INDICATOR 4

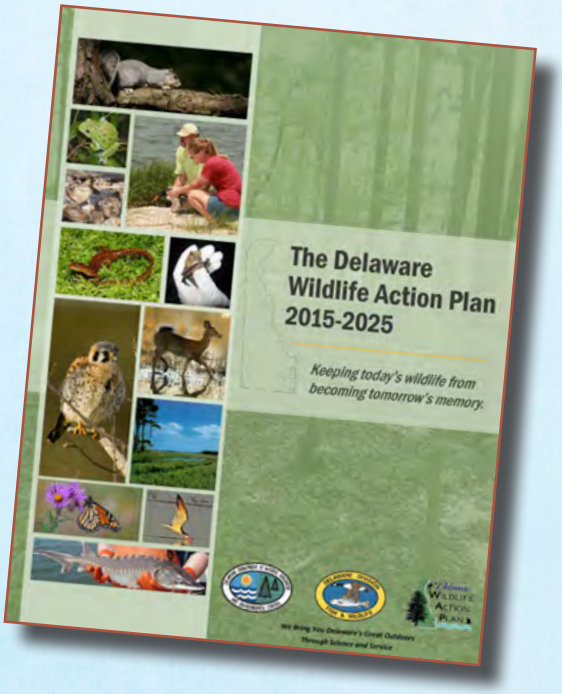
Status of forest/woodland communities and associated species of concern

Forests provide habitat (shelter, food, nesting sites, etc.) for numerous animal species and are home to a wide variety of plant species. Some rare plants are found only in specific types of forest and some rare animals require certain forest habitat for their survival. Protecting and conserving the wide range of forests native to Delaware is critical to the survival of many plant and animal species—both rare and common. Recognizing and understanding the rare, threatened, and endangered species of plants and animals found in our forests is the first step in their conservation.

Delaware is the second smallest state in the United States and yet harbors a surprising diversity of wildlife species and habitats within its borders.

Delaware Wildlife Action Plan

The Delaware Wildlife Action Plan (DEWAP) 2015-2025 is the state's updated version of 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. The first DEWAP was completed in 2006. The updated DEWAP not only considers species and habitats, but it is also comprehensive in terms of those responsible for its implementation. Though DNREC's Division of Fish & Wildlife (F&W) is the lead agency that is coordinating implementation, the DEWAP is intended for all agencies, nonprofits, and individuals who are actively engaged in conservation efforts, including the Delaware Forest Service. Together with all conservation partners, the aim is to maintain existing populations and prevent species from becoming threatened or endangered.



Delaware is the second smallest state in the U.S. and yet it harbors a surprising diversity of wildlife species and habitats within its borders. Over 2,800 species are documented to occur in the state and more than 125 specific types of habitat are found in the state including coastal marine waters and brackish marshes, tidal and non-tidal freshwater streams and wetlands, and upland forests and meadows. Of these, the DEWAP identifies 688 Species of Greatest Conservation Need (SGCN) and nearly all of Delaware's habitats are used to some extent by at least one SGCN. Because the DEWAP is a comprehensive plan for all species, large blocks of forest and wetland habitats (≥250 acres) that support many common species are also identified. Maps depicting habitat for a full array of wildlife species were created to show areas of the state to focus conservation efforts. The maps are also intended to help guide more site-specific conservation planning efforts. One successful example cited as a site-specific community-based planning effort was the Blackbird-Millington Corridor Conservation Area Plan where F&W partnered with The Nature Conservancy.

Recognizing all possible issues that affect habitats and species of conservation concern, whether the impacts are fully understood or not, is an important step in building a comprehensive plan. For 12 habitat groups (including forested non-tidal wetlands and natural forested uplands), 289 issues were identified along with 755 corresponding actions. For five taxa groups (birds, fish, herpetofauna, invertebrates, and mammals), 419 issues and 651 actions were identified. From this extensive list of issues and actions, a clear picture of priorities emerged. Among these were addressing habitat loss and degradation, including loss and conversion of forest habitat to other non-ecological land uses.

