, state and site plans. Incorporate information and actions from these prescriptions into resource management plans as appropriate.

Specific Issue: Baseline Information

- **Action:** Conduct surveys to more fully document the current distribution and status of SGCN, especially in Key Wildlife Habitats, and the current distribution and condition of key habitats (this is a combination of two separate actions in Section 6.4).

Issue Type: Monitoring and Adaptive Management

Specific Issue: Monitoring of SGCN, key habitats, impacts from conservation issues and outcomes of conservation actions

- **Action:** Develop standardized monitoring protocols that incorporate existing state, regional and national monitoring schemes where they exist, and include these protocols in all conservation programs and projects.

Specific Issue: Quantitative measures of success for assessing DEWAP implementation

- **Action:** Develop performance indicators that measure the success of conservation actions for SGCN, key habitats, abatement of “direct threat” conservation issues and resolution of “indirect threat” conservation issue. (this is a combination of three separate actions in Section 6.4).

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Specific Issue: Adaptive management framework for modifying conservation actions

- **Action:** Create an adaptive management framework that utilizes monitoring to adapt planning and implementation of conservation actions to account for unsatisfactory results, changing conditions and new information.

Issue Type: Private Lands Conservation

Specific Issue: Incentives for landowners

- **Action:** Develop incentives for maintaining existing key habitats or SGCN on private lands (as opposed to current incentives for restoring key habitats or SGCN).
- **Action:** Develop additional incentives for exceptional management of key habitats or SGCN (similar to the Conservation Security Program).

Issue Type: Resource Management

Specific Issue: Habitat/Wildlife Management

- **Action:** Analyze species and habitat management on state conservation lands – Wildlife Areas, Parks, and Forests – and adapt management as necessary to increase key habitat patch size and reduce edge effects on SGCN.

Specific Issue: Facility and Program Operations

- **Action:** Review facility and program operations on state conservation lands – Wildlife Areas, Parks, and Forests – and develop state policies for minimizing impacts to key habitats and SGCN. Establish MOUs with DPR and the State Forest Service about consultation with DFW on issues impacting key habitats and SGCN in State Parks and State Forests.

Issue Type: Resource Protection

Specific Issue: Funding for open space acquisition to protect SGCN and key habitats

- **Action:** Provide sufficient funding for the Open Space Program to meet land acquisition objectives designated in the Green Infrastructure Natural Resources Focus Area.

Issue Type: Habitat Loss and Fragmentation

Specific Issue: Residential and Commercial Structures

- **Action:** Coordinate with partners to acquire title to, or easements on, sites that are critical to the conservation of key habitats and SGCN within the Green Infrastructure Natural Resources Focus Area, for management by public agencies or NGOs.
- **Action:** Improve federal/state/local coordination of environmental review to ensure that potential impacts to key habitats and SGCN are minimized for all major projects.

Specific Issue: Transportation Infrastructure

- **Action:** Work with the Delaware Department of Transportation to integrate key habitat and SGCN conservation into long-range transportation planning.
- **Action:** Work with the Delaware Department of Transportation to integrate key habitat and SGCN conservation into wetland and forest mitigation.

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Issue Type: Agricultural and Forestry Operations

Specific Issue: Clearcutting and Other Forestry Practices

- **Action:** Coordinate with partners to acquire title to, or easements on, sites that are critical to the conservation of key habitats and SGCN within the Green Infrastructure Natural Resources Focus Area, for management by public agencies or NGOs.
- **Action:** Work with the Delaware Forest Service to integrate key habitat and SGCN conservation into forest management planning.

Issue Type: Invasive Species, Nuisance Animals and Wildlife Diseases

Specific Issue: Invasive Plants

- **Action:** Work with the Delaware Invasive Species Council and conservation land managers to assess and monitor impacts of invasive plants using the Delaware Alien Plant Invasiveness Risk Assessment protocol, and prioritize control efforts based on degree of risk.
- **Action:** Work with the Delaware Invasive Species Council and conservation land managers to develop and implement adaptive management plans for control of invasive species.

Issue Type: Recreational Activities

Specific Issue: Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles

- **Action:** Assess the impacts of ORVs on beach and dune, early successional and forested habitats, and use this assessment and long-term monitoring to adapt management as necessary.
- **Action:** Strengthen enforcement of regulations for off-road vehicles on public property to protect key habitats and SGCN.
- **Action:** Post and/or fence nesting sites, breeding concentrations or other critical areas on public property to protect SGCN, and enforce restrictions.

Issue Type: Education and Outreach

Specific Issue: Training, education and outreach programs on key habitat ecology, SGCN biology, and conservation issues and actions

- **Action:** Provide training for state staff on key habitat ecology, SGCN biology, and conservation issues and actions.
- **Action:** Develop education and outreach for the general public, such as “profile brochures” for key habitats and SGCN, and “citizen’s guides” for issues and actions.

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SECTION 8

Measuring Success –
Inventory, Monitoring, Research
and Adaptive Management

8. Measuring Success – Inventory, Monitoring, Research and Adaptive Management

The ultimate measure of success for the Plan is the maintenance or restoration of viable populations of SGCN, whether through manipulation of the animals themselves, management of key habitats, reduction of impacts, or improvements to institutional capacity. Achieving stable numbers of these species will secure the overall health of the State's wildlife. Nonetheless, it would be extremely difficult to measure Plan success by monitoring all – or even most – SGCN individually. Monitoring at the species level is typically time consuming and is complicated by seasonal constraints, cryptic habits and other factors. Also, the lag between the implementation of most conservation actions and the responses of species populations is sometimes years, often decades, and may occasionally even be centuries. Such extended delays would impair timely adaptive management.

Monitoring of some SGCN may be required by law or regulation (e.g. endangered species or harvested wildlife), while monitoring of certain indicator species may serve as a surrogate for direct monitoring of habitat condition. However, ultimately it is not necessary to monitor every single SGCN. Most of these species are closely tied to one or several Key Wildlife Habitats, so that habitat viability is usually associated with species viability. Habitat monitoring, characteristically accomplished by measuring community structure and function, is almost always less complex than monitoring large numbers of species belonging to multiple diverse taxa. Lag times between actions and responses at the habitat level are highly variable – ranging from immediate for land acquisition, to one or two years for control of some invasive plants, to decades or more for restoration of certain habitats – but are commonly shorter than those at the species level. These time frames allow for more expedient adaptive management.

Plan success can also be measured by monitoring the abatement of impacts from “direct threat” conservation issues, such as a decrease in the rate of forest habitat loss or a reduction in instances of disturbance of beach-nesting birds. This type of monitoring is usually simpler than biological monitoring, and often has the advantage of being an essentially instantaneous measure. However, it is frequently difficult to strongly correlate this with trends in species or habitat viability.

In addition, success can be measured in terms of actions taken to address impacts of “indirect threats” such as institutional capacity issues. Even though such actions may have significant, long lasting benefit, they are routinely very difficult to relate to changes in species populations or habitat conditions. These issues and actions are therefore most easily monitored with qualitative, as opposed to quantitative, criteria.

Finally, the most timely measures of success are those that directly monitor the rate of Plan implementation. The value of these measures lies not only in their immediacy but in their simplicity, which makes them readily accessible to decision-makers, the general public and other lay people who may not be interested in the intricacies of resource- or issue-based measures.

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Adequately measuring success requires a strategic approach to inventory, monitoring, research and adaptive management. The role of these is described in the sections that follow, with each one introduced by a summary chart of relevant Conservation Issues and Actions from Section 6.4.

8.1. Inventory

Definition

Inventory is the itemization of the abundance and distribution of species or habitats. For the purposes of this definition, inventory is considered synonymous with “survey,” although technically the latter is a subset of the former.

Conservation Issues and Actions

Conservation Issue	Conservation Action
Baseline information	Establish Natural Heritage ranks for all SGCN and key habitats not currently tracked by the Natural Heritage program, and use the results to update SGCN and key habitat lists as necessary. Develop protocols for timely review and revision of all Natural Heritage ranks to maintain currency of SGCN and key habitat lists.
	Conduct surveys to more fully document the current distribution and status of SGCN, especially in Key Wildlife Habitats.
	Conduct surveys to more fully document the current distribution and condition of key habitats.

Strategies

- The selection of SGCN was based largely on data from the Delaware Natural Heritage Program, which uses an internationally accepted methodology for determining the conservation status of animals, plants and natural communities. The value of this protocol is that it allows for comparison of status across all taxa, which can greatly simplify decisions about conservation priorities. However, some Delaware species are currently not tracked by the Natural Heritage Program. All non-tracked species should be evaluated and assigned a conservation status rank in order to provide a uniform basis for determining SGCN. Also, the rationale for all species ranks should be documented in the Natural Heritage database to facilitate review and revision.
- There was insufficient information in the Natural Heritage database about natural communities, from which Key Wildlife Habitats were developed, to allow use of status ranks in evaluating habitat condition. Natural community information should be strengthened to allow its use in rating the conditions of key habitats. As with species, communities that do not have status ranks should be assigned them and all ranking decisions should be documented.
- A standard protocol for review and revision of Natural Heritage ranks and SGCN designations should be developed. At a minimum, comprehensive reviews should be conducted every 10 years in keeping with the time frame of the Plan. However,

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given the rapid pace of land use changes in Delaware, more frequent reviews are probably warranted, possibly as often as every other year for the most sensitive species. Consideration should be given to a protocol that calls for revisions whenever new information becomes available, as opposed to operating on a fixed schedule.

- Comparison of “Known SGCN Species” with “Associated SGCN Species” from the Vital Statistics tables in Section 6.1 shows that only a small portion of potential SGCN have been documented for many key habitats. This may indicate the need to concentrate SGCN inventories in those key habitats. It is especially important that species-habitat associations be validated by observation since most monitoring will probably focus on habitat condition – as opposed to species viability – for reasons of efficiency and effectiveness (see Section 8.2 for further discussion).
- Some key habitats were mapped partly by use of simple models based on topography (Ancient Sand Ridge Forest), aerial photograph interpretation (Coastal Plain Seasonal Pond and Spartina High Salt Marsh), or species-habitat associations (Early Successional Habitat). This mapping needs to be validated by field surveys.

8.2. Monitoring

Definition

Monitoring is the repeated measurement of a conservation parameter – species population, habitat extent, discharge rate of a pollutant, number of participants in a program – using appropriate, consistent methodology that is adequate for detecting significant change over useful periods of time.

Conservation Issues and Actions

Conservation Issue	Conservation Action
Monitoring of SGCN, key habitats, impacts from conservation issues and outcomes of conservation actions	Monitor SGCN and key habitats to determine trends in the distribution and status of SGCN and the distribution and condition of key habitats.
	Monitor abatement of impacts to both SGCN and key habitats from “direct threat” conservation issues.
	Monitor outcomes of conservation actions for SGCN and key habitats.
	Develop standardized monitoring protocols that incorporate existing state, regional and national monitoring schemes where they exist, and include these protocols in all conservation programs and projects.

Strategies

- Biological monitoring for DEWAP should focus on the extent, distribution and condition of Key Wildlife Habitats – as opposed to the population and status of SGCN – for reasons of efficiency and effectiveness. Since key habitats were designated based on known or expected associations with SGCN, the majority of species should be covered by this approach. Generally, individual

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- SGCN will be monitored only if required by regulation, or if the species is especially rare or sensitive to disturbance, or if the species functions as an indicator or keystone for a particular habitat.
- Monitoring should concentrate on permanently protected public and private conservation lands (GAP Stewardship Status 2 or 3). In most cases, these lands form core areas that presently contain, or could be managed for, a great many SGCN and key habitats. The status of resources on these lands is therefore critical to the long term success of the Plan. The spatial distribution of many existing/planned monitoring efforts reflects specific regulatory objectives or statistical considerations without regard for land management status. Whenever possible, existing/planned efforts should be modified to focus on conservation lands, and new monitoring should be directed to these areas as well.
 - Existing/planned monitoring, whether it is done by the state, key conservation partners or others, should be incorporated as much as possible into measures of success for DEWAP. Appendix H lists many of the monitoring activities planned or presently underway in the state, generally those that target SGCN and key habitats, or those that monitor multiple species, habitats, issues and/or locations. Additional monitoring occurs on many individual sites, particularly public and private conservation lands. For example, The Nature Conservancy monitors invasive plants on several of its preserves. Also, the outcomes of specific conservation actions are currently being measured for a number of projects. Although not listed in Appendix H for reasons of brevity, these existing site- and action-specific monitoring activities should also be incorporated into measurements of Plan success when appropriate.
 - Some existing/planned monitoring is local in origin (e.g., contaminant sampling of osprey nestlings), some is regional (e.g., much fish monitoring is directed by interstate management plans), and some is national (e.g., Forest Health Monitoring). Although certain local monitoring efforts, and much of the regional and national monitoring, are not designed specifically for the Plan's SGCN, key habitats or conservation issues, they nonetheless may collect data on these items or could be modified to do so.
 - There is little coverage of SGCN or key upland habitats in existing/planned monitoring efforts, which are biased towards harvested species and aquatic and wetland habitats. Existing/planned monitoring programs should be modified to increase coverage of under-represented resources where it is possible to do so.
 - When new biological monitoring is needed, it should utilize standard protocols for specific taxa and habitats where those exist, and follow accepted scientific methods where they do not. Some large-scale conservation plans, such as the *U.S. Shorebird Conservation Plan*, contain guidance on monitoring, and there are many published and online resources about protocols and methods. Proposed monitoring programs should also be subjected to peer review by recognized experts. Standardization of protocols allows monitoring in Delaware to be rolled up with other states for use in regional and national conservation initiatives, such as Partners in Amphibian and Reptile Conservation, the North American Bat Conservation Partnership Strategic Plan and the Atlantic Coast Joint Venture.
 - Biological monitoring should be implemented at the minimum frequency and sample size that allows detection of biologically or ecologically significant change. Sensitive, indicator or keystone species may call for monitoring every few years, or even

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- annually. Many habitats, on the other hand, could be monitored at longer intervals, although not exceeding every 10 years in keeping with the timeframe of the Plan.
- Biological monitoring should be coordinated both spatially and temporally to maximize efficiency. Key habitats are best monitored by use of permanent plots in representative locations. SGCN monitoring should typically take place at the same locations, although this often may be impossible for aquatic habitats and species. In order to provide coverage of SGCN and key habitats statewide, monitoring should be organized by watershed, such that all resources are checked at least once every 10 years. This would require that anywhere from one to several adjacent watersheds be monitored each year, depending on the number of SGCN and key habitats targeted in each watershed.
 - In addition to monitoring species and habitats, programs must be developed to measure the success of conservation actions that are designed to abate impacts from “direct threat” conservation issues. This monitoring should also seek to substantiate cause-and-effect relationships between conservation issues and actions when these are not known. See Section 8.3 for further discussion of this strategy.

8.3. Research

Definition

Research is the investigation of causal factors that underlie the responses of species to their environments and the structure and function of natural systems.

Conservation Issues and Actions

Conservation Issue	Conservation Action
Baseline information	Conduct research to better characterize the biology of SGCN and the ecology of key habitats as necessary to support adaptive management.
Conservation planning process	Conduct research on the extent and severity of impacts from “direct threat” conservation issues to key habitats and SGCN as needed to support adaptive management.

Strategies

- In the context of the Plan, research should always be designed to provide direct answers to specific management questions, or at least provide the basis for more informed management decisions. Research on the biology of SGCN and the ecology of key habitats should be dictated by the results of monitoring the status and trends of those resources.
- In many cases, cause-and-effect relationships between conservation issues and actions can be reasonably presumed from circumstantial evidence. However, monitoring the abatement of impacts from “direct threat” conservation issues should seek to substantiate these relationships when they are not conclusively known. Typically this requires the sampling of both experimental

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and control areas – or pre- and post-treatment sampling of a single area – in order to isolate a particular conservation action as the sole cause for abatement of a “direct threat.”

