

A close-up photograph of a bog turtle resting in a field of vibrant green grass. The turtle's head is turned to the left, showing a bright orange patch on its face. Its dark, textured shell is prominent, with distinct scutes and concentric growth lines. The background is a soft-focus field of tall grass.

Working Forest Guide to Threatened, Endangered or At Risk Species

**Promoting Sustainable Forests with Exceptional
Value in Pennsylvania**

Introduction

According to the Department of Conservation and Natural Resources (DCNR) Pennsylvania Bureau of Forestry, Pennsylvania has an estimated 16.6 million acres of forest land which are home to many exceptional flora and fauna, including rare, threatened, and endangered plant and animal species that rely on these woodlands for food, shelter, and habitat. Forest management actions can have both positive and negative impacts on at-risk species.

This booklet is written for foresters, loggers, landowners, and other individuals who work on forested lands. It provides guidance on increasing biodiversity and protecting high value forests which may include threatened and endangered species. Regulations and guidelines are explained that protect rare, threatened, and endangered species while still allowing for sustainable forest harvesting operations. This booklet focuses on a few at-risk species that forested landowners may encounter but is not an exhaustive list. State- and federally-listed endangered and threatened plants and animals and their immediate habitats are protected by state and federal laws, regulations, and guidelines. These help safeguard the remaining populations or habitats of these species and must be followed during forest management operations. Landowners, loggers, and timber companies are responsible for ensuring that no harm occurs to threatened and endangered species as a result of their project, or to seek an incidental take permit where appropriate. The following information does not take the place of environmental review or coordination with the government agencies responsible for protecting biodiversity, known as jurisdictional agencies.

The information presented here was developed using publicly available guidance from the jurisdictional agencies in Pennsylvania at the time of writing, such as species fact sheets and management plans.

This booklet was written by DCNR Bureau of Forestry in cooperation with the Pennsylvania Sustainable Forestry Initiative's Implementation Committee.



Pennsylvania
**Department of Conservation
and Natural Resources**
Bureau of Forestry



SFI-01141

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Biodiversity and Sustainable Forests

Forests are managed sustainably when ecological, economic, and socio-economic needs are balanced, and with a plan for perpetuating that forest into the future. Sustainably managed forests typically support higher biological diversity, or “biodiversity.” This is the variety and abundance of species, their genetic composition, and the communities and ecosystems in which they occur. Biodiversity is an indicator of ecosystem health. Intact habitats with well-functioning ecological processes generally have a higher diversity of native plants and animals.

Managing for sustainable forests and biodiversity improves the resilience of the forest. Making sure forests are resilient is important because approximately 70% of terrestrial animals and plants make their homes in forests, according to the Forest Stewardship Council (as of July 2022). Nearly 25% of the world’s people rely on forest resources for their livelihoods according to a recent International Union for Conservation of Nature issues brief.



Through natural processes and active forest management, forest lands host a broad diversity of structural features, climates, and food sources that support an assortment of plants and animals. Although forest sustainability characteristics and biodiversity are complex, it is helpful to think about the presence or absence of quality structural factors—such as snags, cavity trees, down wood and wetlands.

Snags, Cavity Trees, Down Wood

Snags are standing dead or partially dead trees and are valuable for a variety of wildlife species that use them

for nesting, roosting, foraging, perching, and territorial or other displays. Cavity trees are living or dead trees that have a hollow or partially hollow section. According to research, at least 20 species of mammal species and 35 species of birds including wood ducks, screech owls, and pileated woodpeckers, use tree cavities for nest sites, dens, and cover. Maintaining snags and cavity trees is a great way to provide wildlife habitat. Down woody material on a forest floor, (i.e., down wood), especially large, hollow stumps or logs, is important for nutrient cycling, nurse logs for regeneration, and habitat for wildlife. They are used by ruffed grouse for drumming and other small animals as shelter. Decaying logs increase the moisture on the forest floor.

Forested Wetlands and Vernal Pools

Wetlands are defined under Section 404 of the Federal Clean Water Act and Chapter 105 of Pennsylvania's Title 25 Environmental Protection code (under the authority of Pennsylvania's Dam Safety and Encroachment Act enforced by the Pennsylvania Department of Environmental Protection, (DEP)). They are typically characterized by hydrophytic vegetation, hydric soils, and the presence of water at or near the surface for a portion of the year. Forested wetlands usually support a greater diversity of species than nearby upland forests. They provide habitat for wood turtles, water shrews, muskrats, beavers, and waterfowl. Bears are also known to spend time in spring and summer in forested wetlands. Mast and seeds that have fallen or been washed into wetlands and vernal pools are important sources of food for turkeys and many other birds and wildlife in winter.



Vernal pools or seasonal pools are a unique type of wetland habitat. They are typically small, shallow, ephemeral water bodies and, unlike a pond or lake, they have no permanent inlet or outlet. They usually dry up in summer or fall. The rich food supply of microscopic algae and small invertebrates, as well as the lack of predatory fish, make vernal pools critical to the continued survival of some amphibians, insects, and crustaceans. Listening for spring peepers when out in the woods helps to identify vernal pools on the landscape. Protecting wetlands, vernal pools, and providing quality upland habitat nearby is important to the continued life cycle of these species.

SFI and Forests with Exceptional Conservation Value

Forests with Exceptional Conservation Value (FECV) are those that support flora and fauna at significant risk of being lost—rare plants, animals, or ecological communities or groups of species that are commonly found together. These species and ecological communities are considered “critically imperiled” because of a very high risk of extinction due to very restricted range, very few populations, very steep declines, very severe threats, or other factors. “Imperiled” refers to a high risk. Global conservation ranks of “G1” for critically imperiled and “G2” for imperiled are assigned by scientists at NatureServe, a non-profit international network of Natural Heritage Programs using information from network partners worldwide. These ranks can help prioritize conservation and protection. The Sustainable Forestry Initiative (SFI) FECV fiber sourcing standards help ensure that areas with imperiled and critically imperiled species and ecological communities are identified and protected within forest management plans and operations.

Protect Exceptional Value Habitats

A forest’s biodiversity and sensitive habitat, such as wetland and riparian areas, vernal pools, very shallow soils, dry ridgetops, and rich, moist woods, should be conserved as much as possible. To protect sensitive habitat and biodiversity on project sites, plan the project based on the site using on-line tools and additional resources de-

scribed throughout this booklet.

Keeping Common Species Common

While focus is often on minimizing impacts to rare and threatened species, it is also important to keep common species common. This is a conservation principle to preserve the abundance and diversity of native plants and animals that are widespread within an ecosystem.