Forest communities

Delaware is in a floral transition zone between northern and southern forest types, which creates a diverse group of forest communities in a relatively small geographic area. Thirty-one forest communities (with tree canopy ≥60%) and nine woodlands (tree canopy <60%) are listed in the 2009 *Guide to Delaware Vegetation Communities*, which follows the National Vegetation Classification System (NVCS). The NVCS classifies vegetation on a national scale for the United States and is linked to the international vegetation classification. It provides a uniform name and description of vegetation communities found throughout the country and helps determine the relative rarity of different community types.

Delaware rare forest communities include the Inland Dune Ridge Forest found in the Nanticoke River area; Southern New England Red Maple Seepage Swamp found in the Piedmont; North Atlantic Coastal Oak-Holly Forest found in the Nanticoke and Choptank River watersheds; Northern Coastal Plain-Piedmont Basic Mesic Hardwood Forest found scattered throughout the state; and the Chesapeake Bay River Bluff Chestnut Oak Forest found in the Appoquinimink River watershed.

Delaware rare woodlands include Central Appalachian/Piedmont Bedrock Floodplain Woodland found in one location in the Piedmont; several woodlands found in the southern portion of the state including Red Maple-Tussock Sedge Wooded Marsh near Millsboro, the Inland Dune and Ridge Woodland/Forest found in the Indian River and Nanticoke river watersheds, and coastal woodland communities like the maritime Red Cedar Woodland, Loblolly Pine Dune Woodland, and Loblolly Pine-Wax-myrtle-Salt Meadow Cordgrass Woodland. The Pitch Pine Dune Woodland is only found at Cape Henlopen State Park and the Pond Pine Woodland is found at Prime Hook NWR and at a site near Millsboro.

Loblolly pine forest acreage decreased significantly from 1957 to 1999 (149,000 acres) but this trend has since reversed with an increase of 18,000 acres since 1999. Part of this reversal can be attributed to passage of the *Seed Tree Law* and the availability of publicly-funded cost-share programs to assist landowners with reforestation and other forest management expenses. Many of Delaware's bottomland tree species have also experienced substantial declines over the last 50 years due to logging and wide-scale drainage by ditching and stream channelization. Atlantic white-cedar and baldcypress, in particular, experienced significant declines. This loss is evident by the reduction in acres of the oak/gum/cypress forest type where these two species are commonly found. Acreage for this type dropped from 90,000 acres in 1972 to 26,000 in 1999 (see Figure 7). The actual acreage of Atlantic white-cedar and baldcypress is much lower than this total. However, like loblolly pine, the oak/gum/cypress forest type has rebounded and in 2018 the acreage had climbed back up to 56,000 acres. Vegetation communities in which these bottomland species are commonly found include Coastal Plain Atlantic White Cedar-Red Maple Swamp that occurs throughout the Coastal Plain, Atlantic White Cedar/Seaside Alder Woodland found in the Cedar Creek and Prime Hook Creek watersheds, Chesapeake Bay Cypress-Gum Swamp found in the Nanticoke River, Deep Creek, and Pocomoke River watersheds, and Wind-tidal Cypress-Gum Swamp found in the Broad Creek watershed. As a further example, in 2010 the 10,600-acre Great Cypress Swamp in southern Delaware had virtually no Atlantic white-cedar or baldcypress remaining due to historic logging and ditching. However, recent forest management projects by Delaware Wild Lands, Inc., to recover Atlantic white-cedar and baldcypress have been positive and encouraging. Approximately 400 acres have been recovered so far through planting and selective harvesting of competing species. This contiguous swamp is thought to have encompassed over 50,000 acres before European settlers arrived.

Recent forest management projects by Delaware Wild Lands, Inc., to recover Atlantic white-cedar and baldcypress have been positive and encouraging.