8.4. Adaptive Management

Definition

Adaptive management is the cyclical process of adopting, modifying or discarding conservation actions, based on the results of monitoring and research, in order to more effectively and efficiently achieve conservation goals.

Conservation Issues and Actions

Conservation Issue	Conservation Action
Adaptive management framework for modifying conservation actions	Create an adaptive management framework that utilizes monitoring results to adapt planning and implementation of conservation actions to account for unsatisfactory results, changing conditions and new information.
Conservation planning process	Develop standardized classifications systems (species, habitats, issues, actions) and data formats, or at least compatible systems and formats, that will facilitate cooperative planning among DFW and conservation partners.
	Refine the DEWAP wildlife habitat maps to better inform resource management planning, and develop a protocol for periodic updates. This should include incorporating new information such as the recently completed Gap Analysis Project mapping, and updating existing resource maps such as wetlands, forests and land use/land cover.
	Develop quantitative or semi-quantitative risk assessment protocols for all “direct threat” conservation issues where they do not already exist, and utilize risk assessment results to prioritize conservation issues.
	Develop a strategic planning process to “step down” DEWAP into prioritized management prescriptions for SGCN, key habitats, and resolution of “direct threat” conservation issues on public and private lands. Include all relevant conservation actions from existing national, regional, state and site plans. Incorporate information and actions from these prescriptions into resource management plans as appropriate.
Information management for SGCN, key habitat, conservation issue and conservation action data to support adaptive management	Create, implement and/or update spatial computer applications for data management and decision support – e.g. Biotics, Vista, Delaware Invasive Species Tracking System – throughout DFW and other agencies/organizations as appropriate.
Quantitative measures of success for	Develop a quantitative or semi-quantitative scoring system for representing key habitat condition.

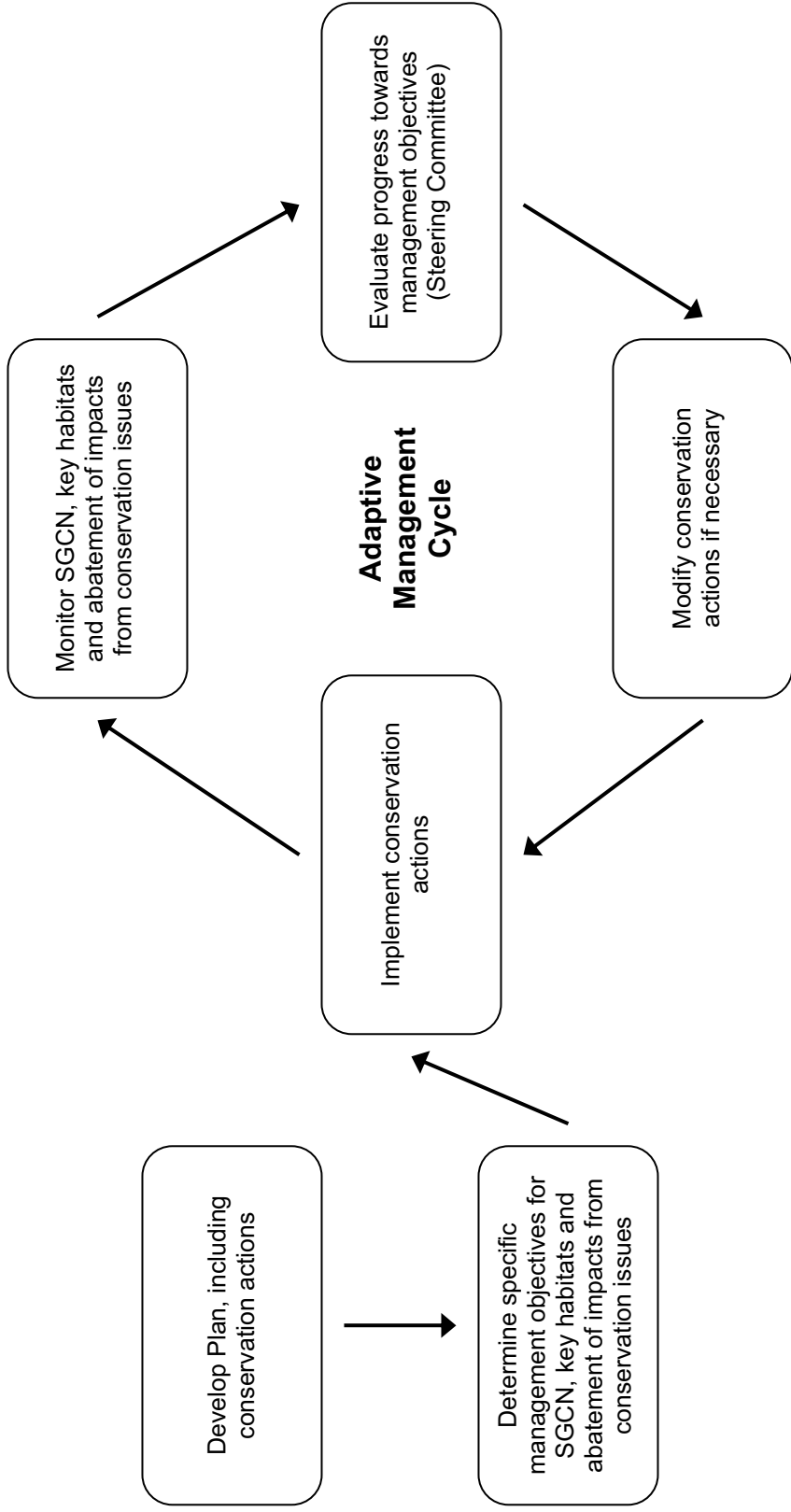
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Conservation Issue	Conservation Action
assessing DEWAP implementation status and effectiveness	Develop performance indicators that measure the success of SGCN and key habitat management by monitoring trends in distribution and status of SGCN, and distribution and condition of key habitats.
	Develop performance indicators that measure the success of conservation actions for abatement of “direct threat” conservation issues by monitoring changes in the extent and severity of impacts from these issues.
	Develop performance indicators that measure the success of conservation actions that resolve “indirect threat” conservation issues by monitoring appropriate metrics.
	Develop performance indicators that measure the success of DEWAP by monitoring the rate of implementation of conservation actions.
	Combine performance indicators into an annual “scorecard” of DEWAP implementation. Provide this scorecard to conservation partners, stakeholders, elected officials, media and the general public in order to enhance accountability.

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Strategies

- Adaptive management of SGCN, key habitats and conservation issues will be facilitated primarily through regular progress reviews by the Steering Committee (see Section 10 for more information). This process can be visualized as follows:



- The Plan itself will also be adapted to reflect changes in SGCN, key habitats, conservation issues and conservation actions during periodic Plan updates (see Section 10 for more information).

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- A key part of adaptive management is the determination of specific management objectives for SGCN, key habitats and abatement of threats from conservation issues. These would take the form of population levels for SGCN, areal extent and dispersion for key habitats, and maximum limits for impacts from “direct threat” conservation issues. Such objectives are often difficult to determine given the complexity of most natural systems, and they are beyond the scope of this Plan. However, population objectives are available for some species in regional and national conservation initiatives (e.g., Partners in Flight and endangered species recovery plans), and there is extensive literature on population viability analysis that can be applied to other species. Habitat objectives are less well developed, although there is a growing body of knowledge about patch size and isolation, connectivity, edge effects and similar factors that influence habitat viability. Some thresholds for impacts are well established, while others are poorly understood and require additional research.
- Standardized schemes for categorizing SGCN, key habitats, conservation issues and conservation actions are necessary to take full advantage of cooperative planning among key partners, which is crucial to the success of the Plan. To this end, the existing habitat classification scheme, based on the National Vegetation Classification System, should be revised using NatureServe’s Ecological Systems scheme, which more accurately depicts habitats from a faunal perspective. Conservation partners should be strongly encouraged to adopt this scheme also. Likewise, partners should consider utilizing the “taxonomies” of conservation issues and actions that were developed for this Plan (Section 5), or new schemes should be developed that are acceptable to all partners.
- The habitat maps prepared for this plan require revision to validate modeling assumptions (Section 8.1) and bring them into conformance with the Ecological Systems classification (above). They also must be updated whenever new baseline information becomes available, particularly aerial photographs, land use/land cover data and wetland mapping. Consideration should be given to updating this baseline information more often and/or synchronizing the updates with DEWAP and other planning processes as appropriate.
- Given that this Plan identifies about 90 different conservation issues that impact SGCN and key habitats, there is an obvious need to prioritize these issues utilizing a consistent risk assessment process. Such a methodology has been developed for assessing the risk posed by invasive plants to natural communities and native species in Delaware. This approach should be generalized to allow its application to all “direct threat” conservation issues.
- A strategic planning process must be developed to facilitate accomplishment of the more than 230 conservation actions in this Plan. Staff, funds and other logistical resources will always be in short supply, and political shifts and public reactions will sporadically exert pressure for inappropriate actions. A systematic approach is needed to establish – and periodically adjust – priorities for conservation actions and to allocate resources so as to best accomplish the most important tasks first.
- Similar to SGCN, key habitats and abatement of threats from conservation issues, the success of conservation actions should be measured relative to management targets, as opposed to absolute numbers of actions taken, whenever possible.
- Adaptive management necessitates tracking all aspects of monitoring, whether it is the status and trends of SGCN and key habitats, the abatement of impacts from conservation issues, or the evaluation of conservation actions. Existing data management and decision support computer applications should be fully implemented and updated, or additional ones developed, to meet this

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need. Of special concern is the documentation of conservation actions, some of which are already being implemented by a variety of public and private providers. Coordination of these actions is essential for successful adaptive management.

- The habitat condition ratings in Section 6.1 are based for the most part on expert knowledge in the absence of quantitative data. Ideally, these ratings would eventually be based on quantitative data, such as the analysis done for Coastal Plain ponds (Section 6.1.7) and forest blocks (Section 6.1.19), and would incorporate Natural Heritage conservation ranks (see Section 8.1 for more information on this issue). Until that time, a more systematic approach using qualitative information is needed to better document habitat condition and facilitate periodic review and revision. An approach similar to that pioneered by The Nature Conservancy, for using the best available knowledge in conservation planning, should be developed. This would entail dividing habitat condition into components, such as number, extent and distribution of protected *vs.* unprotected occurrences; viability and connectivity of individual patches; short and long term trends in number, extent or viability; severity, scope and immediacy of impacts from conservation issues; and sensitivity to disturbance. Each of these would be rated good, fair or poor based on defined criteria, and the component ranks would be combined into an aggregate rating.
- Performance indicators may take several forms, based on the type of monitoring that they seek to measure:
 - *Implementation monitoring* measures the degree to which conservation actions in the plan have been initiated or completed, e.g., the number of “profile brochures,” “citizens guides” and wildlife viewing guides implemented.
 - *Effectiveness monitoring* measures whether or not conservation actions are achieving their desired outcome, e.g., if working with hunters to increase deer harvest on state lands is effective in reducing herbivory impacts to key habitats.
 - *Validation monitoring* measures the assumption of linkage between conservation action outcomes and SGCN status or key habitat condition, e.g., does successfully adapting dune stabilization projects to allow for overwash habitat actually result in increases of beach-nesting birds.

Implementation and validation performance indicators for measuring success are shown in the following table, organized by the Plan’s Guiding Principles for Conservation Actions as outlined in Section 1.1.2. Once a decision support application is in place, information on all of these indicators may be collected initially. However, it is anticipated that, with experience, a subset will be selected that best measures the effectiveness of the Plan as a whole. Implementation indicators are measures of overall Plan success, and validation indicators are applied across all conservation actions. On the other hand, effectiveness indicators are specific to individual actions, and will be developed as actions are employed; a few examples of these are detailed in Section 8.5. Also, any indicator may require modification over time, or additional indicators may need development if entirely new conservation actions arise as part of an adaptive management approach.

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Guiding Principle for Conservation Actions	Implementation Performance Indicators
<p>Management on Conservation Lands – Direct management in state wildlife areas – and state parks and state forests in keeping with their primary missions – towards key habitats and SGCN in the Green Infrastructure Natural Resources Focus Area, in order to protect and restore habitats and species, and to abate the impacts of conservation issues. Encourage Federal and NGO land managers to focus on this same objective.</p>	<ul style="list-style-type: none"> • # of acres/miles of viable key habitats protected or restored in managed areas in GI Natural Resources Focus Area • # of managed area plans incorporating conservation actions in GI Natural Resources Focus Area
<p>Management on Private Lands – Direct private lands management towards buffering and connecting conservation lands in the Green Infrastructure Natural Resources Focus Area, and towards protecting outlying small patch habitats and SGCN.</p>	<ul style="list-style-type: none"> • # of landowners enrolled in conservation programs in GI Natural Resources Focus Area • # of acres/miles of key habitats protected or restored in GI Natural Resources Focus Area • # of dollars appropriated or spent for incentive programs in GI Natural Resources Focus Area • # of turnkey services developed
<p>Measures of Success, Monitoring, Research and Adaptive Management – Establish performance indicators to measure the success of conservation actions and plan implementation. Monitor species, habitats and impacts of conservation issues, and conduct applied research, so as to facilitate adaptive management.</p>	<ul style="list-style-type: none"> • % of conservation actions initiated or completed by DFW • # of standardized monitoring protocols developed • # of specific performance indicators developed • # of management plans incorporating adaptive management framework • Scorecard developed or updated
<p>Data Collection and Information Management – Collect, manage and analyze data to support wildlife diversity conservation efforts with sound science.</p>	<ul style="list-style-type: none"> • # of spatial database applications for decision support installed or updated • # of users of decision support applications • # of agencies and organizations incorporating SGCN and key habitat data into decision making

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Guiding Principle for Conservation Actions	Implementation Performance Indicators
<p>Division Operations – Reorganize, revise and/or enhance DFW administrative structure, staffing, budgeting, procedures and practices as necessary to facilitate implementation of the DEWAP.</p>	<ul style="list-style-type: none"> • % of known species with current Natural Heritage ranks • % of SGCN and key habitats with current distribution and status/condition information • # of standardized or compatible ecological classification systems developed • # of risk assessments initiated or completed for “direct threat” conservation issues • # of management plans initiated or completed for SGCN, key habitat and “direct threat” conservation issues • # of research projects initiated or completed • # of hours of DFW staff time devoted to SGCN and key habitat conservation • # of dollars of State and Federal funding appropriated or spent for SGCN and key habitat conservation
<p>Partnership Development – Strengthen partnerships with other conservation agencies and organizations to link landscapes, tie together complementary approaches, and leverage investments of time, staff and money.</p>	<ul style="list-style-type: none"> • # of hours of partner staff time devoted to SGCN and key habitat conservation • # of dollars of partner funding appropriated or spent for SGCN and key habitat conservation • # of conservation actions initiated or completed by partners
<p>Education, Outreach and Enforcement – Increase public knowledge of wildlife conservation issues to develop an understanding of habitats, SGCN, and conservation issues and actions; foster a sense of responsibility for personal choices; actively engage citizens in conserving natural resources; and otherwise cultivate support for wildlife diversity conservation. Enforce regulations to promote responsible behavior in interactions with wildlife.</p>	<ul style="list-style-type: none"> • # of State staff trained on key habitat ecology, SGCN biology, and conservation issues and actions • # of “profile brochures,” “citizens guides” and wildlife viewing guides initiated or completed • # of Adopt-a-Wetland and Backyard Habitat participants • # of Certified Citizen Naturalists • # of schoolyard habitats initiated or completed • # of enforcement actions pertaining to SGCN and key habitats • # of hours of DFW staff time devoted to enforcement of regulations protecting SGCN and key habitats

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Guiding Principle for Conservation Actions		Validation Performance Indicators
Conservation of Species vs. Habitats – Target the preservation or restoration of SGCN, but emphasize the management of ecological structure and function of key habitats over management of individual species.		<ul style="list-style-type: none"> • # of viable SGCN occurrences, or SGCN population levels • # of species added to or removed from SGCN list or State endangered list, or with changed Heritage rank • # of acres/miles of viable key habitats

8.5. Examples

The following examples show how the Plan would measure success for SGCN and key habitats. Issues and actions are drawn from Sections 6.1-6.4, and inventory, monitoring and research are taken from Sections 8.1-8.3. For purposes of illustration, only selected issues, actions, inventory, monitoring, research and indicators are shown.