Keeping common species common underscores the importance of maintaining the populations of species that are not currently threatened or endangered but may play crucial roles in ecosystem functions and services. By focusing efforts on conserving these common species, forest landowners, conservationists, and land managers can help prevent their decline and ensure the overall health and resilience of ecosystems. This approach recognizes that even though common species may not be at immediate risk, their populations can still be vulnerable to habitat loss, degradation, and other human induced pressures. Therefore, proactive conservation measures are essential to sustain these species and the ecosystems they inhabit for future generations.

Additional Resources:

The following documents can be accessed through the Penn State University's Extension Service. For each publication, enter the publication name in your browser. See Appendix 1 for all QR codes to access using a mobile device.

[Forest Stewardship: Conserving Biological Wealth in Forests \(psu.edu\)](#)

[Forest Stewardship: Best Management Practices for Pennsylvania Forests \(psu.edu\)](#)

[Forest Biodiversity: Understanding Biological Health in Our Forests \(psu.edu\)](#)

[Sustainable Forestry \(psu.edu\)](#)



Pink lady's-slipper orchids (*Cypripedium acaule*, G5 S5) commonly often grow in mixed hardwood and coniferous forests, often with pine and hemlock on rocky slopes or somewhat open acidic humus.

Timber Harvesting and Environmental Regulations

Timber harvesting operations conducted within Pennsylvania are regulated to minimize their impacts on soil and water resources and must be undertaken in accordance with all state and federal regulations. This includes Chapters 93, 102 and 105 of Pennsylvania's Title 25 Environmental Protection code, under the authority of the Clean Streams Law and enforced by the Pennsylvania Department of Environmental Protection (DEP) and the Federal Clean Water Act enforced under the joint authority of the U.S. Environmental Protection Agency, and the U.S. Army Corps of Engineers.

Harvesting operations that involve stream and wetland crossings or other impacts may need to obtain permits from the Pennsylvania DEP or the Army Corps of Engineers. These permits contain requirements that protect threatened and endangered species. This section outlines these regulations and permit requirements and provides resources for complying.



PA Code: Chapter 102 Erosion and Sediment Control

In Pennsylvania, all earth disturbance activities, regardless of size or extent, are required to implement and maintain best management practices (BMPs) to minimize the potential for accelerated erosion and resulting sedimentation to waters of the Commonwealth. When planned disturbances total 5,000 square feet or more, or have the potential to discharge to a special protection surface water (i.e., streams classified as High Quality "HQ", or Exceptional Value "EV" under Chapter 93 of the Pennsylvania Code), DEP regulations require that a written Erosion & Sedimentation (E&S) Plan must also be developed and kept on-site at all times (25 Pa. Code § 102.4(b)(2)). Typically, the earth disturbance activity associated with a timber harvesting activity includes the haul roads, landings, skid roads, and skid trails. DEP's regulations require timber harvesting activities that disturb 25 acres or more

to obtain an E&S Permit (25 Pa. Code § 102.5(b)). All necessary permits must be obtained prior to beginning any earth disturbance.

PA Code: Chapter 105 Dam Safety and Waterway Management

Activities associated with timber harvesting operations are also governed by DEP's Chapter 105 Dam Safety and Waterway Management regulations adopted under the provisions of the Clean Streams Law, Dam Safety and Encroachments Act, and the Floodplain Management Act (32 P.S. §§ 679.101-679.601). Chapter 105 regulations govern the crossing of streams and their floodways, wetlands, and other bodies of water. Bridges, culverts, fills, walls, embankments, other structures, and activities which change the course, current, or cross section of a stream, floodway, wetland, or body of water are regulated by Chapter 105. Most structures and activities in Pennsylvania waterways (dams, water obstructions and encroachments) require some type of authorization or permit from DEP to protect public health, safety, and the environment. For more information, see SFI's Best Management Practices for Timber Harvest Operations (https://www.sfiopa.org/_download_link.php?did=15).

Endangered Species Laws

There are both federal and state laws governing endangered species. Landowners, loggers, timber companies, and DEP are expected to follow the federal and state endangered species laws in order to prevent take of wildlife or threatened and endangered (T&E) species. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Landowners, loggers, companies and other people can be liable of take even if they are not applying for a DEP permit. The onus is on the responsible party to ensure T&E species are not taken in the process of their project. If take seems imminent, consultation with the US Fish and Wildlife Service, PA Game Commission or the PA Fish and Boat Commission is necessary to obtain an incidental take permit.

Federal Laws:

- **Bald and Golden Eagle Act:** prohibits take of bald and golden eagles, their nests or eggs
- **Migratory Bird Treaty Act:** prohibits take of migratory birds
- **Endangered Species Act:** prohibits take of the animals and plants listed as T or E

State Laws:

- **PA Game Code (Title 34, Chapter 21):** prohibits the take of T or E birds or mammals in PA
- **PA Fish Code (Title 30, Chapter 23):** prohibits the take of T or E fish or aquatic species in PA
- **Conservation of Native Wild Plants (Title 17, Chapter 45):** prohibits the take of T or E plants in PA.

Pennsylvania Natural Diversity Inventory Environmental Review

Chapter 102, 105, and other permits require the protection of state and federal T&E species on a project site. In addition, permit applicants may have to address potential impacts to special concern species (non T or E species). The DEP permit review process requires applicants to screen their projects and ensure they do not impact T&E species. Commonly, applicants use the Pennsylvania Natural Diversity Inventory (PNDI) Environmental Review Tool to accomplish this step as it is an efficient and timely means of conducting this screening. More information about the PNDI process can be found in the next section.

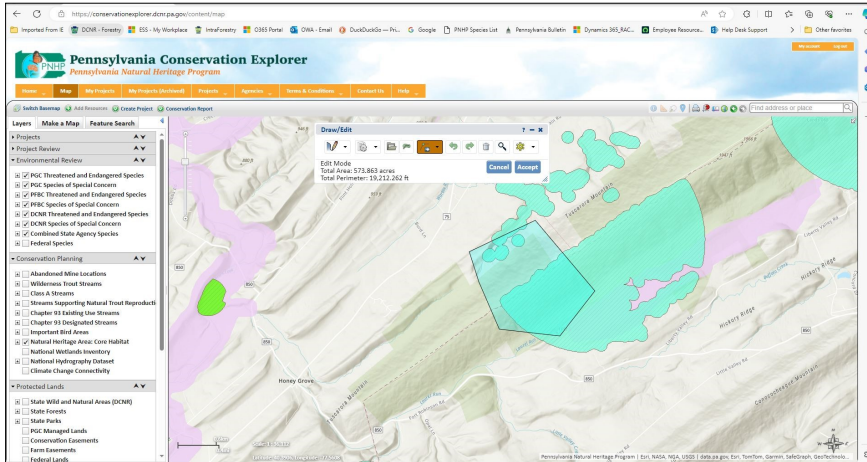
Early coordination (prior to permit application) by prospective applicants and their consultants with the appropriate jurisdictional agencies is the most effective means of a timely permit decision. If the PNDI review determines there are potential impacts to a T&E species, the PNDI receipt will provide an explanation of the potential impact(s) and instructions on how to resolve the potential impact(s). Read and follow these instructions carefully.