Atlantic white-cedar

Coastal Plain seasonal ponds

Coastal Plain seasonal ponds, or Delmarva Bays, are an important part of Delaware's forest landscape. This unique non-tidal freshwater wetland supports a wide variety of state and globally rare plant and animal species. Seasonal ponds are found on the landscape within forested areas and appear as open canopy depressions that are usually elliptical and up to two acres (sometimes larger). Hundreds of these ponds are scattered throughout the state but they most frequently occur in southwestern New Castle County and northwestern Kent County. The geologic origins of Coastal Plain seasonal ponds are still not well understood. The most plausible theory supposes that Delmarva Peninsula ponds were formed between 15,000 and 20,000 years ago when the climate was much colder and drier. The theory suggests that strong winds created blow-outs or depressions in unvegetated sandy areas and deposited the sand around pond perimeters that often appear as elevated rims. Seasonal ponds are strongly influenced ecologically by fluctuating groundwater levels that rise and fall with the seasons. By definition, seasonal pools have no permanent surface water connection to other water bodies. They typically fill in winter and spring when groundwater levels are high and begin to recede during summer months, when precipitation is typically low and evapotranspiration is high. By late summer/early fall, these shallow ponds are usually dry. This is significant for many uncommon animal species that breed in these ponds as they are void of predatory fish.

Seasonal ponds support a distinctive community of vertebrates and invertebrates due to this regime of flooding and drying. Some animals and plants have adapted to life within seasonal ponds and many are very rare in Delaware. The absence of predatory fish permits successful breeding of state-rare amphibians such as the marbled (*Ambystoma opacum*), spotted (*A. maculatum*), and tiger (*A. tigrinum*) salamanders that require seasonal pools to produce offspring. Also included in this list of rare amphibians are Cope's gray treefrog (*Hyla chrysoscelis*), barking treefrog (*H. gratiosa*), and carpenter frog (*Lithobates virgatipes*). They too use fish-free seasonal pools for reproduction. The ambystomid or mole salamanders listed actually spend the majority of their lives underground in forests and woodlands surrounding seasonal ponds. Though the ponds themselves are critical for sustaining salamander populations, the adjacent forests are just as vital to these amphibians, providing critical habitat during most of their annual life cycle.

There are also several state and globally rare plants found in Coastal Plain seasonal ponds. Of nearly 80 native plant species primarily found growing in Delaware seasonal ponds, 40 are state rare and six are globally rare. The feather foil (*Hottonia inflata*) and water crowfoot (*Ranunculus flabellaris*) are examples of state-rare plants that are entirely dependent on the fluctuating groundwater levels of seasonal ponds for the completion of their life cycles. These species flower at the water's surface when the seasonal ponds are filled in the spring and seeds germinate in late summer when ponds recede. Without this regime of flooding and drying, these species would not persist. An example of a globally rare plant found in Delaware seasonal ponds is the dwarf fimbry (*Fimbristylis perpusilla*). This sedge is known from several ponds at Blackbird State Forest in southwestern New Castle County.

Forests encircling seasonal ponds maintain the ecological integrity of these critical habitats in many ways. Coastal Plain seasonal ponds represent about 30% of the approximately 18,760 acres of Category 1 Wetlands in Delaware—rare freshwater wetland communities that are considered ecologically unique. These irreplaceable wetlands provide habitat for many state and globally rare animal and plant species that depend on them for their very survival.

Blackbird State Forest

Spotted turtle

Marbled salamander

Species of conservation concern

More than 2,500 animal species (vertebrates and invertebrates) are native to Delaware and of those, 584 are listed as Species of Greatest Conservation Need (SGCN) or more data is required for further determination or they are extirpated from Delaware (Table 4). Tier 1 SGCN (165 total) are in the highest need of conservation action. These include the rarest species in the state, species that are highly globally imperiled, and species with regionally important Delaware populations that are also under high threat from a changing climate. Tier 2 SCGN are of moderate conservation concern in Delaware. These include species that have rare to uncommon breeding populations in the state, species with broad distributions that are threatened by changes in climate, and species for which Delaware has high responsibility within the northeast region. Tier 3 SCGN are for the most part still relatively common in Delaware, but are listed as SGCN for various reasons, including documented population declines, high responsibility of the northeast region for the global population, or continued need for monitoring and/or management. This tier also includes non-breeding species that are uncommon in Delaware. Extirpated species once occurred in Delaware but have been determined through extensive survey effort to no longer occur in the state. The extirpated species included as SGCN have some possibility of reintroduction (i.e., suitable habitat may occur in the state and potential source populations may exist).