Red Knot			
Conservation Issue	Conservation Action	Inventory, Monitoring, Research	Effectiveness Indicator
Residential and Commercial Structures	Improve federal/state/local coordination of environmental review to ensure that potential impacts to key habitats and SGCN are minimized for all major projects.	Monitor # of major projects receiving coordinated federal/state/local review for impacts to red knots	Change in red knot population level attributable to coordinated review
Recreational Use with Off-Road Vehicles	Strengthen enforcement of regulations for off-road vehicles on managed areas to protect key habitats and SGCN	Monitor # of enforcement actions taken for protection of beach and dune habitats and red knots	Quantity of beach and dune habitat degradation and # of red knot disturbances from off-road vehicles
Overflights	Continue/expand studies of disturbance of red knots from overflights	Research relationship of red knot disturbance to noise level, distance and timing of overflights	# of research projects initiated or completed on disturbance of red knots from overflights
Pets and Subsidized Predators	Work with conservation partners to control subsidized predators in public and NGO conservation lands by reducing subsidies (refuges, food sources), erecting exclosures, or by removal of individuals.	Monitor # of conservation actions taken by partners to control subsidized predators	# of subsidized predators in beach and dune habitats on conservation lands
Validation indicator = red knot population level as determined by monitoring with spring banding and aerial surveys			

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Coastal Plain Seasonal Ponds			
Conservation Issue	Conservation Action	Inventory, Monitoring, Research	Effectiveness Indicator
Residential and Commercial Structures	Coordinate with partners to acquire title to, or easements on, sites that are critical to the conservation of key habitats within the Green Infrastructure Natural Resources Focus Area, for management by public agencies or NGOs	Monitor # of Coastal Plain pond sites acquired or eased in coordination with key partners	Change in acreage of Coastal Plain pond habitat attributable to coordinated acquisition or easement
Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.	Research impacts of groundwater withdrawals on Coastal Plain pond habitat	# of research projects initiated or completed on impacts of groundwater withdrawals on Coastal Plain pond habitat
Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives to tax ditch associations to implement BMPs that minimize impacts to key habitats.	Monitor # of tax ditch associations implementing BMPs	Change in Coastal Plain pond habitat viability from implementation of BMPs
Baseline information	Conduct surveys to more fully document the current distribution and condition of key habitats.	Inventory Coastal Plain ponds mapped with habitat modeling	# of Coastal Plain ponds verified extant
Validation indicator = acres of viable Coastal Plain pond habitat as determined by monitoring habitat distribution and extent			

SECTION 9

Plan Review and Update

9. Plan Review and Update

The Plan will be updated continuously by DFW as soon as new information becomes available about species, habitats, issues or actions. These updates will be formally reviewed for the first time two years after approval, with subsequent reviews every five years. Reviews will be conducted by the Key Partners steering committee (Section 10), and will include all aspects of the Plan – SGCN, Key Wildlife Habitats, and Conservation Issues and Actions. A database is under development to track updates of Plan components in order to facilitate the review process.

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SECTION 10

Plan Implementation

10. Plan Implementation

Two aspects of DEWAP implementation are noteworthy for their use of partnerships. The Key Partners group that provided guidance for the Plan development (Section 1.3) will be reconstituted as a “steering committee,” coordinated by DFW, to guide Plan implementation. For this purpose it will be expanded to include representatives from other state agencies, additional external organizations, and stakeholder and user groups. It is anticipated that initially this group will meet every six months to set priorities, strategize approaches for implementing actions, and review measures of success. Specific tasks may include formulating the schedule and process for Plan updates and revisions and reviewing those updates and revisions; reviewing proposed conservation actions and monitoring efforts; establishing a process for providing State Wildlife Grant funding to external parties; reviewing proposed internal and external grant projects; and others as appropriate.

One implementation strategy will be to develop more detailed, site-based conservation plans for ecologically distinct portions of the Green Infrastructure Natural Resources Focus Area. A pilot project for such plans was recently completed through a partnership between DFW and the Delaware Chapter of The Nature Conservancy. The executive summary and technical report of the *Blackbird-Millington Corridor Conservation Area Plan* is attached in Appendix G.

The Blackbird-Millington plan seeks to preserve and enhance the Corridor’s natural resources by bringing the perspectives of the scientific community together with those of local residents, planning agencies and conservation organizations. This innovative approach to conservation planning focuses on maximizing cooperation and support among a diversity of organizations, agencies, and individuals. The results of this planning effort will serve as a guide for targeting multiple resources to the Corridor – from public and private conservation partners, community members, and other interested individuals.

Also, an interactive version of DEWAP will be posted on the DNREC website and made widely available on CD following acceptance of the Plan. This will incorporate features not included in the hardcopy version (due to format limitations), scalable maps, and hyperlinks.

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SECTION 11

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SECTION 12

Appendices

- Appendix A – Green Infrastructure
- Appendix B – Species of Greatest Conservation Need
- Appendix C – Species-Habitat Associations
- Appendix D – General Wildlife Habitat Maps
- Appendix E – Key Wildlife Habitat Maps
- Appendix F – Key Habitats/Development and Green
Infrastructure Maps
- Appendix G – Blackbird-Millington Corridor
Conservation Area Plan
- Appendix H – Existing/Planned Monitoring Programs

NOTE: *The following appendices are available only on the supplementary Wildlife Action Plan CD: Appendix A, D, E, F, G, H*

Appendix B

Species of Greatest
Conservation Need

Appendix B

Species of Greatest Conservation Need

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Delaware Species of Greatest Conservation Need

See Key on last page for explanation of Criteria factors and Cross Reference schemes

Tier 1 criteria: State Endangered; sensitive/significant DE populations; Federal Endangered or Threatened; global rank G1/T1 or G2/T2; NETC listing warranted; BCR 30 Highest tier; AFS endangered or threatened
Tier 2 criteria: State rank S1, S2, SH, SX, (if not Tier 1); Federal Candidate; global rank G3/T3; NETC concern (if not Tier 1); BCR 30 High tier; AFS vulnerable; NMFS prohibited fishery

Species		CRITERIA										CROSS REFERENCE											
		State Status	State Rank	Sensitive/ Significant DE Populations	Federal Status	Global Rank	NETC Listing	NETC Concern	BCR 30 Tier	AFS Status	NMFS Prohibited	CITES App I	CITES App II	CITES App III	IUCN Cat	ASMFC Mgd	MAFMC Mgd	NBCI Mgd	USSCP Regional Priority	NAWMP Population Goal %	NAWCPC Risk Category	PIF 44 Level	TNC Target
Tier 1																							
Bivalves																							
Alasmidonta heterodon	dwarf wedgemussel	E	SH		E	G1G2	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>	<div></div>	EN	<div></div>	<div></div>	<div></div>					<div>✓</div>
Alasmidonta undulata	triangle floater		SH	restricted range		G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					<div>✓</div>
Alasmidonta varicosa	brook floater	E	SX			G3	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>	DD	<div></div>	<div></div>	<div></div>						<div>✓</div>
Crassostrea virginica	American oyster			regional rarity		G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Lampsilis cariosa	yellow lampmussel	E	SH			G3G4	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>	EN	<div></div>	<div></div>	<div></div>						<div>✓</div>
Lampsilis radiata	Eastern lampmussel	E	S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Leptodea ochracea	tidewater mucket	E	S1			G4	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>	NT	<div></div>	<div></div>	<div></div>						<div>✓</div>
Ligumia nasuta	Eastern pondmussel	E	S1			G4G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>	NT	<div></div>	<div></div>	<div></div>						<div>✓</div>
Crustaceans																							
Callinectes sapidus	blue crab			keystone species			<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Arachnids																							
Limulus polyphemus	horseshoe crab			keystone species		G?	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div>✓</div>	<div></div>	<div></div>						<div>✓</div>
Insects																							
Autochton cellus	gold-banded skipper		SH	regional rarity		G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Callophrys hesseli	Hessel's hairstreak	E	S1			G3G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Callophrys irus	frosted elfin	E	S1			G3	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Catocala antinympha	sweetfern underwing		SH	regional rarity		G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Catocala carissima	an underwing moth		S1?	disjunct		G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Catocala lacrymosa	tearful underwing		S1S3	regional rarity		G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Catocala marmorata	marbled underwing		SU	regional rarity		G3G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Catocala nebulosa	clouded underwing		S1	regional rarity		G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Cicindela dorsalis media	white tiger beetle	E	SU			G4T4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Cicindela lepida	little white tiger beetle	E	S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Cicindela patruela consentanea	a tiger beetle		SH			G3T2T3	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Cicindela rufiventris	a tiger beetle		SU	one occurrence		G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Euphyes conspicua	black dash		S1	restricted range		G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Exyra fax	pitcher plant moth		S1	regional rarity		G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Gomphus fraternus	midland clubtail		S1	restricted range		G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Hadena ectypa	a noctuid moth		SH	regional rarity		G3G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Hydrochus spangleri	Seth Forest water scavenger beetl	E	SH			G1	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Nannothemis bella	elfin skimmer		S1	regional rarity		G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Nicrophorus americanus	American burying beetle		SX		E	G2G3	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>	CR	<div></div>	<div></div>	<div></div>						<div></div>
Papaipema appassionatoa	pitcher plant borer moth		SH	regional rarity		G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Papaipema duplicata	dark stoneroot borer moth		SH	regional rarity		G2G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Papaipema eupatorii	eupatorium borer moth		SH	regional rarity		G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Papaipema maritima	maritime sunflower borer moth		S1	regional rarity		G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Photuris bethaniensis	a firefly	E	S1			G1?	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Poanes massasoit	mulberry wing	E	S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Poanes massasoit chermocki	Chermock's mulberry wing		S1			G4T1	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Problema bulenta	rare skipper	E	S1			G2G3	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Satyrium kingi	King's hairstreak	E	S1			G3G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Fishes																							
Pristis pectinata	smalltooth sawfish				E	G1G3	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	EN	<div></div>	<div></div>	<div></div>						<div></div>

Species		CRITERIA									CROSS REFERENCE												
		State Status	State Rank	Sensitive/ Significant DE Populations	Federal Status	Global Rank	NETC Listing	NETC Concern	BCR 30 Tier	AFS Status	NMFS Prohibited	CITES App I	CITES App II	CITES App III	IUCN Cat	ASMFC Mgd	MAFMC Mgd	NBCI Mgd	USSCP Regional Priority	NAWMP Population Goal %	NAWCP Risk Category	PIF 44 Level	TNC Target
Tier 1																							
Fishes																							
Acantharchus pomotis	mud sunfish		S2			G5	✓	✓			☐	☐	☐		☐	☐	☐						☐
Acipenser brevirostrum	shortnose sturgeon		S3N		E	G3	☐	✓		T	☐	✓	☐	VU	☐	☐	☐						✓
Acipenser oxyrinchus	Atlantic sturgeon	E	S2		C	G3	☐	☐		CD	☐	☐	✓	NT	✓	☐	☐						✓
Cottus caeruleomentum	Blueridge sculpin		S1	one occurrence		G4	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Ictalurus natalis	yellow bullhead		S3S4	restricted range		G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Moxostoma macrolepidotum	shorthead redhorse		S1	one occurrence		G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Notropis bifrenatus	bridle shiner		S1	regional rarity		G5	☐	✓			☐	☐	☐	☐	☐	☐	☐						☐
Notropis chalybaeus	ironcolor shiner		S1	regional rarity		G4	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Percina peltata	shield darter		S1	one occurrence		G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Amphibians																							
Ambystoma tigrinum tigrinum	tiger salamander	E	S1			G5	☐	✓			☐	☐	☐	☐	☐	☐	☐						✓
Hyla gratiosa	barking treefrog	E	S1			G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						✓
Reptiles																							
Caretta caretta	loggerhead sea turtle	E	SNA		T	G3	☐	✓			☐	✓	☐	EN	☐	☐	☐						✓
Cemophora coccinea	scarlet snake		SH	regional rarity		G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Chelonia mydas	Atlantic green turtle	E	SNA		T	G3	☐	✓			☐	✓	☐	EN	☐	☐	☐						☐
Clemmys guttata	spotted turtle		S3	collecting pressure		G5	☐	✓			☐	☐	☐	VU	☐	☐	☐						☐
Dermochelys coriacea	leatherback sea turtle	E	SNA		E	G2	☐	✓			☐	✓	☐	CR	☐	☐	☐						✓
Elaphe guttata	corn snake	E	S1			G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Eumeces laticeps	broadhead skink		SH	regional rarity		G5	☐	✓			☐	☐	☐	☐	☐	☐	☐						☐
Glyptemys muhlenbergii	bog turtle	E	S1		T	G3	☐	✓			☐	✓	☐	EN	☐	☐	☐						✓
Lampropeltis triangulum	milk snake		S1	restricted range		G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Lepidochelys kempii	Kemp's Ridley sea turtle	E	SNA		E	G1	☐	✓			☐	✓	☐	CR	☐	☐	☐						✓
Malaclemys terrapin terrapin	Northern diamondback terrapin		S4			G4T4	✓	✓			☐	☐	☐	NT	☐	☐	☐						☐
Nerodia erythrogaster	plainbelly water snake		S1	disjunct		G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Terrapene carolina carolina	Eastern box turtle		S5	collecting pressure		G5	☐	✓			☐	☐	✓	☐	☐	☐	☐						☐
Birds																							
Accipiter cooperii	Cooper's hawk	E	S1B			G5	☐	☐			☐	☐	✓	☐	☐	☐	☐						☐
Accipiter striatus	sharp-shinned hawk		SHB,S4N	regional rarity		G5	☐	☐			☐	☐	✓	☐	☐	☐	☐						☐
Actitis macularia	spotted sandpiper		S1	regional rarity		G5	☐	☐	Moderate		☐	☐	☐	☐	☐	☐	☐	3					☐
Ammodramus caudacutus	saltmarsh sharp-tailed sparrow		S1N,S3B			G4	☐	✓	Highest		☐	☐	☐	NT	☐	☐	☐				I		☐
Ammodramus henslowii	Henslow's sparrow	E	SHB,S1N			G4	☐	✓	Moderate		☐	☐	☐	☐	☐	☐	☐				I		☐
Ammodramus maritimus	seaside sparrow		S4B			G4	☐	☐	Highest		☐	☐	☐	☐	☐	☐	☐				I		☐
Anas rubripes	American black duck		S4B,S4N			G5	☐	✓	Highest		☐	☐	☐	☐	☐	☐	☐		58				✓
Arenaria interpres	ruddy turnstone		S2N			G5	☐	☐	Highest		☐	☐	☐	☐	☐	☐	☐	4					☐
Asio flammeus	short-eared owl	E	SHB,S2N			G5	☐	✓	Moderate		☐	☐	☐	☐	☐	☐	☐				I		☐
Asio otus	long-eared owl		SHB,S1N	regional rarity		G5	☐	✓			☐	☐	☐	☐	☐	☐	☐						☐
Bartramia longicauda	upland sandpiper	E	SHB			G5	☐	✓			☐	☐	☐	☐	☐	☐	☐	4			Ila		☐
Branta canadensis	Canada goose (migratory)		S4B,S5N			G5	☐	☐	Highest		☐	☐	☐	☐	☐	☐	☐		/ 29, Resi				☐
Buteo platypterus	broad-winged hawk		S1B	regional rarity		G5	☐	☐	High		☐	☐	✓	☐	☐	☐	☐				Ila		☐
Calidris alba	sanderling		S2N			G5	☐	☐	Highest		☐	☐	☐	☐	☐	☐	☐	4					☐
Calidris canutus	red knot		S2N	one occurrence		G5	☐	☐	Highest		☐	☐	☐	☐	☐	☐	☐	5					☐
Catharus bicknelli	Bicknell's thrush		SNA	one occurrence		G4	✓	✓			☐	☐	☐	VU	☐	☐	☐						✓
Certhia americana	brown creeper	E	S1B,S4N			G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						✓
Charadrius melodus	piping plover	E	S1B		T	G3	☐	✓	Highest		☐	☐	☐	VU	☐	☐	☐	5					✓
Chordeiles minor	common nighthawk		S2B	restricted range		G5	☐	☐			☐	☐	☐	☐	☐	☐	☐						☐
Circus cyaneus	Northern harrier	E	S1B,S4N			G5	☐	✓			☐	☐	✓	☐	☐	☐	☐						✓
Cistothorus platensis	sedge wren	E	S1B			G5	☐	✓	Moderate		☐	☐	☐	☐	☐	☐	☐				Ila		☐
Dendroica cerulea	cerulean warbler	E	S1B			G4	☐	✓	Moderate		☐	☐	☐	☐	☐	☐	☐				I		✓
Dendroica discolor	prairie warbler		S4B			G5	☐	✓	Highest		☐	☐	☐	☐	☐	☐	☐				I		✓