The Pennsylvania SFI Implementation Committee encourages conducting PNDI Environmental Reviews prior to all timber harvests conducted in Pennsylvania, regardless of whether or not a permit is required.

Online Tools

Several online tools exist to help landowners or people conducting projects to learn about any threatened or endangered species or other species of concern present in an area and the potential impact of a project.

PNDI & Environmental Review



Scan the QR code to open PA Conservation Explorer (see Appendix 1 for QR code index).

<https://conservationexplorer.dcnr.pa.gov/>

PNDI Environmental Review Tool is commonly used to identify potential impacts to threatened, endangered, special concern species and resources in Pennsylvania. Anyone, including property owners, consultants, project planners, and state and municipal governments can access the tool for PNDI project screening online.

The tool screens project footprints against known species and resource locations. Applicants create a login with username and password, draw their project boundaries into the tool, and may be asked additional questions by the system. A receipt is generated with potential impacts listed and jurisdictional agencies to contact for coordination. Users are charged a \$40 fee per PNDI receipt for convenience of online review, but there is a free option for hard copy mail-in review as well. The agencies work with the applicant to determine best practices to avoid, minimize, or mitigate impacts. DEP uses PNDI as part of the permitting process to ensure no T or E species are impacted by the permits they issue.

It is recommended that timber harvesters complete a PNDI search on operations, whether mandatory or not. Conducting the search as early as possible gives projects a head start on working with professionals to determine best practices if impacts are identified.

The PNDI tool is a product of the Pennsylvania Natural Heritage Program (PNHP) which is a partnership between DCNR, PA Game Commission, PA Fish and Boat Commission, and the Western Pennsylvania Conservancy, in cooperation with the U.S. Fish and Wildlife Service. Below are the responsibilities of each agency (see Appendix 1 for QR codes for links, or enter the agency name in your browser, or click the link below.)

- ⇒ **PA Department of Conservation and Natural Resources:** Jurisdictional authority for plants in Pennsylvania. Reviews and makes recommendations for state-listed plants, as well as non-listed natural communities, terrestrial invertebrates and geologic features. Manages the PA Natural Heritage Program. Administered through the Bureau of Forestry (www.dcnr.pa.gov)
- ⇒ **PA Game Commission:** Jurisdictional authority for birds and mammals in Pennsylvania. Reviews and makes recommendations for state-listed birds and mammals (www.pgc.pa.gov)
- ⇒ **PA Fish and Boat Commission:** Jurisdictional authority for aquatic species in Pennsylvania. Reviews and makes recommendations for state-listed fish, reptiles, amphibians, and aquatic organisms (www.fishandboat.com)
- ⇒ **US Fish and Wildlife Service:** Authority for any species listed under the Federal Endangered Species Act. Reviews and makes determinations for Federally listed species (www.fws.gov)

Pennsylvania Conservation Explorer

The PNDI tool is housed within the Pennsylvania Conservation Explorer, which provides conservation planning information. Here, users see locations of important habitats, protected lands, high quality water resources as well as other conserved lands, or upload their own shapefiles. Users can generate a free Conservation Planning Report, summarizing the above information, for use in landscape level planning or project specific assessment.

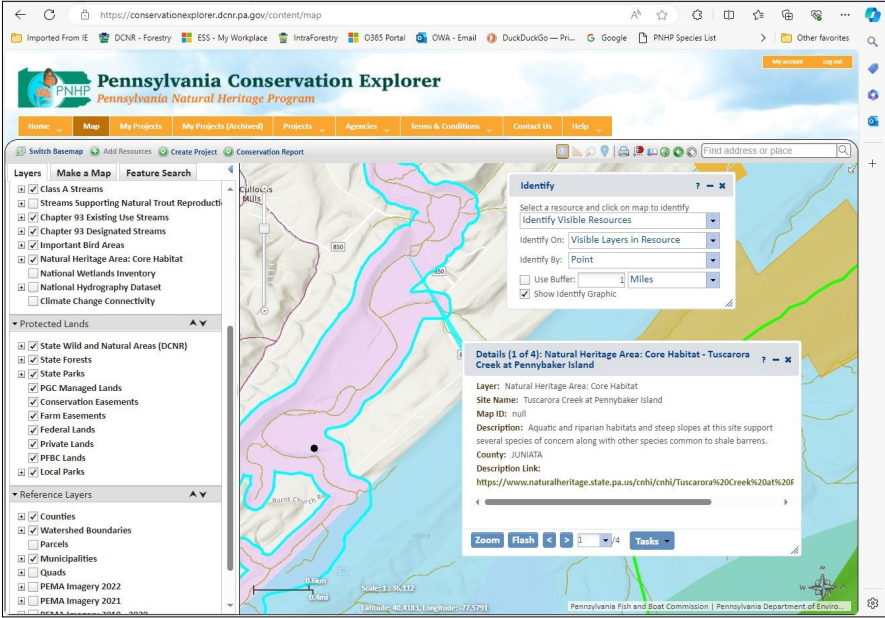


How to create a conservation report



Other Resources

For information on how to create a conservation report and for other resources, scan the QR codes above. See Appendix 1 for all QR codes



<https://conservationexplorer.dcnr.pa.gov/>

Conservation Opportunity Area Tool

The Conservation Opportunity Area Tool (COA Tool) is a web-based representation of the current Pennsylvania Wildlife Action Plan species accounts. It includes spatial data for 552 of 664 Species of Greatest Conservation Need (SGCN) at the 10-acre planning unit scale. SGCN are native wildlife species facing significant threats, declining populations, or for which Pennsylvania is responsible for a significant portion of the species range that are identified in the Pennsylvania Wildlife Action Plan (www.pgc.pa.gov/Wildlife/WildlifeActionPlan/Pages/Default.aspx).

SGCN associated habitats, conservation actions, research and survey needs also are available in an Area of Interest Report.

This tool is available for anyone interested in conserving at-risk species, including private landowners seeking to improve habitat on non-governmental organizations (e.g., land trusts, conservancies), municipalities, Conservation Districts, resource managers, users curious about SGCN in their area, and many others.

Note that this tool does not satisfy or replace regulatory review requirements and is not for PNDI project screening.