Table 4. Status of native animals in Delaware, 2018.*

Taxonomic Group	*Estimated Total Number of DE Species*	*Species of Greatest Conservation Need (SGCN)*					
		Total	*Tier 1*	*Tier 2*	*Tier 3*	*Data Needs*	*Extirpated*
Mammals	60	16	4	3	5	3	1
Birds	410	173	48	68	53	3	1
Amphibians	28	18	5	7	6	0	0
Snakes and Lizards	24	14	3	9	1	1	0
Turtles	16	5	3	2	0	0	0
Fishes	177	32	10	12	10	0	0
Mussels	14	11	6	4	0	0	1
Invertebrates	1,700+	289	82	96	27	80	4
Snails	96+	26	4	20	2	0	0
Total	***2,525+***	***584***	***165***	***221***	***104***	***87***	***7***

* Only animals found when terrestrial, freshwater, and brackish habitats are included. The total number of species is a conservative estimate given that many more invertebrae species likely occur in the state.

Source: The Delaware Wildlife Action Plan 2015-2025

Forest-dependent state endangered species

Delaware is home to 538 different species of mammals, birds, reptiles, and amphibians. Of these, 13 species are listed as endangered in the state and are forest-dependent (Table 5). For these species, healthy and contiguous forests are essential for their well-being. Continuing efforts should be made to protect critical forested habitat where these species occur. This could include actively managing the forest to prevent the ecological value to these species from degradation. Forest management and wildlife management activities that have common goals and objectives are mutually compatible. Efforts should consider active forest management as a viable method of protecting and enhancing forest habitat for all wildlife species both common and endangered.

13 species are listed as endangered in the state that are forest-dependent. Healthy and contiguous forests are essential for their well-being.

Forest-dependent birds

Avian diversity in Delaware forests depends on the geographic location, forest type, structure, and age. Of the more than 100 native bird species that are dependent on forests for breeding, migration, or overwintering, four are considered state-endangered (Table 5). Distributed widely throughout the state, some bird species depend on forest block size, tree size, plant community composition, forest and understory structure, and forest condition and growth stage (age). This further highlights the importance of maintaining a mosaic of forest types and age classes to maintain the diversity and health of all forest-related ecosystems.

Hooded warbler

Table 5. State of Delaware endangered forest-dependent species, 2015.

Scientific Name	*Common Name*	*Federal Status*	*Global Rank*	*State Rank*	*DEWAP Tier*	
					2007	*2015*
Birds						
Buteo platypterus	Broad-winged Hawk	NL	G5	S1B, S1N	1	1
Setophaga cerulea	Cerulean Warbler	NL	G4	S1B	1	1
Setophaga citrina	Hooded Warbler	NL	G5	S1B	1	1
Limnothlypis swainsonii	Swainson's Warbler	NL	G4	SHB	1	1
Reptiles						
Pantherophis guttatus	Red Cornsnake	NL	G5	S1	1	1
Cemophora coccinea	Scarletsnake	NL	G5	SH	1	1
Nerodia erythrogaster	Plain-bellied Watersnake	NL	G5	S1	1	1
Amphibians						
Pseudotriton montanus	Mud Salamander	NL	G5	S1	1	1
Ambystoma tigrinum	Eastern Tiger Salamander	NL	G5	S1	1	1
Hyla gratiosa	Barking Treefrog	NL	G5	S1	1	1
Mammals						
Myotis lucifugus	Little Brown Bat	NL	G5	S1	1	1
Myotis septentrionalis	Northern Long-eared Bat	LT	G4	S1	1	1
Sciurus niger cinereus	Delmarva Fox Squirrel	LE, XN	G5T3	S1	1	1

Source: The Delaware Wildlife Action Plan 2015-2025

NL Not listed
LT Listed as Threatened
LE Not evaluated
XN Delisted
G3 Vulnerable – At moderate risk of extinction due to restricted range, relatively few populations (≤80), recent and widespread declines, or other factors.
G4 Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 Secure – Common; widespread and abundant.
T3 Subspecies ranking (see G3 above).
S1 Extremely rare within the state (typically 5 or fewer occurrences).
SH Historically known to occur in the state.
B Breeding population.
N Non-breeding population.