Species	CRITERIA										CROSS REFERENCE											
	State Status	State Rank	Sensitive/ Significant DE Populations	Federal Status	Global Rank	NETC Listing	NETC Concern	BCR 30 Tier	AFS Status	NMFS Prohibited	CITES App I	CITES App II	CITES App III	IUCN Cat	ASMFC Mgd	MAFMC Mgd	NBCI Mgd	USSCP Regional Priority	NAWMP Population Goal %	NAWCP Risk Category	PIF 44 Level	TNC Target
Tier 1																						
Birds																						
<i>Haematopus palliatus</i>	E	S1B	American oystercatcher		G5	<input type="checkbox"/>	<input type="checkbox"/>	Highest		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5				<input checked="" type="checkbox"/>
<i>Haliaeetus leucocephalus</i>	E	S2B,S3N	bald eagle	T	G4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Moderate		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>
<i>Hylocichla mustelina</i>		S5B	wood thrush		G5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Highest		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				I	<input type="checkbox"/>
<i>Lanius ludovicianus</i>	E	SHB	loggerhead shrike		G4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Moderate		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				IIc	<input type="checkbox"/>
<i>Laterallus jamaicensis</i>	E	S1B	black rail		G4	<input type="checkbox"/>	<input type="checkbox"/>	High		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				IIa	<input checked="" type="checkbox"/>
<i>Limnothlypis swainsonii</i>	E	SHB	Swainson's warbler		G4	<input type="checkbox"/>	<input type="checkbox"/>	Moderate		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				I	<input checked="" type="checkbox"/>
<i>Melanerpes erythrocephalus</i>	E	S1	red-headed woodpecker		G5	<input type="checkbox"/>	<input type="checkbox"/>	Moderate		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				I	<input type="checkbox"/>
<i>Melospiza georgiana nigrescens</i>		S3B	Coastal Plain swamp sparrow		G5T3	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Numenius phaeopus</i>		SNA	whimbrel		G5	<input type="checkbox"/>	<input type="checkbox"/>	Highest		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5				<input type="checkbox"/>
<i>Nyctanassa violacea</i>	E	S1B	yellow-crowned night-heron		G5	<input type="checkbox"/>	<input type="checkbox"/>	Moderate		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			3		<input type="checkbox"/>
<i>Nycticorax nycticorax</i>	E	S1B	black-crowned night-heron		G5	<input type="checkbox"/>	<input type="checkbox"/>	Moderate		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			3		<input type="checkbox"/>
<i>Pandion haliaetus</i>		S3B	osprey		G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>
<i>Parula americana</i>	E	S1B	Northern parula		G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>
<i>Podilymbus podiceps</i>	E	S1B,S3N	pieb-billed grebe		G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>
<i>Puffinus lherminieri</i>		SNA	Audubon's shearwater		G4G5	<input type="checkbox"/>	<input type="checkbox"/>	Highest		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			5		<input type="checkbox"/>
<i>Rynchops niger</i>	E	S1B	black skimmer		G5	<input type="checkbox"/>	<input type="checkbox"/>	High		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			4		<input checked="" type="checkbox"/>
<i>Scolopax minor</i>		S4	American woodcock		G5	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Highest		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5			IIa	<input type="checkbox"/>
<i>Setophaga ruticilla</i>		S1B	American redstart		G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>
<i>Somateria mollissima</i>		SNA	common eider		G5	<input type="checkbox"/>	<input type="checkbox"/>	Highest		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Sterna antillarum</i>	E	S1B	least tern	E	G4	<input type="checkbox"/>	<input checked="" type="checkbox"/>	High		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			4		<input type="checkbox"/>
<i>Sterna dougallii dougallii</i>		SNA	roseate tern	E	G4T3	<input type="checkbox"/>	<input type="checkbox"/>	High		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input type="checkbox"/>
<i>Sterna forsteri</i>	E	S1B	Forster's tern		G5	<input type="checkbox"/>	<input type="checkbox"/>	Moderate		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			3		<input type="checkbox"/>
<i>Sterna hirundo</i>	E	S1B	common tern		G5	<input type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			2		<input type="checkbox"/>
<i>Vermivora pinus</i>		S1B	blue-winged warbler		G5	<input type="checkbox"/>	<input type="checkbox"/>	Highest		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				I	<input checked="" type="checkbox"/>
<i>Wilsonia citrina</i>	E	S1B	hooded warbler		G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
Mammals																						
<i>Balaena glacialis</i>		SXB	Northern right whale	E	G1	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	EN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Balaenoptera borealis</i>		SNA	sei whale	E	G3	<input type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	EN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Balaenoptera musculus</i>		SNA	blue whale	E	G3G4	<input type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	EN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Balaenoptera physalus</i>		SNA	fin whale	E	G3G4	<input type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	EN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Megaptera novaeangliae</i>		SNA	humpback whale	E	G3	<input type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	VU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Myotis leibii</i>		SU	Eastern small-footed myotis		G3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Phocoena phocoena</i>		SNA	harbor porpoise		G4G5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Physeter catodon</i>		SNA	sperm whale	E	G3G4	<input type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	VU	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>
<i>Sciurus niger cinereus</i>	E	S1	Delmarva fox squirrel	E	G5T3	<input type="checkbox"/>	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					<input checked="" type="checkbox"/>

Species		CRITERIA									CROSS REFERENCE												
		State Status	State Rank	Sensitive/ Significant DE Populations	Federal Status	Global Rank	NETC Listing	NETC Concern	BCR 30 Tier	AFS Status	NMFS Prohibited	CITES App I	CITES App II	CITES App III	IUCN Cat	ASMFC Mgd	MAFMC Mgd	NBCI Mgd	USSCP Regional Priority	NAWMP Population Goal %	NAWCW Risk Category	PIF 44 Level	TNC Target
Tier 2																							
Gastropods																							
Anguispira alternata	flamed tigersnail		S1S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Anguispira fergusonii	Coastal Plain tigersnail		S1?			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Carychium exiguum	obese thorn		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						
Discus catskillensis	angular disc		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Euconulus dentatus	toothed hive		S1?			G4G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Gastrocopta armifera	armed snaggletooth		S1S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Haplotrema concavum	gray-foot lancetooth		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Philomycus flexuolaris	winding mantleslug		S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Pomatiopsis lapidaria	slender walker		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Punctum vitreum	glass spot		S1?			G4G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Pupoides albilabris	white-lip dagger		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Stenotrema hirsutum	hairy slitmouth		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Triodopsis tridentata	Northern threetooth		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Ventridens intertextus	pyramid dome		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Vertigo pygmaea	crested vertigo		S1?			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Vertigo teskeyae	swamp vertigo		S1?			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Vertigo tridentata	honey vertigo		S2S3			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Zonitoides nitidus	black gloss		S1?			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Bivalves																							
Anodonta implicata	alewife floater		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Elliptio fisheriana	Northern lance		S2			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Strophitus undulatus	creeper		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Insects																							
Acontia delecta	a noctuid moth		S1S3			G4?	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Acronicta connecta	a noctuid moth		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Acronicta exilis	exiled dagger moth		S2?			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Acronicta increta	a dagger moth		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Acronicta lithospila	streaked dagger moth		SH			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Acronicta rubricoma	a dagger moth		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Aeshna tuberculifera	black-tipped darner		S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Aeshna verticalis	green-striped darner		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Agabetes acuductus	a hydrophylid beetle		SU			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Agnorisma bollii	a noctuid moth		S1S3			G4?	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Agrius cingulata	pink spotted hawkmoth		SU			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Amblyscirtes aesculapius	lace-winged roadside-skipper		SNR			G3G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Amblyscirtes carolina	Carolina roadside-skipper		SNR			G3G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Amorpha juglandis	walnut sphinx		SH			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Anacamptodes pergracilis	cypress looper		S1			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Anatrytone logan	Delaware skipper		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Anax longipes	comet darner		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						✓
Archanara subflava	a moth		SU			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Archilestes grandis	great spreadwing		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Argia bipunctulata	seepage dancer		S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						✓
Argia moesta	powdered dancer		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Argia translata	dusky dancer		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Argyrostromis quadrifilaris	a noctuid moth		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Asterocampa celtis	hackberry emperor		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Atlides halesus	great purple hairstreak		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						✓
Atrytonopsis hianna	dusted skipper		S1			G4G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Battus philenor	pipevine swallowtail		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>

Species		CRITERIA									CROSS REFERENCE												
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Tier 2																							
Insects																							
Bellura gortynoides	a moth		SU			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Boloria bellona	meadow fritillary		SU			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Boloria selene	silver-bordered fritillary		S1			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
Boloria selene myrina	myrina fritillary		S1			G5T5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Brachymesia gravida	four-spotted pennant		S1			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Callophrys augustinus	brown elfin		SU			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Callophrys gryneus	juniper hairstreak		S2			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Callophrys henrici	Henry's elfin		SU			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Calyptra canadensis	Canadian owlet		S1S2			GNR	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Caripeta aretaria	a moth		S1S3			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala alabamae	Alabama underwing		S1S2			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala cerogama	yellow banded underwing		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala flebilis	mournful underwing		S1S3			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala insolabilis	inconsolable underwing		SH			GNR	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala maestosa	sad underwing		SH			GNR	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala minuta	little underwing		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala palaeogama	oldwife underwing		SU			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala parta	mother underwing		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala praeclara	praeclara underwing		S1S2			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala residua	residua underwing		S2?			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Catocala unijuga	once-married underwing		SH			GNR	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Celithemis monomelaena	black spotted skimmer		S2			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Celithemis ornata	faded pennant		S2			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Celithemis verna	double-ringed pennant		S1			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Ceratomia undulosa	waved sphinx		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cerura scitiscrypta	black-etched prominent		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Chloropteryx tepperaria	angle winged emerald moth		S2?			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cicindela dorsalis	Eastern beach tiger beetle		SH			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cicindela duodecimguttata	a tiger beetle		SU			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cicindela formosa generosa	a tiger beetle		SU			G5T5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cicindela hirticollis	beach-dune tiger beetle		S2			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cicindela marginata	a tiger beetle		S1			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cicindela patruela	a tiger beetle		SH			G3	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cicindela purpurea	a tiger beetle		SU			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input checked="" type="checkbox"/>
Cicindela scutellaris	a tiger beetle		S1?			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cicindela unipunctata	a tiger beetle		S2?			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cirrhophanus triangulifer	a noctuid moth		S2S3			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cisthene kentuckiensis	Kentucky lichen moth		SH			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cisthene tenuifascia	a lichen moth		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Copivaleria grotei	Grote's sallow		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cordulegaster bilineata	brown spiketail		S2			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Cordulegaster erronea	tiger spiketail		S2			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input checked="" type="checkbox"/>
Darapsa versicolor	hydrangea sphinx		S1S3			GNR	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Deidamia inscripta	lettered sphinx		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Dolba hyloeus	black alder or pawpaw sphinx		SH			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Drasteria graphica	a noctuid moth		S1			G4	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Drasteria graphica atlantica	Atlantic graphic moth		S1			GNR	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Dromogomphus spinosus	black-shouldered spinyleg		S2			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>
Enallagma dubium	burgundy bluet		S1			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input checked="" type="checkbox"/>
Enallagma durum	big bluet		S2			G5	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						<input type="checkbox"/>

Species		CRITERIA									CROSS REFERENCE												
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Tier 2																							
Insects																							
Enallagma pallidum	pale bluet		S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Enallagma vesperum	vesper bluet		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Enallagma weewa	blackwater bluet		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Erynnis baptisiae	wild indigo duskywing		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Erynnis brizo brizo	sleepy dusky wing		SU			G5T5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Erynnis icelus	dreamy duskywing		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Erynnis martialis	mottled duskywing		SH			G3G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Euphydryas phaeton	Baltimore checkerspot		S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Euphyes dion	dion skipper		S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Feniseca tarquinius	harvester		SU			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Gluphisia lintneri	a notodontid moth		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Gomphaeschna antilope	taper-tailed darner		S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Gomphaeschna furcillata	harlequin darner		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Gomphus apomyius	banner clubtail		S1			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Gomphus plagiatus	russet-tipped clubtail		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Gomphus rogersi	sable clubtail		S1			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Gomphus spiniceps	arrow clubtail		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Gomphus villosipes	unicorn clubtail		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Grammia phyllira	phyllira tiger moth		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Haploa colona	a moth		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Helocombus bifidus	a water-scavenger beetle		SU			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Helocordulia selysii	Selys' sundragon		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Hemileuca maia maia	the buckmoth		SU			G5T5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Hesperia metea	cobweb skipper		S1			G4G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Hesperia sassacus	indian skipper		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Heterocampa astarte	a notodontid moth		SH			G4G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Hoperius planatus	a hydrophilid beetle		S1			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Ischnura kellicotti	lilypad forktail		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Lepipolys perscripta	a moth		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Lestes eurinus	amber-winged spreadwing		S2			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Leucorrhinia intacta	dot-tailed whiteface		SH			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Libellula auripennis	golden-winged skimmer		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Libellula axilena	bar-winged skimmer		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Libellula deplanata	blue corporal		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Libellula flavida	yellow-sided skimmer		SH			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Libytheana carinenta	American snout		SH			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Lophocampa caryae	an arctiid moth		S1			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Lucanus elephus	giant stag beetle		SH			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Lycaena hyllus	bronze copper		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Macrochilo louisiana	a noctuid moth		SU			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Macromia illinoiensis	Illinois river cruiser		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Macromia taeniolata	royal river cruiser		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Manduca jasmineearum	ash sphinx		SH			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Manduca rustica	a sphinx moth		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Megacephala virginica	Virginia big-headed tiger beetle		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Melitara prodenialis	a moth		SH			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Nehalennia gracilis	sphagnum sprite		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Nehalennia integricollis	Southern sprite		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Nehalennia irene	sedge sprite		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Nigetia formosalis	a noctuid moth		S1S2			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>