<https://wildlifeactionmap.pa.gov/>

The screenshot shows the homepage of the Conservation Opportunity Area Tool. At the top, there is a navigation bar with links for Home, Map, My Projects, Statewide Search, Data Info, Terms & Conditions, Our Thanks, and Help. To the right of the navigation bar are logos for the Pennsylvania Wildlife Action Plan and the Pennsylvania Game Commission. Below the navigation bar, the main heading reads "Welcome to the Pennsylvania Wildlife Action Plan Conservation Opportunity Area Tool!". A yellow banner below the heading contains the text "**Updates**" and "This site was last updated on 4 May 2024. Refer to the Data Info tab for data status. It is recommended to clear your browser's cache for the updates to be visible." Below the banner is a large, vibrant image collage featuring a person in a hat looking through binoculars, a bright red cardinal perched on a branch, a monarch butterfly, a waterfall in a forest, a large owl, and a person kneeling in a field. At the bottom of the collage, a teal banner contains the text "! Important!" and "This tool does not satisfy or replace regulatory review requirements and is not for Pennsylvania Natural Diversity Inventory (PNDI) project".

NatureServe Explorer

NatureServe is an international network of natural heritage programs that gather and provide information on the location and status of important ecological resources (plants, vertebrates, invertebrates, natural communities, and geologic features). NatureServe provides information on 100,000 rare and endangered species and ecosystems in the Americas that it tracks. The Pennsylvania Natural Heritage Program is a member of NatureServe. This is a great way to get general information about rare species and their status nationwide.

<https://explorer.natureserve.org/>

The screenshot shows the NatureServe Explorer interface for the species *Isotria medeoloides* (Small Whorled Pogonia). At the top, there is a navigation bar with links for Search, About the Data, About Us, Help, Explorer Pro, and Adopt a Species. A language dropdown is set to English. Below the species name, a row of conservation status icons is displayed: GX (Presumed Extinct), GH (Possibly Extinct), G1 (Critically Imperiled), G2 (Imperiled - highlighted in orange), G3 (Vulnerable), G4 (Apparently Secure), G5 (Secure), and No Status Rank. Below this, a map shows the state/provincial conservation status and documented distribution. The map includes a legend with categories: Presumed Extirpated (SX), Possibly Extirpated (SH), Critically Imperiled (S1), Imperiled (S2), Vulnerable (S3), Apparently Secure (S4), Secure (S5), No Status Rank (SNR/SU/SNA), Exotic, and Hybrid. The map shows the species' range from the Great Lakes region down to the Gulf of Mexico and across the eastern United States. A scale bar indicates 1000 km and 800 mi. The footer of the map area includes the text: Province of Ontario, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada, and Powered by Esri.

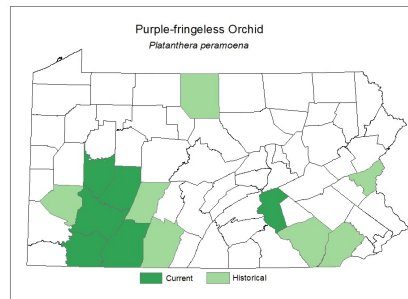
Species Profiles

Introduction to Species Profiles

Pennsylvania is home to many plant and animal species, common and rare alike, in many different habitat types. This section provides information on some species that are at risk in Pennsylvania for landowners, loggers, foresters, and other resource management professionals. In many cases, land management can benefit these species.

The species accounts provide overviews of each species, their habitats, and management practices. The following pages feature accounts for plants, mammals, birds, reptiles and amphibians at risk in Pennsylvania. Each species profile includes an information bar at the bottom of each page with the following:

- Common name (*Scientific name*)
- Status: state and/or federal listing
- Global and State Ranks: Nature Serve ranks summarize the global (G) and state (S) rarity of a species as “G1,” most rare globally, to “G5,” most secure. Similarly, S ranks indicate the level of rarity at state level.
- Habitat information summarizing the type of forest (deciduous vs. coniferous), setting (shady, sunny, dry, moist), and other important features (rocky, wetlands, vernal pools, cliffs or caves, near bodies of water, grassland, and young forest).
- Range is shown by a county map, example shown here. Where information is available, dark green counties show currently known populations, and lighter green represent historical populations (where the species might not be present currently). The range maps were developed based on known PA Natural Heritage Program data and if available, recovery plans from the jurisdictional agencies.



Example map

Plants and Habitat

Plants play a major role in every ecosystem on the planet. They create the oxygen we breathe and are the first link in the food chain. They convert energy from the sun into usable forms.

In fact, plants are so important that a special law, the Wild Resource Conservation Act, established a procedure for protection of wild flora in Pennsylvania. DCNR has jurisdiction for native wild plants in Pennsylvania, which includes surveying plant populations, classifying them, and providing for their conservation.

Pennsylvania is home to approximately 3,000 plant species, and roughly two-thirds of those are considered native to the Commonwealth. Of these native plants, 582 are classified by DCNR, with 349 considered rare, threatened, or endangered in Pennsylvania. Some common habitat types landowners may encounter follow in this booklet, with a few rare plants that could benefit from forest management.

General Rare Plant Considerations:

- ⇒ Herbaceous (non-woody) plants are seasonal and can be protected in part by conducting forest operations in after seed has set or, where cold winters enough, conducting operations on frozen ground.
- ⇒ Some plants do not tolerate shade but prefer sunny, open conditions. Timber harvesting practices may be used to open the canopy and “daylight” sites with such species.
- ⇒ Many rare plants, like their rare animal associates, are found in rare natural community types such as limestone barrens and vernal pools. Conserving these important habitats will conserve a suite of species.
- ⇒ Invasive plant management can benefit native and rare plants by removing competition and providing more suitable habitat. Invasive plant management help can be found at DCNR’s invasive plant webpage: www.dcnr.pa.gov/Conservation/WildPlants/InvasivePlants/Pages/default.aspx.

Wetland and Wet Area Plants

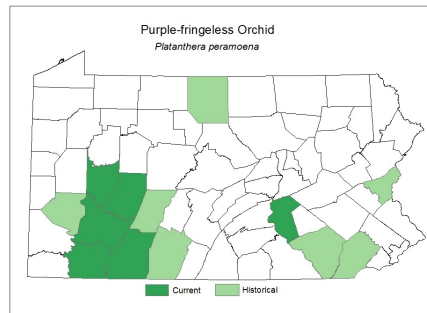
Obligate wetland plants require wet or saturated soil, upland plants use drier sites. Plants that can use either are called facultative. Sedges (*Carex* species) and rushes (*Juncus* species) are good indicators of the presence of a wetland.

Purple Fringeless Orchid

Description: Purple fringeless orchid grows to about 3 ft. tall, with loose spikes of violet-pink flowers. It is thought that the flower shapes are adapted for pollination by daytime moths and butterflies. It grows in open, swampy places such as roadside ditches, in forest openings and meadows, and near vernal pools, in acidic soil. It flowers July – August.

Management Practices: The orchid's restricted habitat has made it vulnerable to changing land use and forest harvesting or management practices. Forest management that removes shady overstory of wetlands may benefit this plant where it grows. Care should be taken to avoid direct impact such as felling logs, skidding or placing landing areas in known populations of the orchid or in wetlands.