Ten years ago, Delaware listed eight bird species as endangered. Since then, five were removed and one was added. The bald eagle (*Haliaeetus leucocephalus*) moved from Tier 1 to Tier 3 because it is now relatively common throughout the state. Cooper's hawk (*Accipiter cooperii*) was removed from the SGCN altogether. And the red-headed woodpecker (*Melanerpes erythrocephalus*), brown creeper (*Certhia americana*), and northern parula (*Parula amiricana*) were moved from Tier 1 to Tier 2. The new addition is the broad-winged hawk (*Buteo platypterus*) that is a raptor of extensively forested areas and very few nest in Delaware due to the extent of forest fragmentation. However, during migration, thousands pass through the northern Delaware Piedmont on their way to South America for the winter.

Table 6. Forest-dependent bird species of greatest conservation need (SGCN).

Scientific Name	*Common Name*	*DEWAP Tier*
Forest Birds		
Vireo gilvus	Warbling Vireo	2
Colaptes auratus	Northern Flicker	3
Haliaeetus leucocephalus	Bald Eagle	3
Icterus galbula	Baltimore Oriole	3
Myiarchus crinitus	Great Crested Flycatcher	3
Tyrannus tyrannus	Eastern Kingbird	3
Forest Interior Birds		
Buteo platypterus	Broad-winged Hawk	1
Setophaga cerulea	Cerulean Warbler	1
Certhia americana	Brown Creeper	2
Pheucticus ludovicianus	Rose-breasted Grosbeak	2
Piranga olivacea	Scarlet Tanager	2
Setophaga dominica	Yellow-throated Warbler	2
Buteo lineatus	Red-shouldered Hawk	3
Piranga rubra	Summer Tanager	3
Vireo flavifrons	Yellow-throated Vireo	3
Forest Interior Understory Birds		
Setophaga citrina	Hooded Warbler	1
Catharus fuscescens	Veery	2
Hylocichla mustelina	Wood Thrush	2
Setophaga ruticilla	American Redstart	2
Empidonax virescens	Acadian Flycatcher	3
Geothlypis formosa	Kentucky Warbler	3
Helmitheros vermivorum	Worm-eating Warbler	3
Mniotilta varia	Black-and-white Warbler	3
Parkesia motacilla	Louisiana Waterthrush	3
Bonasa umbellus	Ruffed Grouse	extirpated
Forest Interior Wetlands Birds		
Limnothlypis swainsonii	Swainson's Warbler	1
Setophaga americana	Northern Parula	2
Protonotaria citrea	Prothonotary Warbler	3
Pine Specialist Birds		
Melanerpes erythrocephalus	Red-headed Woodpecker	2
Sitta pusilla	Brown-headed Nuthatch	2

Source: The Delaware Wildlife Action Plan 2015-2025

The other three Delaware endangered forest-dependent bird species are all warblers—small neotropical migrants that require forest habitat for breeding. The cerulean warbler (*Setophaga cerulea*) uses mature floodplain forest for nesting in Delaware typically in semi-open canopy well above the forest floor. This species is restricted to the Piedmont region of Delaware within the northern reaches of the White Clay Creek watershed. Sharply contrasting with the cerulean warbler, the Swainson's warbler (*Limnothlypis swainsonii*) and hooded warbler (*Setophaga citrina*) nest much closer to the ground. For these two species, the forest structure (particularly the understory) is far more important that the other forest components. Hooded warbler breeding records are widely distributed across Delaware but are rare. This species requires rich, moist upland forest with a very dense understory. Swainson's warbler also requires a very dense understory, but this species prefers mature forested swamps and bogs and is restricted to Sussex County (Pocomoke and Nanticoke watersheds). Both species are quite rare, and there have been no confirmed reports of Swainson's warbler breeding in Delaware since the 1970s, most likely due to decreased habitat suitability and outright habitat loss.

The many SGCN birds that depend on interior forests are faced with shrinking forest patches and higher levels of competition for food and nesting resources.