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Tier 2																							
Insects																							
Orgyia detrita	a tussock moth		S1			GNR	■	■			■	■	■		■	■	■						■
Ostrocerca prolongata	a stonefly		SNR			G3	■	■			■	■	■		■	■	■						■
Paonias astylus	huckleberry sphinx		SH			G4G5	■	■			■	■	■		■	■	■						
Papaipema araliae	aralia shoot borer moth		SH			G3G4	■	■			■	■	■		■	■	■						■
Papaipema astuta	yellow stoneroot borer		SH			G3G4	■	■			■	■	■		■	■	■						■
Papaipema baptisiae	wild indigo borer moth		SH			G4	■	■			■	■	■		■	■	■						■
Papaipema birdi	umbellifer borer moth		SH			G5	■	■			■	■	■		■	■	■						■
Papaipema circumlucens	hop borer		SH			G4	■	■			■	■	■		■	■	■						■
Papaipema furcata	ash borer moth		SU			G4	■	■			■	■	■		■	■	■						■
Papaipema lysimachiae	loosestrife borer moth		SU			G4	■	■			■	■	■		■	■	■						■
Papaipema pterisii	bracken borer moth		SH			G5	■	■			■	■	■		■	■	■						■
Papaipema rigida	a noctuid moth		SH			G5	■	■			■	■	■		■	■	■						■
Papaipema rutila	mayapple borer moth		SU			G4	■	■			■	■	■		■	■	■						■
Papaipema speciosissima	osmunda borer moth		SH			G4	■	■			■	■	■		■	■	■						■
Papaipema stenocelis	chain fern borer moth		S2?			G4	■	■			■	■	■		■	■	■						■
Parahypenodes quadralis	a noctuid moth		SU			G4	■	■			■	■	■		■	■	■						■
Parapamea buffaloensis	a borer moth		SH			G4	■	■			■	■	■		■	■	■						■
Paratrea plebeja	trumpet vine sphinx		SH			G5	■	■			■	■	■		■	■	■						■
Pero hubneraria	a moth		S1?			GNR	■	■			■	■	■		■	■	■						■
Pero zalissaria	a moth		S1S3			G4	■	■			■	■	■		■	■	■						■
Photuris frontalis	a firefly		S1			GNR	■	■			■	■	■		■	■	■						■
Photuris hebes	a firefly		S1S2			GNR	■	■			■	■	■		■	■	■						■
Photuris pensylvanica	a firefly		S2S3			GNR	■	■			■	■	■		■	■	■						■
Photuris pyralomimus	a firefly		S1S3			GNR	■	■			■	■	■		■	■	■						■
Photuris tremulans	a firefly		S1			GNR	■	■			■	■	■		■	■	■						■
Poanes hobomok	hobomok skipper		SU			G5	■	■			■	■	■		■	■	■						■
Polygonia progne	gray comma		SH			G5	■	■			■	■	■		■	■	■						■
Pompeius verna	little glassywing		SU			G5	■	■			■	■	■		■	■	■						■
Pontia protodice	checkered white		SU			G4	■	■			■	■	■		■	■	■						■
Satyrium liparops	striped hairstreak		S1			G5	■	■			■	■	■		■	■	■						■
Satyrium liparops strigosum	striped hairstreak		S1			G5T5	■	■			■	■	■		■	■	■						■
Satyrodes eurydice	eyed brown		SH			G4	■	■			■	■	■		■	■	■						■
Schinia septentrionalis	a noctuid moth		SH			GU	■	■			■	■	■		■	■	■						■
Schinia spinosae	a noctuid moth		SH			G4	■	■			■	■	■		■	■	■						■
Schinia trifascia	three-lined flower moth		SH			GNR	■	■			■	■	■		■	■	■						■
Somatochlora filosa	fine-lined emerald		S2			G5	■	■			■	■	■		■	■	■						■
Somatochlora provocans	treetop emerald		S1			G4	■	■			■	■	■		■	■	■						✓
Speyeria aphrodite	aphrodite fritillary		SH			G5	■	■			■	■	■		■	■	■						■
Speyeria idalia	regal fritillary		SX			G3	■	■			■	■	■		■	■	■						✓
Sphinx chersis	great ash sphinx		SH			G4G5	■	■			■	■	■		■	■	■						■
Sphinx eremitus	hermit sphinx		S1			G4	■	■			■	■	■		■	■	■						■
Sphinx franckii	Franck's sphinx		SH			G4	■	■			■	■	■		■	■	■						■
Stiriodes obtusa	a moth		S2S3			G4G5	■	■			■	■	■		■	■	■						■
Stylogomphus albistylus	least clubtail		S2			G5	■	■			■	■	■		■	■	■						■
Sympetrum ambiguum	blue-faced meadowhawk		S1			G5	■	■			■	■	■		■	■	■						■
Sympetrum semicinctum	band-winged meadowhawk		S1			G5	■	■			■	■	■		■	■	■						■
Synanthedon castaneae	chestnut clearwing moth		SX			G3G5	■	■			■	■	■		■	■	■						■
Tetragoneuria costalis	stripe-winged baskettail		S1			G4	■	■			■	■	■		■	■	■						■
Tetragoneuria spinosa	robust baskettail		S1			G4	■	■			■	■	■		■	■	■						■
Tolyte notialis	a lasiocampid moth		SH			GNR	■	■			■	■	■		■	■	■						■

Species		CRITERIA									CROSS REFERENCE												
		State Status	State Rank	Sensitive/ Significant DE Populations	Federal Status	Global Rank	NETC Listing	NETC Concern	BCR 30 Tier	AFS Status	NMFS Prohibited	CITES App I	CITES App II	CITES App III	IUCN Cat	ASMFC Mgd	MAFMC Mgd	NBCI Mgd	USSCP Regional Priority	NAWMP Population Goal %	NAWCPC Risk Category	PIF 44 Level	TNC Target
Tier 2																							
Insects																							
Xestia youngii	a noctuid moth		S1S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Zale metata	a noctuid moth		S2S3			GNR	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Fishes																							
Lampetra aepyptera	least brook lamprey		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Lampetra appendix	American brook lamprey		S2			G4	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Fishes																							
Carcharhinus obscurus	dusky shark				C	G3	<div></div>	<div></div>		V	<div>✓</div>	<div></div>	<div></div>	NT	<div></div>	<div></div>	<div></div>						<div>✓</div>
Carcharodon carcharias	white shark					G?	<div></div>	<div></div>		CD	<div>✓</div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Cetorhinus maximus	basking shark					G?	<div></div>	<div></div>		V	<div>✓</div>	<div></div>	<div>✓</div>	VU	<div></div>	<div></div>	<div></div>						<div>✓</div>
Squatina dumeril	Atlantic angel shark					G?	<div></div>	<div></div>			<div>✓</div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Fishes																							
Alosa mediocris	hickory shad		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div>✓</div>	<div></div>	<div></div>						<div></div>
Apeltes quadracus	fourspine stickleback		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Enneacanthus chaetodon	blackbanded sunfish		S2			G4	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Enneacanthus obesus	banded sunfish		S2			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Etheostoma vitreum	glassy darter		S1			G4G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Notropis amoenus	comely shiner		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Noturus insignis	marginéd madtom		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Amphibians																							
Ambystoma maculatum	spotted salamander		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Eurycea longicauda	longtail salamander		S1			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Hemidactylium scutatum	four-toed salamander		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Hyla chrysoscelis	Cope's gray treefrog		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Pseudotriton montanus montanu	mud salamander		S1			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Rana virgatipes	carpenter frog		S1			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Scaphiopus holbrookii	Eastern spadefoot		S4			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Reptiles																							
Agkistrodon contortrix	copperhead		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Eretmochelys imbricata imbricat	hawksbill		SNA			G3	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Heterodon platirhinos	Eastern hognose snake		S4			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Lampropeltis getula	common kingsnake		S2S3			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Opheodrys aestivus	rough green snake		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Pituophis melanoleucus melanol	pine snake		SNA			G4	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Pseudemys rubriventris	redbelly turtle		S5			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Regina septemvittata	queen snake		S1			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Scincella lateralis	ground skink		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Storeria occipitomaculata	redbelly snake		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Thamnophis sauritus sauritus	Eastern ribbon snake		S2			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Virginia valeriae	smooth earth snake		S1			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Birds																							
Ammodramus savannarum	grasshopper sparrow		S3B			G5	<div></div>	<div>✓</div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ilc	<div></div>
Anas clypeata	Northern shoveler		SHB,S4N			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>		159				<div></div>
Anas platyrhynchos	mallard		S5B,S5N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>		118				<div></div>
Ardea herodias	great blue heron		S2B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				1		<div></div>
Aythya affinis	lesser scaup		S4N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>		55				<div>✓</div>
Aythya americana	redhead		S2N			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>		157				<div></div>
Aythya marila	greater scaup		S4N			G5	<div></div>	<div>✓</div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>		55				<div>✓</div>
Aythya valisineria	canvasback		S2N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>		127				<div>✓</div>
Bonasa umbellus	ruffed grouse		SX			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Botaurus lentiginosus	American bittern		S1B			G4	<div></div>	<div>✓</div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>

Species		CRITERIA									CROSS REFERENCE												
		State Status	State Rank	Sensitive/ Significant DE Populations	Federal Status	Global Rank	NETC Listing	NETC Concern	BCR 30 Tier	AFS Status	NMFS Prohibited	CITES App I	CITES App II	CITES App III	IUCN Cat	ASMFC Mgd	MAFMC Mgd	NBCI Mgd	USSCP Regional Priority	NAWMP Population Goal %	NAWCP Risk Category	PIF 44 Level	TNC Target
Tier 2																							
Birds																							
Branta bernicla	brant		S4N			G5	<div></div>	<div>✓</div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>			98			<div></div>
Bubulcus ibis	cattle egret		S1B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				1		<div></div>
Bucephala albeola	bufflehead		S4N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Buteo lineatus	red-shouldered hawk		S2B,S3N			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div>✓</div>	<div></div>	<div></div>	<div></div>	<div></div>						<div></div>
Calidris alpina	dunlin		S3N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	3					<div></div>
Calidris fuscicollis	white-rumped sandpiper		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	3					<div></div>
Calidris maritima	purple sandpiper		S1N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	3					<div></div>
Calidris pusilla	semipalmated sandpiper		S3N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	4					<div></div>
Caprimulgus vociferus	whip-poor-will		S4B			G5	<div></div>	<div>✓</div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				Ila		<div></div>
Casmerodius albus	great egret		S1B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>			1			<div></div>
Catharus fuscescens	veery		S2B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Catoptrophorus semipalmatus	willet		S4B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	4					<div></div>
Chaetura pelagica	chimney swift		S5B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				Ila		<div></div>
Charadrius wilsonia	Wilson's plover		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	4					<div></div>
Chlidonias niger	black tern		SNA			G4	<div></div>	<div>✓</div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>			3			<div></div>
Cistothorus palustris	marsh wren		S4B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Clangula hyemalis	oldsquaw		S3N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Coccyzus erythrophthalmus	black-billed cuckoo		S1B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Colaptes auratus	Northern flicker		S5			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Colinus virginianus	Northern bobwhite		S4			G5	<div></div>	<div>✓</div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div>✓</div>					Ila	<div></div>
Coragyps atratus	black vulture		S2B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Coturnicops noveboracensis	yellow rail		SNA			G4	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Cygnus columbianus	tundra swan		S3N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>		103				<div></div>
Dendroica dominica	yellow-throated warbler		S2B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Dendroica pensylvanica	chestnut-sided warbler		S1B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Dolichonyx oryzivorus	bobolink		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Egretta caerulea	little blue heron		S1B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				4		<div></div>
Egretta thula	snowy egret		S1B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				4		<div></div>
Egretta tricolor	tricolored heron		S1B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				4		<div></div>
Empidonax minimus	least flycatcher		SHB			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Empidonax traillii	willow flycatcher		S3B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					I	<div></div>
Falco peregrinus	peregrine falcon		S1N			G4	<div></div>	<div>✓</div>			<div>✓</div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Fulica americana	American coot		S1B			G5	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Gavia stellata	red-throated loon		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Helmitheros vermivorus	worm-eating warbler		S3B			G5	<div></div>	<div>✓</div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					I	<div>✓</div>
Himantopus mexicanus	black-necked stilt		S2B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Icteria virens	yellow-breasted chat		S3B			G5	<div></div>	<div>✓</div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Icterus galbula	Baltimore oriole		S4B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Ixobrychus exilis	least bittern		S1B			G5	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Larus marinus	great black-backed gull		S1B,S5N			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>			1			<div></div>
Larus minutus	little gull		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>			4			<div></div>
Limnodromus griseus	short-billed dowitcher		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	3					<div></div>
Limosa fedoa	marbled godwit		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	4					<div></div>
Limosa haemastica	Hudsonian godwit		SNA			G4	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	4					<div></div>
Lophodytes cucullatus	hooded merganser		S1B,S4N			G5	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Melanitta fusca	white-winged scoter		S3N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Melanitta nigra	black scoter		S3N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Melanitta perspicillata	surf scoter		S5N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div>✓</div>
Mniotilta varia	black-and-white warbler		S3B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Myiarchus crinitus	great crested flycatcher		S5B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>

Species		CRITERIA									CROSS REFERENCE												
		State Status	State Rank	Sensitive/ Significant DE Populations	Federal Status	Global Rank	NETC Listing	NETC Concern	BCR 30 Tier	AFS Status	NMFS Prohibited	CITES App I	CITES App II	CITES App III	IUCN Cat	ASMFC Mgd	MAFMC Mgd	NBCI Mgd	USSCP Regional Priority	NAWMP Population Goal %	NAWCP Risk Category	PIF 44 Level	TNC Target
Tier 2																							
Birds																							
Oporornis formosus	Kentucky warbler		S3B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					I	<div></div>
Passerculus sandwichensis	savannah sparrow		SHB, S4N			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Pelecanus erythrorhynchos	American white pelican		SNA			G3	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				3		<div></div>
Pelecanus occidentalis	brown pelican		S1N			G4	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				3		<div></div>
Petrochelidon pyrrhonota	cliff swallow		S1B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Phalacrocorax auritus	double-crested cormorant		S1B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				1		<div></div>
Phalacrocorax carbo	great cormorant		S2N			G5	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				3		<div></div>
Phalaropus lobatus	red-necked phalarope		SNA			G4G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	3					<div></div>
Phalaropus tricolor	Wilson's phalarope		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	3					<div></div>
Pipilo erythrophthalmus	Eastern towhee		S5B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Piranga olivacea	scarlet tanager		S4B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Plegadis falcinellus	glossy ibis		S1B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				2		<div></div>
Pluvialis dominica	American golden-plover		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	4					<div></div>
Pluvialis squatarola	black-bellied plover		S4N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	3					<div></div>
Podiceps auritus	horned grebe		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Poocetes gramineus	vesper sparrow		S3B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Porzana carolina	sora		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Protonotaria citrea	prothonotary warbler		S4B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					I	<div></div>
Puffinus gravis	greater shearwater		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				4		<div></div>
Rallus elegans	king rail		S2			G4G5	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Rhodostethia rosea	Ross' gull		SNA			G3G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				4		<div></div>
Riparia riparia	bank swallow		S2B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Seiurus motacilla	Louisiana waterthrush		S3B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Sitta pusilla	brown-headed nuthatch		S2			G5	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Spizella pusilla	field sparrow		S4			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Sterna anaethetus	bridled tern		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				4		<div></div>
Sterna nilotica	gull-billed tern		SHB,S2N			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				4		<div></div>
Sterna paradisaea	Arctic tern		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>				4		<div></div>
Strix varia	barred owl		S2			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Toxostoma rufum	brown thrasher		S4B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Tringa melanoleuca	greater yellowlegs		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	4					<div></div>
Tringa solitaria	solitary sandpiper		SNA			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>	3					<div></div>
Tryngites subruficollis	buff-breasted sandpiper		SNA			G4	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>	NT	<div></div>	<div></div>	<div></div>	4					<div></div>
Tyrannus tyrannus	Eastern kingbird		S5B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Tyto alba	barn owl		S3			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Vermivora chrysoptera	golden-winged warbler		SNA			G4	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Vireo flavifrons	yellow-throated vireo		S3B			G5	<div></div>	<div></div>	High		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>					Ila	<div></div>
Vireo gilvus	warbling vireo		S2B			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Wilsonia canadensis	Canada warbler		SNA			G5	<div></div>	<div></div>	Moderate		<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Mammals																							
Canis latrans	coyote		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Cryptotis parva	least shrew		SNR			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Lasionycteris noctivagans	silver-haired bat		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Lasiurus borealis	Eastern red bat		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Lasiurus cinereus	hoary bat		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Myotis septentrionalis	Northern myotis		SU			G4	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Nycticeius humeralis	evening bat		SU			G5	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>
Sorex fontinalis	Maryland shrew		SU			G4Q	<div></div>	<div></div>			<div></div>	<div></div>	<div></div>		<div></div>	<div></div>	<div></div>						<div></div>