Sources: PA Natural Heritage Program



Purple Fringeless Orchid (*Platanthera peramoena*)

Status: PA Threatened (G5, S3)

Habitat: Wet areas, Deciduous

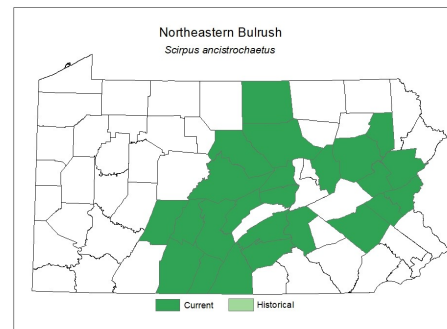
Northeastern Bulrush

Description: Northeastern bulrush is a tall sedge with short thick underground rhizomes from where the leaves emerge in May. Sedges look a bit like grass but their stems are usually triangular and have edges.

Leaves are three-angled, narrow, green to whitish or brown, and have basal sheaths. The flower heads sometimes resemble the exploding of a firework. Throughout its range, including in Pennsylvania, it is found growing on the edges of seasonal pools, wet depressions, beaver ponds, wetlands, and small ponds. It fruits in July.

Management Practices: Daylighting vernal pools through careful, targeted removal of trees shading pools or wetlands may benefit northeastern bulrush populations. Threats include habitat degradation from road construction, upland runoff, off road vehicles, and conversion of land for other uses. Invasion of aggressive non-native plants in wetlands is also a threat. Avoid directing culverts into, driving through, or draining vernal pools to minimize pollution, siltation and invasive plant seeding.

Sources: PA Natural Heritage Program, US Fish and Wildlife Service



Northeastern Bulrush (*Scirpus ancistrochaetus*)

Status: Federally Threatened, PA Endangered (G3, S3)

Habitat: Open, Sunny, Vernal pools, Wet areas, Deciduous, Young forest

Dry Site Plants

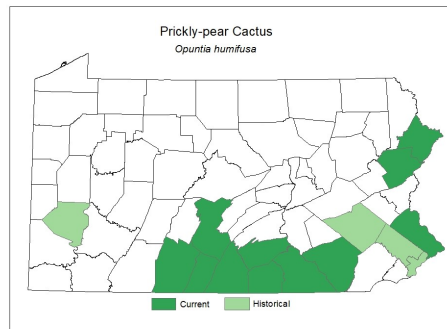
Plants of dry sites are adapted to harsh conditions. They have evolved features to protect themselves from sun exposure and drying, such as a thick outer coating, spines, fine hairs, or tiny leaves.

Eastern Prickly-pear Cactus

Description: Eastern prickly-pear cactus stems are shaped into fleshy, flattened pads that are up to 4 in. long and 2 in. wide. The pads are armed with tiny, barbed hairs that irritate skin. The leaves are reduced to spines, which are not always present. The flowers are very attractive, appearing in June and July and are bright yellow and 3 in. wide. The fruit is edible fleshy, vase-shaped, and red/purple. It grows on dry, open, rocky ground, such as on shale barrens, slopes, and cliffs. It is also cultivated and may escape locally from these plantings.

Management Practices: This cactus is threatened by habitat loss, natural succession, invasive species, quarrying, and the collection of wild plants by gardeners. Because of the preference of the species for sunny conditions, active management, such as fire or invasive species removal, may help to maintain an open setting. Escapes from cultivation are not considered to be of conservation significance.

Sources: PA Natural Heritage Program



Eastern Prickly-pear Cactus (*Opuntia humifusa*)

Status: PA Rare (G5, S3)

Habitat: Dry, Open, Sunny, Rocky, Young forest

Acidic Hillsides

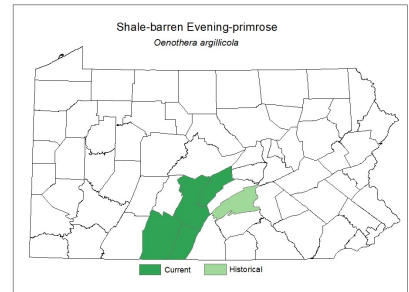
Soils formed from shale or sandstone create more acidic environments than limestone. Some species do not tolerate the acidic soils but others can make use of these places and prefer the lack of competition.

Shale-barren Evening-primrose

Description: This species is a showy herbaceous plant that lives 2 years and can reach about 5 ft. in height. It stands upright with leaves that reach upwards and are glossy, dark green and sometimes finely hairy. The flowers are small and yellow with four petals, lasting only one day. Flowers July-Sept. in a drooping spike on top.



Management Practices: This species grows on shale barrens, which occur on dry, open, usually steep slopes, banks, and cliffs, with shale substrate, typically on south or west-facing slopes overlooking streams. Active management that limits or removes woody vegetation and shading, such as prescribed fire or silvicultural practices, may benefit shale-barren evening-primrose. Protecting pollinators by avoiding spraying pesticides would also be a benefit.

Sources: PA Natural Heritage Program





Common Native Trees and their Threats and Stressors



Several native tree species are faced with threats of pests or disease that affect forests. They may not be considered rare, but may be of importance to landowners. Their threats or stressors and management options for landowners are noted below. Scan the QR code for DCNR's website with more information. All QR codes are found in Appendix 1.

Species	Threats and Stressors	Management or Treatment Options	QR Code
Eastern Hemlock (<i>Tsuga canadensis</i>)	Hemlock Woolly Adelgid, Hemlock Scale	Ground-spraying equipment or soil injection of horticultural oils and insecticidal soaps. Sprays must completely drench the entire tree to be effective, therefore this method is only recommended for trees less than 30 feet tall. Applications of special insecticides can be made to the tree trunk or to the soil around the tree roots. This way the tree moves the chemical to the twigs and needles where the adelgids are feeding.	
White Ash (<i>Fraxinus americana</i>)	Emerald Ash Borer	Several insecticide options are available to effectively treat landscape ash trees. Effective insecticides include systemic ones that are applied as soil injections or drenches, trunk injections, lower trunk sprays, and protective cover sprays that are applied to the trunk, main branches, and foliage.	