Although three of the four Delaware endangered birds rely on forest interior, there are many other SGCN in the Tier 2 and Tier 3 categories that also utilize this particular forested habitat (Table 6). The red-shouldered hawk (*Buteo lineatus*), for example, is very sensitive to disturbance of any kind. Nesting within the interior of a forest block reduces the potential for disturbance that would otherwise cause this bird to abandon its nesting attempts. Other species, including many forest-dependent songbirds, require forest interior habitat to reduce the predation and parasitism pressure on their respective populations. Associated with forest edge are greater densities of predators such as foxes, raccoons, and even other avian predators such as blue jays (*Cyanocitta cristata*) and crows (*Corvus brachyrhynchos*). Parasitism by the brown-headed cowbird (*Molothrus ater*) also occurs more frequently along forest edges where the species can easily detect host nests.

Cerulean warbler

The many bird SGCN that depend on interior forests are faced with shrinking forest patches and higher levels of inter- and intra-specific competition for food and nesting resources. As Delaware's forests become more fragmented, this creates more edge and an advantage for the parasitic cowbird. Large blocks of contiguous forest provide greater interior habitat that benefits non-breeding bird species that may use these large forested areas as migratory stop-over sites or for overwintering. Losses of forest interior habitat not only negatively affects many local breeding bird populations, but also places additional stress on those birds that spend a short period in Delaware during spring and fall migration.

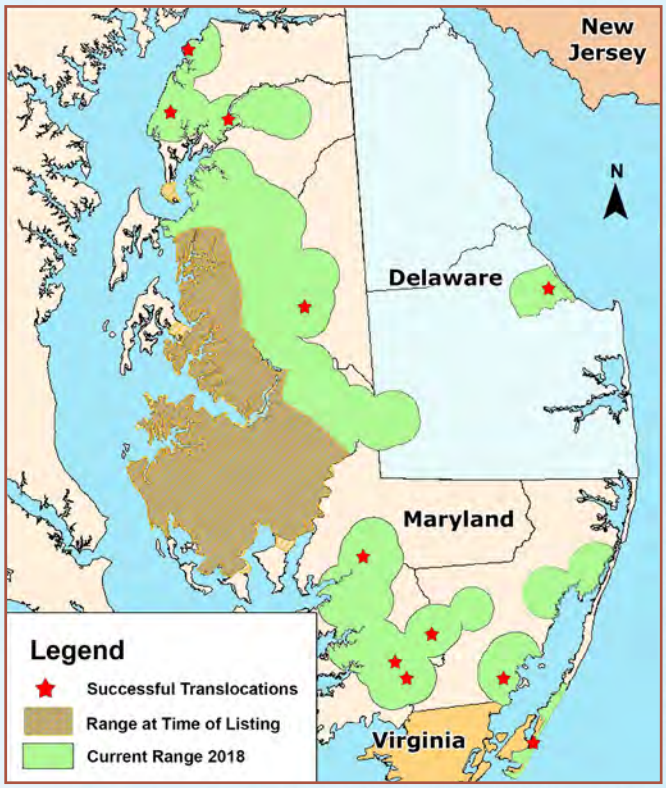
Delmarva fox squirrel

Ten years ago, the Delmarva fox squirrel (*Sciurus niger cinereus*), a subspecies of fox squirrel found only on the Delmarva Peninsula, was the only terrestrial mammal in Delaware listed under the Federal Endangered Species Act as an endangered species. This species' population had been reduced to a small portion (<10%) of its original native range due to habitat loss and hunting (Figure 17). The process to develop a Habitat Conservation Plan (HCP) for the squirrel was initiated in 2003 and included an HCP advisory team and science team. The HCP was not completed until 2014 due to disagreements among landowners and government officials concerning permissible land uses. Then in November 2015, the Delmarva fox squirrel was delisted as a federally endangered species by the U.S. Fish & Wildlife Service.