Key
Criteria

State Status: E = species listed as Endangered in DE
State Rank: S1 = species that are extremely rare in DE; S2 = very rare in DE; S3 = rare to uncommon in DE; S4 = apparently secure in DE; S5 = demonstrably secure in DE; SU = status uncertain in DE but of conservation concern; SH = known historically in DE; SX = extirpated from DE;
SNR = not yet ranked in DE; SNA = occurrences in DE of limited conservation value; _B = breeding status; _N = nonbreeding status
Sensitive/Significant DE populations: other factors that lead to increased conservation concern in DE
Federal Status: E = species listed as endangered in the US; T = listed as threatened in the US; C = candidate for listing in the US
Global Rank: G1/T1 = species/subspecies that are extremely rare rangewide; G2/T2 = very rare rangewide; G3/T3 = rare to uncommon rangewide; G4/T4 = apparently secure rangewide; G5/T5 = demonstrably secure rangewide
NETC (Northeast Endangered Species and Wildlife Diversity Technical Committee) Listing = northeastern species warranting consideration as Federal Endangered or Threatened
NETC Concern: northeastern species of regional conservation concern
BCR 30: conservation tier in Bird Conservation Region 30 (Mid-Atlantic)
AFS (American Fisheries Society) Status: fish species that are E = endangered; T = threatened; V = vulnerable; CD = conservation dependent
NMFS (National Marine Fisheries Service) prohibited: species for which fishing is prohibited by NMFS

Cross Reference

CITES (Convention on International Trade in Endangered Species) App I: species for which all trade is prohibited except by permit
CITES App II: species for which all trade is controlled
CITES App III: species for which trade is controlled in some countries
IUCN (International Union for the Conservation of Nature) Cat: Category CR = critically endangered; EN = endangered; VU = vulnerable; NT = near threatened; DD = data deficient
ASMFC (Atlantic States Marine Fisheries Commission) Mgd: fish species with an ASMFC Interstate Fishery Management Plan
MAFMC (Mid-Atlantic Fisheries Management Council) Mgd: fish species with a MAFMC Fishery Management Plan
NBCI (Northern Bobwhite Conservation Initiative) Mgd: managed according to the Northern Bobwhite Conservation Initiative
USSCP (US Shorebird Conservation Plan) Reg Priority: regional shorebird species that are 5 = highly imperiled; 4 = species of high concern; 3 = species of moderate concern; 2 = species of low concern; 1 = species not at risk
NAWMP (North American Waterfowl Management Plan) Managed: waterfowl species managed under the NAWMP
NAWCP (North American Waterbird Conservation Plan) Category: waterbird species that are 1 = highly imperiled; 2 = high concern; 3 = moderate concern; 4 = low concern; 5 = not currently at risk
PIF (Partners in Flight) 44 Tier: bird species in Physiographic Area 44 (Mid-Atlantic) that are I = high continental importance; II = high regional priority; IIa = high regional concern; IIb = high regional responsibility; IIc = high regional threats
TNC (The Nature Conservancy) Target = species targeted for conservation in TNC Ecoregional Plans

Appendix C

Species-Habitat Associations

Appendix C

Species-Habitat Associations

Delaware Wildlife Action Plan

Habitat Associations of Delaware Species of Greatest Conservation Need

Habitat Level 1	Habitat Level 2	Habitat Level 3
Gastropods		
<i>Anguispira alternata</i>	flamed tigersnail	Tier 2
Upland Habitats	Upland Forests	
<i>Anguispira fergusonii</i>	Coastal Plain tigersnail	Tier 2
undetermined		
<i>Carychium exiguum</i>	obese thorn	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
<i>Discus catskillensis</i>	angular disc	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Euconulus dentatus</i>	toothed hive	Tier 2
undetermined		
<i>Gastrocopta armifera</i>	armed snaggleteeth	Tier 2
Upland Habitats	Upland Forests	
<i>Haplotrema concavum</i>	gray-foot lancet tooth	Tier 2
Upland Habitats	Upland Forests	
<i>Philomycus flexuolaris</i>	winding mantleslug	Tier 2
undetermined		
<i>Pomatiopsis lapidaria</i>	slender walker	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	
<i>Punctum vitreum</i>	glass spot	Tier 2
undetermined		
<i>Pupoides albilabris</i>	white-lip dagger	Tier 2
undetermined		
<i>Stenotrema hirsutum</i>	hairy slitmouth	Tier 2
Upland Habitats	Upland Forests	
<i>Triodopsis tridentata</i>	Northern threetooth	Tier 2
Upland Habitats	Upland Forests	
<i>Ventridens intertextus</i>	pyramid dome	Tier 2
Upland Habitats	Upland Forests	
<i>Vertigo pygmaea</i>	crested vertigo	Tier 2
undetermined		
<i>Vertigo teskeyae</i>	swamp vertigo	Tier 2
undetermined		
<i>Vertigo tridentata</i>	honey vertigo	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	
<i>Zonitoides nitidus</i>	black gloss	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
Bivalves		
<i>Alasmodonta heterodon</i>	dwarf wedgemussel	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Alasmodonta undulata</i>	triangle floater	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Alasmodonta varicosa</i>	brook floater	Tier 1
Freshwater Aquatic Habitats	Piedmont Streams	
<i>Anodonta implicata</i>	alewife floater	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Crassostrea virginica</i>	American oyster	Tier 1
undetermined		

Habitat Level 1	Habitat Level 2	Habitat Level 3
Bivalves		
<i>Elliptio fisheriana</i>	Northern lance	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Lampsilis cariosa</i>	yellow lampmussel	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Lampsilis radiata</i>	Eastern lampmussel	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Leptodea ochracea</i>	tidewater mucket	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Ligumia nasuta</i>	Eastern pondmussel	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Strophitus undulatus</i>	creeper	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Crustaceans		
<i>Callinectes sapidus</i>	blue crab	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Arachnids		
<i>Limulus polyphemus</i>	horseshoe crab	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Insects		
<i>Acontia delecta</i>	a noctuid moth	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
<i>Acronicta connecta</i>	a noctuid moth	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Shrub Swamps Piedmont Stream Valley Wetlands
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Scrub-Shrub Wetlands
<i>Acronicta exilis</i>	exiled dagger moth	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Acronicta increta</i>	a dagger moth	Tier 2
undetermined		
<i>Acronicta lithospila</i>	streaked dagger moth	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Acronicta rubricoma</i>	a dagger moth	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Aeshna tuberculifera</i>	black-tipped darner	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds Streamside Herbaceous Wetlands
<i>Aeshna verticalis</i>	green-striped darner	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds Streamside Herbaceous Wetlands
<i>Agabetes acuductus</i>	a hydrophilid beetle	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Isolated Forested Wetlands
<i>Agnorisma bollii</i>	a noctuid moth	Tier 2
Upland Habitats	Upland Forests	
<i>Agrius cingulata</i>	pink spotted hawkmoth	Tier 2
undetermined		
<i>Amblyscirtes aesculapius</i>	lace-winged roadside-skipper	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Amblyscirtes carolina</i>	Carolina roadside-skipper	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Amorpha juglandis</i>	walnut sphinx	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
Upland Habitats	Upland Forests	
<i>Anacamptodes pergracilis</i>	cypress looper	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Anatrytone logan</i>	Delaware skipper	Tier 2
undetermined		
<i>Anax longipes</i>	comet darner	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Archana subflava</i>	a moth	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Streamside Herbaceous Wetlands
<i>Archilestes grandis</i>	great spreadwing	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Argia bipunctulata</i>	seepage dancer	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Peat Wetlands
<i>Argia moesta</i>	powdered dancer	Tier 2
undetermined		
<i>Argia translata</i>	dusky dancer	Tier 2
Freshwater Aquatic Habitats	Piedmont Streams Ponds, Lakes & Reservoirs	
<i>Argyrostroma quadrifilaris</i>	a noctuid moth	Tier 2
undetermined		
<i>Asterocampa celtis</i>	hackberry emperor	Tier 2
undetermined		
<i>Atlides halesus</i>	great purple hairstreak	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Shrub Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Scrub-Shrub Wetlands
<i>Atrytonopsis hianna</i>	dusted skipper	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats Shrub/brush Upland Habitats
<i>Autochthon cellus</i>	gold-banded skipper	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	
<i>Battus philenor</i>	pipevine swallowtail	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Bellura gortynoides</i>	a moth	Tier 2
undetermined		
<i>Boloria bellona</i>	meadow fritillary	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Boloria selene</i>	silver-bordered fritillary	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands
<i>Boloria selene myrina</i>	myrina fritillary	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands
<i>Brachymesia gravida</i>	four-spotted pennant	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
<i>Callophrys augustinus</i>	brown elfin	Tier 2
undetermined		
<i>Callophrys gryneus</i>	juniper hairstreak	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Callophrys henrici</i>	Henry's elfin	Tier 2
undetermined		
<i>Callophrys hesseli</i>	Hessel's hairstreak	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Callophrys irus</i>	frosted elfin	Tier 1
Upland Habitats	Upland Forests Early Successional Upland Habitats	Coastal Plain Upland Forests
<i>Calyptra canadensis</i>	Canadian owlet	Tier 2
Upland Habitats	Early Successional Upland Habitats	
<i>Caripeta aretaria</i>	a moth	Tier 2
Upland Habitats	Beach & Dune Habitats Upland Forests	Dune Forests & Woodlands Coastal Plain Upland Forests
<i>Catocala alabamae</i>	Alabama underwing	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Catocala antinympha</i>	sweetfern underwing	Tier 1
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Catocala carissima</i>	an underwing moth	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Catocala cerogama</i>	yellow banded underwing	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Catocala flebilis</i>	mournful underwing	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Catocala insolabilis</i>	inconsolable underwing	Tier 2
Upland Habitats	Upland Forests	
<i>Catocala lacrymosa</i>	tearful underwing	Tier 1
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Catocala maestosa</i>	sad underwing	Tier 2
Upland Habitats	Upland Forests	
<i>Catocala marmorata</i>	marbled underwing	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Catocala minuta</i>	little underwing	Tier 2
undetermined		
<i>Catocala nebulosa</i>	clouded underwing	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Catocala palaeogama</i>	oldwife underwing	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Catocala parta</i>	mother underwing	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
<i>Catocala praeclara</i>	praeclara underwing	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Catocala residua</i>	residua underwing	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Catocala unijuga</i>	once-married underwing	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Celithemis monomelaena</i>	black spotted skimmer	Tier 2
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Other Habitats	Sand/Gravel Pits	
<i>Celithemis ornata</i>	faded pennant	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Celithemis verna</i>	double-ringed pennant	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
Other Habitats	Sand/Gravel Pits	
<i>Ceratomia undulosa</i>	waved sphinx	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
<i>Cerura scitiscrypta</i>	black-etched prominent	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
Upland Habitats	Upland Forests	
<i>Chloropteryx tepperaria</i>	angle winged emerald moth	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Cicindela dorsalis</i>	Eastern beach tiger beetle	Tier 2
Upland Habitats	Beach & Dune Habitats	Dune Grasslands
<i>Cicindela dorsalis media</i>	white tiger beetle	Tier 1
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
<i>Cicindela duodecimguttata</i>	a tiger beetle	Tier 2
undetermined		
<i>Cicindela formosa generosa</i>	a tiger beetle	Tier 2
undetermined		
<i>Cicindela hirticollis</i>	beach-dune tiger beetle	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Interdunal Wetlands
Upland Habitats	Beach & Dune Habitats	Dune Shrublands Dune Grasslands Unvegetated Sandy Beach
<i>Cicindela lepida</i>	little white tiger beetle	Tier 1
Upland Habitats	Beach & Dune Habitats	Dune Shrublands Dune Grasslands Unvegetated Sandy Beach
<i>Cicindela marginata</i>	a tiger beetle	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
<i>Cicindela patruela</i>	a tiger beetle	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Cicindela patruela consentanea</i>	a tiger beetle	Tier 1
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Cicindela purpurea</i>	a tiger beetle	Tier 2
undetermined		
<i>Cicindela rufiventris</i>	a tiger beetle	Tier 1
Other Habitats	Sand/Gravel Pits	
<i>Cicindela scutellaris</i>	a tiger beetle	Tier 2
Upland Habitats	Early Successional Upland Habitats	
Other Habitats	Sand/Gravel Pits	
<i>Cicindela unipunctata</i>	a tiger beetle	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Cirrhophanus triangulifer</i>	a noctuid moth	Tier 2
Upland Habitats	Early Successional Upland Habitats	
<i>Cisthene kentuckiensis</i>	Kentucky lichen moth	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Cisthene tenuifascia</i>	a lichen moth	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Copivaleria grotei</i>	Grote's swallow	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
Upland Habitats	Upland Forests	

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Cordulegaster bilineata</i>	brown spiketail	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands
<i>Cordulegaster erronea</i>	tiger spiketail	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands
<i>Darapsa versicolor</i>	hydrangea sphinx	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Shrub Swamps
<i>Deidamia inscripta</i>	lettered sphinx	Tier 2
Upland Habitats	Upland Forests	
<i>Dolba hyloeus</i>	black alder or pawpaw sphinx	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Drasteria graphica</i>	a noctuid moth	Tier 2
Upland Habitats	Beach & Dune Habitats	
<i>Drasteria graphica atlantica</i>	Atlantic graphic moth	Tier 2
Upland Habitats	Beach & Dune Habitats	Dune Shrublands
<i>Dromogomphus spinosus</i>	black-shouldered spinyleg	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Enallagma dubium</i>	burgundy bluet	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Enallagma durum</i>	big bluet	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Enallagma pallidum</i>	pale bluet	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Enallagma vesperum</i>	vesper bluet	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Enallagma weewa</i>	blackwater bluet	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Erynnis baptisiae</i>	wild indigo duskywing	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Erynnis brizo brizo</i>	sleepy dusky wing	Tier 2
undetermined		
<i>Erynnis icelus</i>	dreamy duskywing	Tier 2
undetermined		
<i>Erynnis martialis</i>	mottled duskywing	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Euphydryas phaeton</i>	Baltimore checkerspot	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands
<i>Euphyes conspicua</i>	black dash	Tier 1
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands Streamside Herbaceous Wetlands
<i>Euphyes dion</i>	dion skipper	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds Piedmont Stream Valley Wetlands Streamside Herbaceous Wetlands