Common Threats to Native Tree Species

Species	Threats and Stressors	Management or Treatment Options	QR Code
<p>American Beech (<i>Fagus grandifolia</i>)</p>	<p>Beech Bark Disease, Beech Leaf Disease</p>	<p>Currently there is no available treatment for Beech Leaf Disease in forests. Individual trees can be treated, but this can be expensive.</p> <p>Beech Bark Disease: Silvicultural management guidelines are to reduce the amount of over story beech (focusing on removing diseased or poor vigor trees with cankered or fissured bark), use harvesting systems that minimizes root injury. Retain beech trees that appear to be disease-free with good healthy crowns and smooth, tight bark. Other recommendations include the use of herbicides.</p>	
<p>Shortleaf Pine, Loblolly Pine, Virginia Pine, Pitch Pine (<i>Pinus</i> species)</p>	<p>Southern Pine Beetle (<i>Dendroctonus frontalis</i> Zimmermann)</p>	<p>Outbreaks of southern pine beetle occur every 6-12 years and generally last for 2-3 years. Natural enemies such as <i>Thanasimus dubius</i> can maintain or reduce population levels. However, effective suppression is achieved by the removal of infested host trees through the cut-and-remove, cut-and-leave, cut-and-hand-spray, or cut-and-burn treatment. To prevent southern pine beetle infestation, pine stands should be thinned to <math><80\text{ ft}^2</math> basal area, and pine trees be planted at least 20 ft apart in urban areas.</p>	

Common Threats to Native Tree Species

Species	Threats and Stressors	Management or Treatment Options	QR Code
White Pine <i>(Pinus strobus)</i>	Rust, Needle Cast, Scale	Forestry practices such as thinning to lower forest density, promote crown vigor, radial growth, and significantly reduce white pine needle cast severity. On a landscape scale, thin white pine groves and rows or remove neighboring less desirable plants. Eliminate unnecessary stresses on white pine by avoiding moisture extremes and following proper cultural practices.	
Oak Family <i>Quercus spp.</i>	Oak Wilt	Removal is the only option after diagnosis. Root grafts must be broken before the infected tree is removed because there is a risk that infected sap can "backwash" into the healthy tree. Use a trencher or vibratory plow to a depth of 3-4 feet to break root grafts. Once the root grafts are broken, still-healthy trees can be injected with propiconazole to protect them. Propiconazole doesn't "cure" oak wilt, but does provide suppression. Infected trees should be removed as soon as possible after trenching. Prompt removal of infected oaks is important to protect those trees not yet infected. Destroy wood immediately, including the stump, by chipping, burning, burying, or debarking so that it is not attractive to the insects responsible for the spread of oak wilt. Do not stack the wood for firewood or transport logs or firewood with intact bark since insects in the infected wood can leave and carry the fungal spores to healthy trees.	

Mammals

Several species of mammals are protected in Pennsylvania under the Game and Wildlife Code and listed by the PA Game Commission as endangered or threatened. They may also be federally endangered or threatened. Below are some species that forest landowners may be able to benefit through management.

Cave Bats

Three state and federally endangered cave-dwelling bats are found in Pennsylvania:

- Indiana bat (*Myotis sodalis*)
- Northern long-eared bat (*Myotis septentrionalis*)
- Tricolored bat (*Perimyotis subflavus*)

These bats share several similarities, such as hibernating in caves in the winter, foraging and rearing pups in forests in summer, particularly in snags and trees with peeling bark and cavities. A healthy prey base of insects is also important to them. These species are described more fully in the sections below.

Threats to Cave Bats:

- White-nose syndrome, a fungal disease, is the primary reason for steep population declines. Humans entering caves can spread this disease to new locations in addition to disturbing hibernating bats.
- Changes to hibernacula (e.g. caves, mines) and the surrounding area can alter airflow and degrade habitat. This



Trees with peeling or flaking bark like this shagbark hickory are important roosts.

includes urban development, highway traffic, and loss of habitat through conversion of forests to non-forest.

- Wind turbines, pesticides and feral cats are also threats to bats.

Life Cycle Timing for Indiana, Northern long-eared and Tricolored bats (as per US Fish and Wildlife Service):

- Hibernating: Nov. 16-March 31
- Spring staging: April 1-May 14
- Summer occupancy: April 1-Sept. 30
- Pup season: May 15-July 31
- Swarming activity: Aug. 16-Nov. 15

Management Practices:

- Harvest during hibernation if possible: Nov. 16-March 31 in Pennsylvania.
- Reserve several snags or dead/dying trees 11" to 20" dbh. or larger, if present. Reserve shagbark or shellbark hickory trees, and larger trees with peeling bark or cavities. This allows suitable habitat for mother bats to rear their pups.
- Do not harvest snags, shag/shellbark hickory, or trees with loose or peeling bark from early June to late July, when pups are still too young to fly.
- Maintain a healthy forest in a variety of stages, with a diversity of height and tree sizes. Maintain canopy corridors in hedgerows, along riparian areas and roadways.



- Do not disturb hibernacula especially during hibernation. Avoid projects that change airflow in caves.
- If you see a bat fleeing a tree, stop operations and call the PA Game Commission Headquarters at 1-833-742-4868.



Left, a large cave opening, potential habitat for cave-dwelling bat species. Right, a snag with many cavities, potential roost habitat for bats.

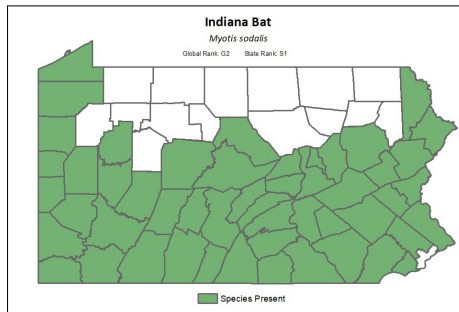
Indiana Bat

Description: Indiana bats are relatively small, at approximately 2-4 inches in length and weighing 0.2 to 0.3 ounces. Their wingspan is 9.5 to 10.5 inches. Their fur is brown and grey with lighter bellies. When hibernating they can be identified by their tight clusters, brown-grey fur and pink noses.

Winter habitat: Indiana bats utilize forests for foraging and roosting and are found in forested areas in the eastern half of the United States. In winter, Indiana bats hibernate in spacious caves (especially limestone or dolomite) and abandoned mines where the ambient temperature is stable and remains below 50°F, but above freezing.

Summer habitat: Females use forested areas for maternity roost sites, especially under peeling bark of dead and dying trees that get a lot of sunlight, such as along a fence line or hedgerow. Pups are born and reared in maternity colonies through the summer. Indiana bats use open or semi-open woods/forests for foraging. Riparian areas, bottomlands, floodplains, wooded wetlands and upland communities may be used for maternity colonies or foraging. Adult males occupy similar habitats but can use a wider range of roosts compared to females.

Sources: PA Game Commission, US Fish and Wildlife Service



Indiana Bat (*Myotis sodalis*)

Status: Federally and PA Endangered (G2, S1)

Habitat: Cliffs/Caves, Deciduous, Young forests, Riparian areas

Northern Long-eared Bat

Description: Northern long-eared bats are about 3-7 inches in body length and weigh between 0.2 to 0.3 ounces. Their wingspan is 8.9 to 10.2 inches. Fur is medium to dark brown on the back, dark brown ears and wing membranes, and pale or tawny fur on the belly. Their most distinguishing characteristic is the prominent ear length, which is 0.7 inches.