Delmarva fox squirrel

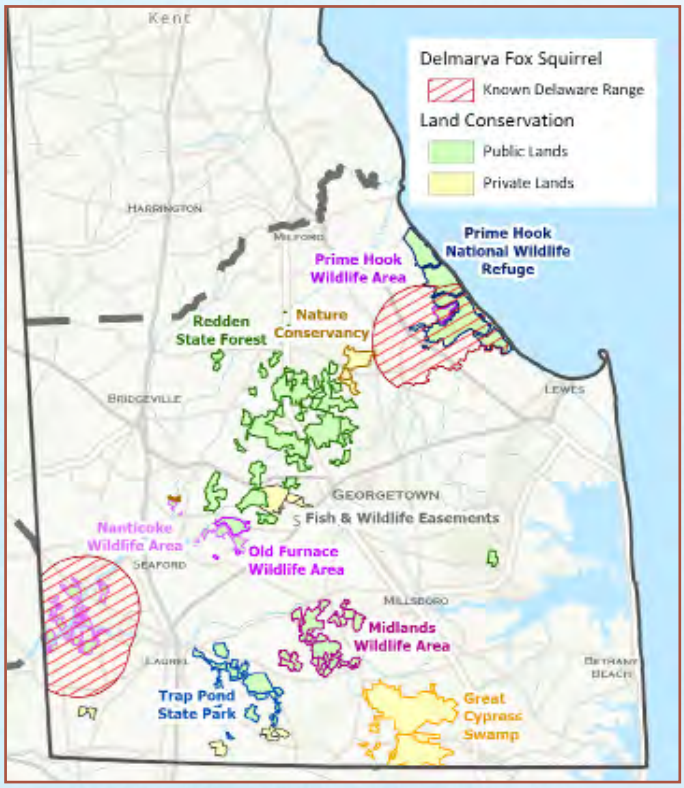
Although still listed as endangered by the State of Delaware because of its rarity locally (only two confirmed locations), the federal delisting has paved the way for cooperative efforts with private and public forest landowners to expand existing populations. There are no longer any federal restrictions on forest management activities that may or may not directly affect the fox squirrel. Additionally, the state's Division of Fish & Wildlife drafted a conservation plan for the species in 2014. Connectivity between Prime Hook and Nanticoke Wildlife Area populations may be possible through translocation of individuals from existing populations to suitable forested habitat in and around Redden State Forest (Figure 18). Without any restrictive federal mandates on forestland use with respect to this rare Delaware species, neighboring forest landowners might be more likely to help build the Delmarva fox squirrel population to its historically widespread level.

Figure 17. Current distribution of the Delmarva fox squirrel, *Sciurus niger cinereus*.



Source: U.S. Fish & Wildlife Service

Figure 18. Current distribution of the Delmarva fox squirrel, *Sciurus niger cinereus*, in Delaware.



Source: State of Delaware

Forest-dependent bats

Forests offer many essential resources to bats including a diverse assemblage of prey insects, trees for maternity colony and individual roosts, overwintering locations, and ponds. Some bats use buildings in the summer to raise their young while others use caves, mines, or other structures for winter hibernation. However, all Delaware bat species use forests for some aspect of their life history requirements. Therefore, forest management is crucial to maintaining high-quality habitat and healthy bat populations.

Threats to bats include habitat loss, pollution, climate change, direct persecution, wind turbines, and disease. Tragically, several species experienced precipitous population declines in eastern North America as a result of white-nose syndrome (WNS). This exotic fungal disease invades the bats' skin tissue during hibernation disrupting physiological processes and causing them to awaken and expend energy needed to survive the winter. The disease has killed millions of bats and continues to spread throughout North America at an unprecedented rate.

Little brown bat

Of particular concern in Delaware are the forest-dependent little brown bat (*Myotis lucifugus*) and northern long-eared bat (*M. septentrionalis*), both Tier 1 SGCN with the latter also listed as federally threatened. Also affected by WNS are the eastern small-footed bat (*M. leibii*), big brown bat (*Eptesicus fuscus*), and tri-colored bat (*Perimyotis subflavous*).

To ease population decline, resource managers can take actions that benefit bats during the spring, summer, and fall. Securing habitats and providing roosting, food, and watering sites may help both the survivors of WNS and bats not affected by WNS. Accommodating the needs of the various species requires a mosaic of forest types and ages as well as non-forest habitats (e.g., grasslands, wetlands, scrub-shrub, etc.). The size and juxtaposition of patches are also critical to meeting life history requirements of many bats. At a local scale, the presence of high-quality maternity habitat near quality foraging and water localities can be key to maintaining population levels.