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Exyra fax</i>	pitcher plant moth	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Peat Wetlands
<i>Feniseca tarquinius</i>	harvester	Tier 2
undetermined		
<i>Gluphisia lintneri</i>	a notodontid moth	Tier 2
undetermined		
<i>Gomphaeschna antilope</i>	taper-tailed darner	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Coastal Plain Seasonal Ponds Peat Wetlands
<i>Gomphaeschna furcillata</i>	harlequin darner	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Gomphus apomyius</i>	banner clubtail	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Gomphus fraternus</i>	midland clubtail	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Gomphus plagiatus</i>	russet-tipped clubtail	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Gomphus rogersi</i>	sable clubtail	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Gomphus spiniceps</i>	arrow clubtail	Tier 2
Freshwater Aquatic Habitats	Piedmont Streams	
<i>Gomphus villosipes</i>	unicorn clubtail	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Grammia phyllira</i>	phyllira tiger moth	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Hadena ectypa</i>	a noctuid moth	Tier 1
Upland Habitats	Upland Forests	
<i>Haploa colona</i>	a moth	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Helocombus bifidus</i>	a water-scarvenger beetle	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Isolated Forested Wetlands
<i>Helocordulia selysii</i>	Selys' sundragon	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Hemileuca maia maia</i>	the buckmoth	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Hesperia metea</i>	cobweb skipper	Tier 2
undetermined		
<i>Hesperia sassacus</i>	indian skipper	Tier 2
undetermined		
<i>Heterocampa astarte</i>	a notodontid moth	Tier 2
Upland Habitats	Beach & Dune Habitats	
<i>Hoperius planatus</i>	a hydrophilid beetle	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Isolated Forested Wetlands
<i>Hydrochus spangleri</i>	Seth Forest water scavenger beetle	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Isolated Forested Wetlands
<i>Ischnura kellicotti</i>	lilypad forktail	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Riverine Aquatic & Submerged Vegetation
<i>Lepipolys perscripta</i>	a moth	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Lestes eurinus</i>	amber-winged spreadwing	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Leucorrhinia intacta</i>	dot-tailed whiteface	Tier 2
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Libellula auripennis</i>	golden-winged skimmer	Tier 2
undetermined		
<i>Libellula axilena</i>	bar-winged skimmer	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Marshes
<i>Libellula deplanata</i>	blue corporal	Tier 2
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Libellula flavida</i>	yellow-sided skimmer	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands
<i>Libytheana carinenta</i>	American snout	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Lophocampa caryae</i>	an arctiid moth	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Lucanus elephus</i>	giant stag beetle	Tier 2
Upland Habitats	Upland Forests	
<i>Lycaena hyllus</i>	bronze copper	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Streamside Herbaceous Wetlands
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Marshes
<i>Macrochilo louisiana</i>	a noctuid moth	Tier 2
undetermined		
<i>Macromia illinoensis</i>	Illinois river cruiser	Tier 2
Freshwater Aquatic Habitats	Piedmont Streams	
<i>Macromia taeniolata</i>	royal river cruiser	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Manduca jasmineearum</i>	ash sphinx	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Scrub-Shrub Wetlands
<i>Manduca rustica</i>	a sphinx moth	Tier 2
undetermined		
<i>Megacephala virginica</i>	Virginia big-headed tiger beetle	Tier 2
undetermined		
<i>Melitara prodenialis</i>	a moth	Tier 2
Upland Habitats	Beach & Dune Habitats	Dune Forests & Woodlands Dune Grasslands
<i>Nannothemis bella</i>	elfin skimmer	Tier 1
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Marshes
<i>Nehalennia gracilis</i>	sphagnum sprite	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Peat Wetlands
<i>Nehalennia integricollis</i>	Southern sprite	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Nehalennia irene</i>	sedge sprite	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Nicrophorus americanus</i>	American burying beetle	Tier 1
Upland Habitats	Upland Forests Early Successional Upland Habitats	

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Nigetia formosalis</i>	a noctuid moth	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Orgyia detrita</i>	a tussock moth	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Ostrocercia prolongata</i>	a stonefly	Tier 2
Freshwater Aquatic Habitats	Piedmont Streams	
<i>Paonias astylus</i>	huckleberry sphinx	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
Upland Habitats	Upland Forests	
<i>Papaipema appassionate</i>	pitcher plant borer moth	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Peat Wetlands
<i>Papaipema araliae</i>	aralia shoot borer moth	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Papaipema astuta</i>	yellow stoneroot borer	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Papaipema baptisiae</i>	wild indigo borer moth	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Papaipema birdi</i>	umbellifer borer moth	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Shrub Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal High Marshes
<i>Papaipema circumlucens</i>	hop borer	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Papaipema duplicata</i>	dark stoneroot borer moth	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Papaipema eupatorii</i>	eupatorium borer moth	Tier 1
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands Streamside Herbaceous Wetlands
<i>Papaipema furcata</i>	ash borer moth	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Papaipema lysimachiae</i>	loosestrife borer moth	Tier 2
undetermined		
<i>Papaipema maritima</i>	maritime sunflower borer moth	Tier 1
Upland Habitats	Early Successional Upland Habitats	
<i>Papaipema pterisii</i>	bracken borer moth	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Papaipema rigida</i>	a noctuid moth	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Papaipema rutila</i>	mayapple borer moth	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Papaipema speciosissima</i>	osmunda borer moth	Tier 2
undetermined		
<i>Papaipema stenocelis</i>	chain fern borer moth	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands Peat Wetlands
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Scrub-Shrub Wetlands
<i>Parahypenodes quadralis</i>	a noctuid moth	Tier 2
undetermined		

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Parapamea buffaloensis</i>	a borer moth	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Piedmont Stream Valley Wetlands
<i>Paratrea plebeja</i>	trumpet vine sphinx	Tier 2
Upland Habitats	Beach & Dune Habitats Early Successional Upland Habitats	Dune Forests & Woodlands Shrub/brush Upland Habitats
<i>Pero hubneraria</i>	a moth	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
<i>Pero zalissaria</i>	a moth	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
<i>Photuris bethaniensis</i>	a firefly	Tier 1
Non-tidal Wetland Habitats	Non-forested Wetlands	Interdunal Wetlands
<i>Photuris frontalis</i>	a firefly	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Photuris hebes</i>	a firefly	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Photuris pensylvanica</i>	a firefly	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Photuris pyralomimus</i>	a firefly	Tier 2
Upland Habitats		
<i>Photuris tremulans</i>	a firefly	Tier 2
Upland Habitats		
<i>Poanes hobomok</i>	hobomok skipper	Tier 2
undetermined		
<i>Poanes massasoit</i>	mulberry wing	Tier 1
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds Piedmont Stream Valley Wetlands Streamside Herbaceous Wetlands
<i>Poanes massasoit chermocki</i>	Chermock's mulberry wing	Tier 1
Non-tidal Wetland Habitats	Non-forested Wetlands	Streamside Herbaceous Wetlands
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Marshes
<i>Polygonia progne</i>	gray comma	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Pompeius verna</i>	little glassywing	Tier 2
undetermined		
<i>Pontia protodice</i>	checkered white	Tier 2
undetermined		
<i>Problema bulenta</i>	rare skipper	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
<i>Satyrrium kingi</i>	King's hairstreak	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Satyrrium liparops</i>	striped hairstreak	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Satyrrium liparops strigosum</i>	striped hairstreak	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Satyrodes eurydice</i>	eyed brown	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands Streamside Herbaceous Wetlands
<i>Schinia septentrionalis</i>	a noctuid moth	Tier 2
Upland Habitats	Early Successional Upland Habitats	

Habitat Level 1	Habitat Level 2	Habitat Level 3
Insects		
<i>Schinia spinosae</i>	a noctuid moth	Tier 2
Upland Habitats	Beach & Dune Habitats	Dune Shrublands Dune Grasslands
<i>Schinia trifascia</i>	three-lined flower moth	Tier 2
undetermined		
<i>Somatochlora filosa</i>	fine-lined emerald	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Somatochlora provocans</i>	treetop emerald	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Speyeria aphrodite</i>	aphrodite fritillary	Tier 2
Upland Habitats	Upland Forests Early Successional Upland Habitats	Piedmont Upland Forests Herbaceous Upland Habitats Shrub/brush Upland Habitats
<i>Speyeria idalia</i>	regal fritillary	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats Shrub/brush Upland Habitats
<i>Sphinx chersis</i>	great ash sphinx	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
<i>Sphinx eremitus</i>	hermit sphinx	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
<i>Sphinx franckii</i>	Franck's sphinx	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	
Upland Habitats	Upland Forests	
<i>Stiriodes obtusa</i>	a moth	Tier 2
undetermined		
<i>Stylogomphus albistylus</i>	least clubtail	Tier 2
Freshwater Aquatic Habitats	Piedmont Streams	
<i>Sympetrum ambiguum</i>	blue-faced meadowhawk	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Coastal Plain Seasonal Ponds
<i>Sympetrum semicinctum</i>	band-winged meadowhawk	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds Piedmont Stream Valley Wetlands Streamside Herbaceous Wetlands
<i>Synanthedon castaneae</i>	chestnut clearwing moth	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Tetragoneuria costalis</i>	stripe-winged baskettail	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Tetragoneuria spinosa</i>	robust baskettail	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Tolyte notialis</i>	a lasiocampid moth	Tier 2
Upland Habitats	Beach & Dune Habitats Upland Forests	Dune Forests & Woodlands Coastal Plain Upland Forests
<i>Xestia youngii</i>	a noctuid moth	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Peat Wetlands
<i>Zale metata</i>	a noctuid moth	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
Fishes		
<i>Lampetra aepyptera</i>	least brook lamprey	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Lampetra appendix</i>	American brook lamprey	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	

Habitat Level 1	Habitat Level 2	Habitat Level 3
Fishes		
<i>Carcharhinus obscurus</i>	dusky shark	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats Offshore Habitats	
<i>Carcharodon carcharias</i>	white shark	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats Offshore Habitats	
<i>Cetorhinus maximus</i>	basking shark	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats Offshore Habitats	
<i>Pristis pectinata</i>	smalltooth sawfish	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Squatina dumeril</i>	Atlantic angel shark	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Fishes		
<i>Acantharchus pomotis</i>	mud sunfish	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Acipenser brevirostrum</i>	shortnose sturgeon	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Acipenser oxyrinchus</i>	Atlantic sturgeon	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Alosa mediocris</i>	hickory shad	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Apeltes quadracus</i>	fourspine stickleback	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Cottus caeruleomentum</i>	Blueridge sculpin	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Enneacanthus chaetodon</i>	blackbanded sunfish	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Enneacanthus obesus</i>	banded sunfish	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Etheostoma vitreum</i>	glassy darter	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Ictalurus natalis</i>	yellow bullhead	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Moxostoma macrolepidotum</i>	shorthead redhorse	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Notropis amoenus</i>	comely shiner	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Notropis bifrenatus</i>	bridle shiner	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Notropis chalybaeus</i>	ironcolor shiner	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
<i>Noturus insignis</i>	margined madtom	Tier 2
Freshwater Aquatic Habitats	Piedmont Streams Coastal Plain Streams	

Habitat Level 1	Habitat Level 2	Habitat Level 3
Fishes		
<i>Percina peltata</i>	shield darter	Tier 1
Freshwater Aquatic Habitats	Coastal Plain Streams	
Amphibians		
<i>Ambystoma maculatum</i>	spotted salamander	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Ambystoma tigrinum tigrinum</i>	tiger salamander	Tier 1
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Eurycea longicauda</i>	longtail salamander	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Piedmont Stream Valley Wetlands
<i>Hemidactylium scutatum</i>	four-toed salamander	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands Coastal Plain Seasonal Ponds
<i>Hyla chrysoscelis</i>	Cope's gray treefrog	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Coastal Plain Seasonal Ponds
<i>Hyla gratiosa</i>	barking treefrog	Tier 1
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
<i>Pseudotriton montanus montanus</i>	mud salamander	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Rana virgatipes</i>	carpenter frog	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands
<i>Scaphiopus holbrookii</i>	Eastern spadefoot	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Coastal Plain Seasonal Ponds
Other Habitats	Sand/Gravel Pits	
Reptiles		
<i>Agkistrodon contortrix</i>	copperhead	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Caretta caretta</i>	loggerhead sea turtle	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Cemophora coccinea</i>	scarlet snake	Tier 1
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Chelonia mydas</i>	Atlantic green turtle	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Clemmys guttata</i>	spotted turtle	Tier 1
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands Shrub Swamps Coastal Plain Seasonal Ponds
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Marshes
<i>Dermochelys coriacea</i>	leatherback sea turtle	Tier 1
Brackish & Marine Aquatic Habitats	Offshore Habitats	
<i>Elaphe guttata</i>	corn snake	Tier 1
Upland Habitats	Beach & Dune Habitats Upland Forests	Dune Forests & Woodlands Coastal Plain Upland Forests
<i>Eretmochelys imbricata imbricata</i>	hawksbill	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Eumeces laticeps</i>	broadhead skink	Tier 1
Upland Habitats	Upland Forests	Coastal Plain Upland Forests