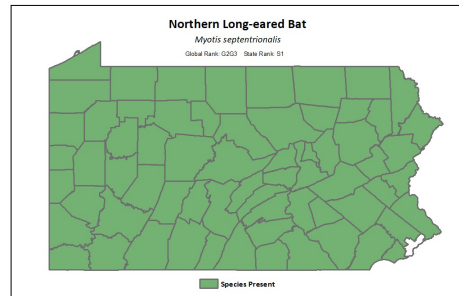
Winter habitat: They hibernate in caves and mines with fairly constant temperatures (32 to 48°F), high humidity and no strong currents. They can also use other areas that have similar temperature, humidity and airflow such as abandoned railroad tunnels, especially where caves or mines are not present.

Summer habitat: Females roost and form maternity colonies in live or dead trees with cavities or crevices, often a group of trees. Northern long-eared bats tolerate shadier roosts than Indiana bats. They can also use human made structures such as bat boxes or abandoned buildings. Mixed-type mature forests with open understories, small gaps or clearings, are an important habitat type for foraging. They also use small gaps such as forest trails, forested creeks or roads, with sparse to medium vegetation (but not totally open or clear-cut) as travel and foraging routes.

Sources: PA Game Commission, US Fish and Wildlife Service



Photo by Aura Stauffer



Northern Long-eared Bat (*Myotis septentrionalis*)

Status: Federally and PA Endangered (G2G3, S1)

Habitat: Cliffs/Caves, Deciduous, Conifers, Riparian areas

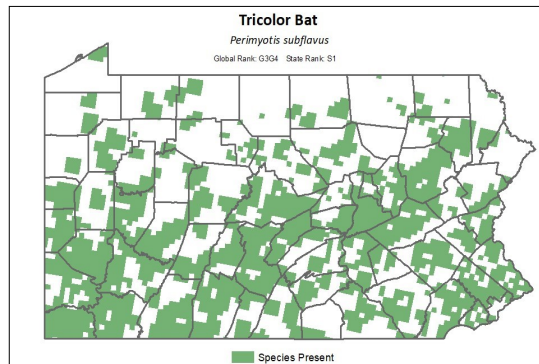
Tricolored Bat

Description: Tricolored bats are one of the smallest bats in eastern North America and are distinguished by their unique hair coloring that appears dark at the base, lighter in the middle, and dark at the tip. Tricolored bats often appear yellowish to nearly orange, or silvery-gray, chocolate brown, or black.

Winter habitat: They hibernate in caves and mines in Pennsylvania and can also use rock outcrops, culverts and abandoned water wells. They can utilize hibernacula with a warmer ambient temperature, on average about 51.6° F. Compared to Indiana and northern long-eared bats, they can utilize smaller sites and hibernate singly more often.

Summer habitat: During the spring, summer, and fall (i.e., non-hibernating seasons), tricolored bats primarily roost among leaf clusters of live or recently dead deciduous hardwood trees. Occasionally tricolored bats roost among pine needles, leaf clusters in tree crotches, or eastern red cedar. Females form maternity colonies and switch roosts regularly while males roost singly. Tricolored bats forage over waterways and forest edges.

Sources: PA Game Commission, US Fish and Wildlife Service



Tricolored Bat (*Perimyotis subflavus*)

Status: Federally and PA Endangered (G3G4, S1)

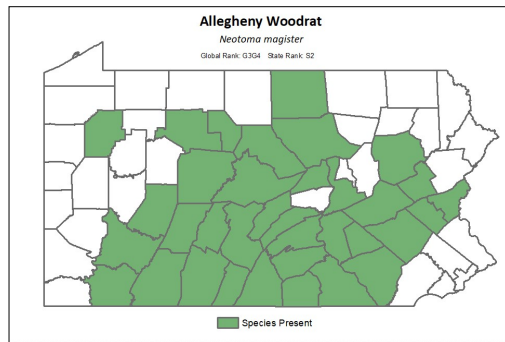
Habitat: Cliffs/Caves, Deciduous, Conifers, Riparian areas

Allegheny Woodrat

Description: Adults weigh less than a pound and are about 17 inches long, including the 8-inch tail. The fur is gray above with white bellies and white feet. They have a furry two-toned tail, unlike the naked tail of the Norway rat, and large round ears. They forage at night for seeds, nuts, fruit, twigs, leaves, fungi and other things. Allegheny woodrats are packrats and build nests in crevices and protected ledges of rocky outcrops. They maintain a cache site, storing wasp nests, bones, snake-skins, candy wrappers, shotgun shells etc. and a separate latrine.

Management Practices: This species uses large patches of habitat including very rocky terrain amidst a forested setting with mast-producing trees, providing food and nest materials. Poor mast-production and a lack of quality food may increase their vulnerability to predators or diseases. Forest pests and diseases, like chestnut blight and spongy moth, impact important food sources. Maintaining a healthy forest is key. Habitat loss and degradation of ridgetop forests create barriers for the woodrat to travel between habitat patches. Maintaining forested buffers around rocky habitat areas or forested corridors between rocky patches would be beneficial to Allegheny woodrat. Avoiding siting infrastructure or roads within ridgetop forests would also benefit this species.

Sources: PA Game Commission

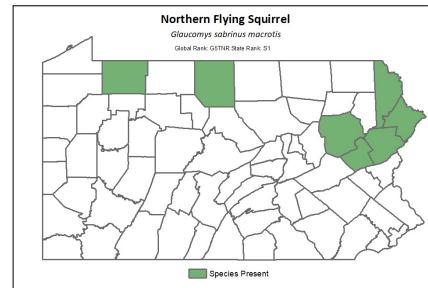


Northern Flying Squirrel

Description: The northern flying squirrel has very large eyes and specially adapted flaps of skin between the front and rear paws that, when extended, act like a parachute allowing it to glide. They are nocturnal and live in trees, nesting in tree cavities lined with sticks, moss, bark, or lichens. They forages for acorns, beechnuts, conifer seeds and other seeds. An important food source is a type of fungi that is dependent on spruce and hemlock trees. This is a rare subspecies of flying squirrel and looks similar to its more common cousin, the southern flying squirrel but is slightly larger (body length 8-10 in.) and has two-toned belly hairs. The northern flying squirrel is only found in older-growth northern forests with a heavy conifer component, often in moist soil with heavy woody debris on the ground.



Management Practices: Habitat loss of older conifer and mixed forests to development or other practices is threat. The squirrels rely on a fungi associated with spruce and hemlock trees. Hemlock wooly adelgid has also impacted this species through loss of hemlock trees. Competition with other species and diseases are also problems. Maintaining large, connected patches of older-growth conifer/mixed forests in the northern tier or Pocono region can help maintain habitat availability. Treating of hemlock trees to combat wooly adelgid could benefit this species. Placing flying squirrel nest boxes could help by providing additional nesting sites.