Delaware forests play an essential role in bat ecology by providing breeding habitat in summer months, roosting sites for local and migratory species in the spring and fall, and hibernation sites for some species during winter. The silver-haired bat (*Lasionycteris noctivagans*), red bat (*Lasiurus borealis*), and big brown bat hibernate in the tree hollows, under bark, in wood piles, and in leaf litter. While specific roost tree and landscape types vary among species, most bats prefer to roost in large-diameter trees and snags, which generally persist longer than smaller snags and can support more roosting bats.

Northern long-eared bat

Forest plants

Because of its latitude, Delaware is in a transition zone for northern and southern plant species. For example, Delaware is the northern extreme limit of certain southern tree species such as loblolly pine and baldcypress. Conversely, some northern species are not found south of Delaware, except primarily at higher elevations (e.g., sugar maple [*Acer saccharum*], basswood [*Tilia americana*], and eastern hemlock [*Tsuga canadensis*]). Wetland and upland forest interior habitats in Delaware support a greater diversity of native vascular plants than any other specific habitat type in the state, with upland forest types as the most species-rich. Specifically, 450 taxa (species and varieties) are considered forest interior species in Delaware and 260 of these are considered upland species. No tree species known to have occurred in Delaware at the time of European settlement are extirpated and none are listed as federally threatened or endangered.

Basswood

Two forest interior plant species are federally listed as threatened by the U.S. Fish & Wildlife Service: swamp pink (*Helonias bullata*) and small whorled pagonia (*Isotria medeoloides*). Although Delaware's state endangered species law does not include plants, the state's Wildlife Species Conservation & Research Program maintains a list of rare Delaware plant species. Approximately 36% (163 species) of all native forest interior plants within the state are rare with the greatest number (57%) of these occurring in upland forests. The primary cause of decline is loss of habitat including wetlands and upland forests.

Swamp pink

Conclusions

Although no Delaware tree species are federally threatened or endangered, significant changes have occurred in Delaware's forest types. In addition to the outright loss of loblolly pine forests, there has been a significant loss of baldcypress and Atlantic white-cedar, two species that once dominated the landscape in their respective habitats. Though only two plant and one animal species that are forest dependent are federally listed as threatened, there are many other state SGCN that require forested habitats. Further loss of forests in Delaware will most certainly place many other species at risk. Forest management practices that can enhance and protect critical wildlife habitat should be encouraged and those practices that cause harm should be avoided.

Summary – Criterion 1

While Delaware has more forested acres now than a century ago, forest acreage is currently declining. There has been a net annual loss of just under 1,000 acres since 1986. This loss is due to Delaware's ever-increasing human population and the demand for housing. Recent growth patterns in land development create even more forest fragmentation and parcelization. Delaware has taken active steps to protect the remaining forestland—approximately 30% (107,000 acres) of its 359,000 acres of forestland are now protected through either public ownership or permanent conservation easements. This is an improvement over ten years ago of approximately 7,000 acres. However, substantially more acres need protection from conversion to non-forest uses for future generations to ensure that there is a sufficient forest base to sustain many of the natural benefits and services Delawareans currently enjoy.

Likewise, we must ensure an adequate mixture of forest types for the future from both an ecologic and economic point of view. Delaware experienced a dramatic decline in loblolly pine in the late 20th century and a slow but very steady increase in the volume of older and larger timber. These trends are not catastrophic but require our attention so that a balance is maintained for species composition as well as age and size composition. This balance is necessary to ensure that sufficient habitat is available for the animal and plant species that require a wide diversity of forest habitat and cover, particularly threatened species and species of greatest conservation concern. Approximately one-third of forest dependent plants and animals are included on the state's list of species of concern.

Maintaining a critical mass of forestland and a wide range of forest types in Delaware ties directly into two of the U.S. Forest Service's State and Private Forestry (S&PF) national priorities—*Conserve and manage working forest landscapes for multiple values and uses* and *Enhance public benefits from trees and forests.*