Habitat Level 1	Habitat Level 2	Habitat Level 3
Reptiles		
<i>Glyptemys muhlenbergii</i>	bog turtle	Tier 1
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands
<i>Heterodon platirhinos</i>	Eastern hognose snake	Tier 2
Upland Habitats	Beach & Dune Habitats Upland Forests	Dune Forests & Woodlands Coastal Plain Upland Forests
<i>Lampropeltis getula</i>	common kingsnake	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Lampropeltis triangulum</i>	milk snake	Tier 1
Upland Habitats	Upland Forests Early Successional Upland Habitats	Piedmont Upland Forests Coastal Plain Upland Forests Herbaceous Upland Habitats Shrub/brush Upland Habitats
<i>Lepidochelys kempii</i>	Kemp's Ridley sea turtle	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Malaclemys terrapin terrapin</i>	Northern diamondback terrapin	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Dune Grasslands
<i>Nerodia erythrogaster</i>	plainbelly water snake	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Opheodrys aestivus</i>	rough green snake	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands
<i>Pituophis melanoleucus melanoleuc</i>	pine snake	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Pseudemys rubriventris</i>	redbelly turtle	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
<i>Regina septemvittata</i>	queen snake	Tier 2
Freshwater Aquatic Habitats	Piedmont Streams Coastal Plain Streams	
Non-tidal Wetland Habitats	Non-forested Wetlands	Piedmont Stream Valley Wetlands Streamside Herbaceous Wetlands
<i>Scincella lateralis</i>	ground skink	Tier 2
Upland Habitats	Beach & Dune Habitats Upland Forests	Dune Forests & Woodlands Coastal Plain Upland Forests
<i>Storeria occipitomaculata</i>	redbelly snake	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Terrapene carolina carolina</i>	Eastern box turtle	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests Early Successional Upland Habitats	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Thamnophis sauritus sauritus</i>	Eastern ribbon snake	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands Non-forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands Coastal Plain Seasonal Ponds Piedmont Stream Valley Wetlands Streamside Herbaceous Wetlands
<i>Virginia valeriae</i>	smooth earth snake	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
Birds		
<i>Accipiter cooperii</i>	Cooper's hawk	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Accipiter striatus</i>	sharp-shinned hawk	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Actitis macularia</i>	spotted sandpiper	Tier 1
Freshwater Aquatic Habitats	Piedmont Streams Coastal Plain Streams Ponds, Lakes & Reservoirs	
Other Habitats	Impoundments	
<i>Ammodramus caudacutus</i>	saltmarsh sharp-tailed sparrow	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
<i>Ammodramus henslowii</i>	Henslow's sparrow	Tier 1
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats Shrub/brush Upland Habitats
<i>Ammodramus maritimus</i>	seaside sparrow	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
<i>Ammodramus savannarum</i>	grasshopper sparrow	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Anas clypeata</i>	Northern shoveler	Tier 2
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Other Habitats	Impoundments	
<i>Anas platyrhynchos</i>	mallard	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes
Other Habitats	Impoundments	
<i>Anas rubripes</i>	American black duck	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
Other Habitats	Impoundments	
<i>Ardea herodias</i>	great blue heron	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes
<i>Arenaria interpres</i>	ruddy turnstone	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
<i>Asio flammeus</i>	short-eared owl	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Asio otus</i>	long-eared owl	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Aythya affinis</i>	lesser scaup	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Other Habitats	Impoundments	
<i>Aythya americana</i>	redhead	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Aythya marila</i>	greater scaup	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Other Habitats	Impoundments	
<i>Aythya valisineria</i>	canvasback	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Other Habitats	Impoundments	
<i>Bartramia longicauda</i>	upland sandpiper	Tier 1
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Bonasa umbellus</i>	ruffed grouse	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Botaurus lentiginosus</i>	American bittern	Tier 2
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal High Marshes
<i>Branta bernicla</i>	brant	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Branta canadensis</i>	Canada goose (migratory)	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
Other Habitats	Impoundments	
<i>Bubulcus ibis</i>	cattle egret	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes
<i>Bucephala albeola</i>	bufflehead	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Other Habitats	Impoundments	
<i>Buteo lineatus</i>	red-shouldered hawk	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands
<i>Buteo platypterus</i>	broad-winged hawk	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Calidris alba</i>	sanderling	Tier 1
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
<i>Calidris alpina</i>	dunlin	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
Other Habitats	Impoundments	
<i>Calidris canutus</i>	red knot	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
<i>Calidris fuscicollis</i>	white-rumped sandpiper	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Other Habitats	Impoundments	
<i>Calidris maritima</i>	purple sandpiper	Tier 2
Upland Habitats	Beach & Dune Habitats	Dune Grasslands Unvegetated Sandy Beach

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Calidris pusilla</i>	semipalmated sandpiper	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
Other Habitats	Impoundments	
<i>Caprimulgus vociferus</i>	whip-poor-will	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Isolated Forested Wetlands
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Casmerodius albus</i>	great egret	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes
<i>Catharus bicknelli</i>	Bicknell's thrush	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Catharus fuscescens</i>	veery	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Catoptrophorus semipalmatus</i>	willet	Tier 2
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Other Habitats	Impoundments	
<i>Certhia americana</i>	brown creeper	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Chaetura pelagica</i>	chimney swift	Tier 2
Upland Habitats	Early Successional Upland Habitats	
Other Habitats	Structures	
<i>Charadrius melodus</i>	pipin plover	Tier 1
Upland Habitats	Beach & Dune Habitats	Dune Grasslands Unvegetated Sandy Beach
<i>Charadrius wilsonia</i>	Wilson's plover	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Dune Grasslands Unvegetated Sandy Beach
Other Habitats	Impoundments	
<i>Chlidonias niger</i>	black tern	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	
<i>Chordeiles minor</i>	common nighthawk	Tier 1
Upland Habitats	Beach & Dune Habitats Early Successional Upland Habitats	Dune Forests & Woodlands Dune Shrublands Dune Grasslands Shrub/brush Upland Habitats
Other Habitats	Structures	
<i>Circus cyaneus</i>	Northern harrier	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Cistothorus palustris</i>	marsh wren	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Streamside Herbaceous Wetlands
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Cistothorus platensis</i>	sedge wren	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal High Marshes
<i>Clangula hyemalis</i>	oldsquaw	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Coccyzus erythrophthalmus</i>	black-billed cuckoo	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests Shrub/brush Upland Habitats
	Early Successional Upland Habitats	
<i>Colaptes auratus</i>	Northern flicker	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
	Early Successional Upland Habitats	
<i>Colinus virginianus</i>	Northern bobwhite	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats Shrub/brush Upland Habitats
<i>Coragyps atratus</i>	black vulture	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
	Early Successional Upland Habitats	
Other Habitats	Structures	
<i>Coturnicops noveboracensis</i>	yellow rail	Tier 2
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes
<i>Cygnus columbianus</i>	tundra swan	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
Other Habitats	Impoundments	
<i>Dendroica cerulea</i>	cerulean warbler	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Dendroica discolor</i>	prairie warbler	Tier 1
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Dendroica dominica</i>	yellow-throated warbler	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Dendroica pensylvanica</i>	chestnut-sided warbler	Tier 2
Upland Habitats	Upland Forests Early Successional Upland Habitats	Piedmont Upland Forests Shrub/brush Upland Habitats
<i>Dolichonyx oryzivorus</i>	bobolink	Tier 2
Tidal Wetland Habitats	Freshwater Tidal Wetlands	Freshwater Tidal Marshes
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Egretta caerulea</i>	little blue heron	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes
<i>Egretta thula</i>	snowy egret	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Egretta tricolor</i>	tricolored heron	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes
<i>Empidonax minimus</i>	least flycatcher	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Empidonax traillii</i>	willow flycatcher	Tier 2
Non-tidal Wetland Habitats	Non-forested Wetlands	Shrub Swamps
<i>Falco peregrinus</i>	peregrine falcon	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
Other Habitats	Structures	
<i>Fulica americana</i>	American coot	Tier 2
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
Other Habitats	Impoundments	
<i>Gavia stellata</i>	red-throated loon	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Haematopus palliatus</i>	American oystercatcher	Tier 1
Upland Habitats	Beach & Dune Habitats	Dune Grasslands Unvegetated Sandy Beach
<i>Haliaeetus leucocephalus</i>	bald eagle	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Helmitheros vermivorus</i>	worm-eating warbler	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Himantopus mexicanus</i>	black-necked stilt	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Other Habitats	Impoundments	
<i>Hylocichla mustelina</i>	wood thrush	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Icteria virens</i>	yellow-breasted chat	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Icterus galbula</i>	Baltimore oriole	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Ixobrychus exilis</i>	least bittern	Tier 2
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal High Marshes
<i>Lanius ludovicianus</i>	loggerhead shrike	Tier 1
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats Shrub/brush Upland Habitats
<i>Larus marinus</i>	great black-backed gull	Tier 2
Upland Habitats	Beach & Dune Habitats	Dune Shrublands
<i>Larus minutus</i>	little gull	Tier 2
undetermined		
<i>Laterallus jamaicensis</i>	black rail	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal High Marshes

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Limnodromus griseus</i>	short-billed dowitcher	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Other Habitats	Impoundments	
<i>Limnothlypis swainsonii</i>	Swainson's warbler	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Limosa fedoa</i>	marbled godwit	Tier 2
Other Habitats	Impoundments	
undetermined		
<i>Limosa haemastica</i>	Hudsonian godwit	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
Other Habitats	Impoundments	
<i>Lophodytes cucullatus</i>	hooded merganser	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams Ponds, Lakes & Reservoirs	
Other Habitats	Impoundments	
<i>Melanerpes erythrocephalus</i>	red-headed woodpecker	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Melanitta fusca</i>	white-winged scoter	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Melanitta nigra</i>	black scoter	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Melanitta perspicillata</i>	surf scoter	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Melospiza georgiana nigrescens</i>	Coastal Plain swamp sparrow	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal High Marshes
<i>Mniotilta varia</i>	black-and-white warbler	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Myiarchus crinitus</i>	great crested flycatcher	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Numenius phaeopus</i>	whimbrel	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
Upland Habitats	Beach & Dune Habitats	Unvegetated Sandy Beach
<i>Nyctanassa violacea</i>	yellow-crowned night-heron	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes
<i>Nycticorax nycticorax</i>	black-crowned night-heron	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes
<i>Oporornis formosus</i>	Kentucky warbler	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Pandion haliaetus</i>	osprey	Tier 1
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes Tidal High Marshes
Other Habitats	Impoundments	
<i>Parula americana</i>	Northern parula	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Passerculus sandwichensis</i>	savannah sparrow	Tier 2
Upland Habitats	Beach & Dune Habitats Early Successional Upland Habitats	Dune Grasslands Herbaceous Upland Habitats
<i>Pelecanus erythrorhynchos</i>	American white pelican	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	
<i>Pelecanus occidentalis</i>	brown pelican	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
<i>Petrochelidon pyrrhonota</i>	cliff swallow	Tier 2
Other Habitats	Structures	
<i>Phalacrocorax auritus</i>	double-crested cormorant	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
<i>Phalacrocorax carbo</i>	great cormorant	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
<i>Phalaropus lobatus</i>	red-necked phalarope	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Other Habitats	Impoundments	
<i>Phalaropus tricolor</i>	Wilson's phalarope	Tier 2
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Other Habitats	Impoundments	
<i>Pipilo erythrophthalmus</i>	Eastern towhee	Tier 2
Upland Habitats	Beach & Dune Habitats Upland Forests Early Successional Upland Habitats	Dune Shrublands Piedmont Upland Forests Coastal Plain Upland Forests Shrub/brush Upland Habitats
<i>Piranga olivacea</i>	scarlet tanager	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Plegadis falcinellus</i>	glossy ibis	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Pluvialis dominica</i>	American golden-plover	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats Early Successional Upland Habitats	Unvegetated Sandy Beach Herbaceous Upland Habitats
Other Habitats	Impoundments	

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Pluvialis squatarola</i>	black-bellied plover	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats Early Successional Upland Habitats	Unvegetated Sandy Beach Herbaceous Upland Habitats
Other Habitats	Impoundments	
<i>Podiceps auritus</i>	horned grebe	Tier 2
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
Other Habitats	Impoundments	
<i>Podilymbus podiceps</i>	pied-billed grebe	Tier 1
Freshwater Aquatic Habitats	Ponds, Lakes & Reservoirs	
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes
Other Habitats	Impoundments	
<i>Poocetes gramineus</i>	vesper sparrow	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Porzana carolina</i>	sora	Tier 2
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal High Marshes
<i>Protonotaria citrea</i>	prothonotary warbler	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands
<i>Puffinus gravis</i>	greater shearwater	Tier 2
undetermined		
<i>Puffinus lherminieri</i>	Audubon's shearwater	Tier 1
undetermined		
<i>Rallus elegans</i>	king rail	Tier 2
Tidal Wetland Habitats	Freshwater Tidal Wetlands Saltwater & Brackish Tidal Wetlands	Freshwater Tidal Marshes Tidal Low Marshes
<i>Rhodostethia rosea</i>	Ross' gull	Tier 2
undetermined		
<i>Riparia riparia</i>	bank swallow	Tier 2
Other Habitats	Sand/Gravel Pits	
<i>Rynchops niger</i>	black skimmer	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Dune Grasslands Unvegetated Sandy Beach
<i>Scolopax minor</i>	American woodcock	Tier 1
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Seiurus motacilla</i>	Louisiana waterthrush	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Setophaga ruticilla</i>	American redstart	Tier 1
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Sitta pusilla</i>	brown-headed nuthatch	Tier 2
Upland Habitats	Beach & Dune Habitats Upland Forests	Dune Forests & Woodlands Coastal Plain Upland Forests
<i>Somateria mollissima</i>	common eider	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Spizella pusilla</i>	field sparrow	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats Shrub/brush Upland Habitats
<i>Sterna anaethetus</i>	bridled tern	Tier 2
undetermined		

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Sterna antillarum</i>	least tern	Tier 1
Upland Habitats	Beach & Dune Habitats	Dune Grasslands Unvegetated Sandy Beach
<i>Sterna dougallii dougallii</i>	roseate tern	Tier 1
Brackish & Marine Aquatic Habitats	Offshore Habitats	
<i>Sterna forsteri</i>	Forster's tern	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
<i>Sterna hirundo</i>	common tern	Tier 1
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
Upland Habitats	Beach & Dune Habitats	Dune Grasslands Unvegetated Sandy Beach
<i>Sterna nilotica</i>	gull-billed tern	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes
<i>Sterna paradisaea</i>	Arctic tern	Tier 2
undetermined		
<i>Strix varia</i>	barred owl	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps Isolated Forested Wetlands
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Toxostoma rufum</i>	brown thrasher	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Tringa melanoleuca</i>	greater yellowlegs	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
Other Habitats	Impoundments	
<i>Tringa solitaria</i>	solitary sandpiper	Tier 2
Freshwater Aquatic Habitats	Coastal Plain Streams	
Other Habitats	Impoundments	
<i>Tryngites subruficollis</i>	buff-breasted sandpiper	Tier 2
Upland Habitats	Early Successional Upland Habitats	Herbaceous Upland Habitats
<i>Tyrannus tyrannus</i>	Eastern kingbird	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Tyto alba</i>	barn owl	Tier 2
Tidal Wetland Habitats	Saltwater & Brackish Tidal Wetlands	Tidal Low Marshes Tidal High Marshes
<i>Vermivora chrysoptera</i>	golden-winged warbler	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Vermivora pinus</i>	blue-winged warbler	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Vireo flavifrons</i>	yellow-throated vireo	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Vireo gilvus</i>	warbling vireo	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Wilsonia canadensis</i>	Canada warbler	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests

Habitat Level 1	Habitat Level 2	Habitat Level 3
Birds		
<i>Wilsonia citrina</i>	hooded warbler	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
Mammals		
<i>Balaena glacialis</i>	Northern right whale	Tier 1
Brackish & Marine Aquatic Habitats	Offshore Habitats	
<i>Balaenoptera borealis</i>	sei whale	Tier 1
Brackish & Marine Aquatic Habitats	Offshore Habitats	
<i>Balaenoptera musculus</i>	blue whale	Tier 1
Brackish & Marine Aquatic Habitats	Offshore Habitats	
<i>Balaenoptera physalus</i>	fin whale	Tier 1
Brackish & Marine Aquatic Habitats	Offshore Habitats	
<i>Canis latrans</i>	coyote	Tier 2
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Cryptotis parva</i>	least shrew	Tier 2
Upland Habitats	Early Successional Upland Habitats	Shrub/brush Upland Habitats
<i>Lasionycteris noctivagans</i>	silver-haired bat	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Lasiurus borealis</i>	Eastern red bat	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Lasiurus cinereus</i>	hoary bat	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests Coastal Plain Upland Forests
<i>Megaptera novaeangliae</i>	humpback whale	Tier 1
Brackish & Marine Aquatic Habitats	Offshore Habitats	
<i>Myotis leibii</i>	Eastern small-footed myotis	Tier 1
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Myotis septentrionalis</i>	Northern myotis	Tier 2
Upland Habitats	Upland Forests	Piedmont Upland Forests
<i>Nycticeius humeralis</i>	evening bat	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps
<i>Phocoena phocoena</i>	harbor porpoise	Tier 1
Brackish & Marine Aquatic Habitats	Nearshore Habitats	
<i>Physeter catodon</i>	sperm whale	Tier 1
Brackish & Marine Aquatic Habitats	Offshore Habitats	
<i>Sciurus niger cinereus</i>	Delmarva fox squirrel	Tier 1
Upland Habitats	Upland Forests	Coastal Plain Upland Forests
<i>Sorex fontinalis</i>	Maryland shrew	Tier 2
Non-tidal Wetland Habitats	Forested Wetlands	Forested Floodplains & Riparian Swamps