Sources: PA Game Commission

Northern Flying-Squirrel (*Glaucomys sabrinus macrotis*)

Status: PA Endangered (G5, S1)

Habitat: Mature Deciduous & Coniferous forests



A rocky cliff, potential habitat for Allegheny woodrat.



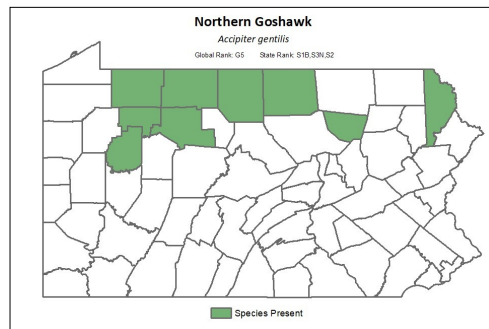
Northern flying squirrel uses mature hemlock woods, like this.

Raptors

Raptors are birds of prey. Several are protected in Pennsylvania under the Game and Wildlife Code and listed by the PA Game Commission as endangered or threatened. Even common raptors are protected under the federal Migratory Bird Treaty Act of 1918 and the Lacey Act. The raptors listed below are all species forest landowners may be able to benefit through management.

Northern Goshawk

Description: Adult body size is 20-26 in.; wingspread 40-47 in.; and weigh about 1.5-3 lbs. Adults are blue gray above and white with fine grey barring below and have red eyes with a bright white line over each. Young are brown above with lighter mottled undersides with heavy streaking. They are agile fliers and gliders, maneuvering through thick forests. They feed on other birds and small mammals. Northern goshawks defend their nests aggressively with a shrill “ca, ca, ca” call, but are otherwise secretive. They prefer large tracts of mature, mixed, heavily forested areas with open understories for nesting in central and northern Pennsylvania and higher elevations. They build large bulky “stick nests” (3-4 feet diameter) up to 75 feet high up in trees. Pairs will reuse the same nests or build ones nearby. Females lay 3-4 eggs and incubate for 36-38 days.



Northern Goshawk (*Accipiter gentilis*)

Status: PA Endangered, Federally Protected (G5, S1)

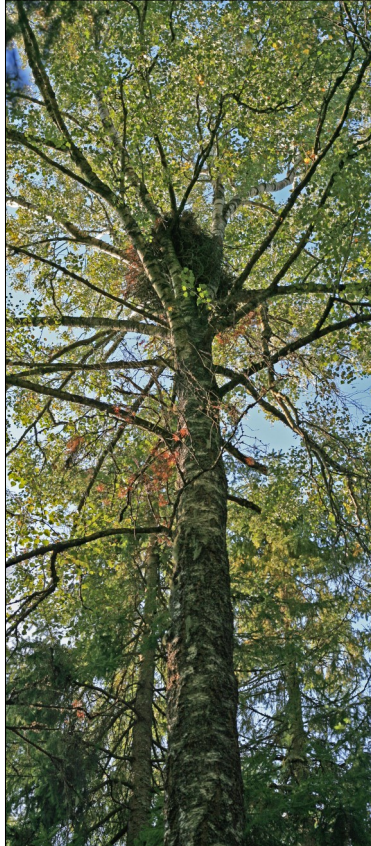
Habitat: Mature Deciduous & Coniferous forests

Management Practices: Northern goshawks require large tracts of mature, mixed, northern forests for nesting. The primary reason for decline of this species is habitat loss and degradation of older forests. Predation, prey availability, and disturbance to nests are also major factors in their decline. Management that promotes large tracts of older growth northern forests, including setting aside large blocks of uncut mature forest, will benefit this species. Landowners who observe goshawks or a stick nest should maintain a safe distance, avoid impacting it and contact the PA Game Commission.

Sources: PA Game Commission



Examples of stick nests built by raptors. (Left) likely a northern goshawk or cooper's hawk, (right) a goshawk. If you see a stick nest in your forest, keep your distance and contact the PA Game Commission



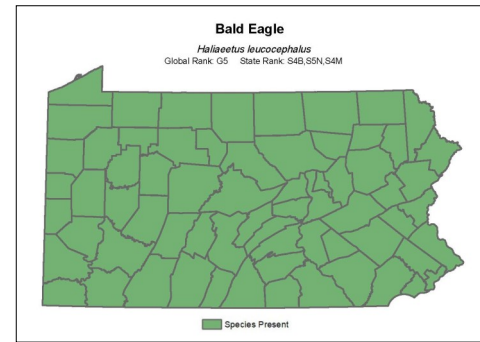
Bald Eagle

Description: Adult bald eagles are easily identified by their white heads, dark brown bodies, yellow feet, and large size, weighing up to 14 lbs. with 7-ft. wingspans. Juveniles, up to age 5, are dark brown with light mottling. Males and females are the same color, but females are larger. They have prominent hooked bills and sharp talons for gripping and tearing prey, mainly fish, but also birds, mammals, other animals, and carrion. Their call is a fast, repetitive gull-like “kleek kik ik ik ik.” Bald eagles perform an elaborate aerial mating ritual. Nests called “eyries” are built in large trees, generally near a body of water. Nests are large, about 5 ft. wide and 2 ft. high or bigger, made of sticks, branches, moss, and other vegetation. Mated pairs add to existing nests each year. Females lay 2 eggs per year and incubate for 35 days.



In 1995, the bald eagle’s status was changed from federally endangered to threatened, then in 2007 was removed from the federal list of endangered and threatened species in the lower 48 states. Although bald eagles are no longer listed as endangered or threatened, they are still protected by the Bald and Golden Eagle Act, the Lacey Act, and the Migratory Bird Treaty Act.

Management Practices: Bald eagles require forested areas near water, such as riparian areas or wetlands, with easy access to adequate food sources. They can use hardwood or deciduous forests but require mature, tall trees that can support nesting and visibility. People



Bald Eagle (*Haliaeetus leucocephalus*)

Status: Federally Protected (G5, S4)

Habitat: Forested wetlands, Deciduous & Coniferous forests, near open water

should avoid getting too close to active nests and disturbing them (however, occasionally eagles will nest in more developed areas or near roads/agriculture.) Adult bald eagles may abandon nests, or eaglets may try to fledge too early, if disturbed. Federal regulations prohibit disturbing nests, and recommend placing a 660-ft. buffer around active nests. If landowners observe bald eagles nesting on their property, they should observe the 660-ft. no-disturbance buffer during nesting season and contact the PA Game Commission. Unlike some other raptors, bald eagles are not likely to use artificial nest structures. Management actions landowners may take include reserving riparian forests with tall trees and avoiding known nesting sites.

Sources: PA Game Commission, US Fish and Wildlife Service



It is a good idea to buffer bald eagle nests by 660 feet.

Bald Eagle (*Haliaeetus leucocephalus*)

Status: Federally Protected (G5, S4)

Habitat: Forested wetlands, Deciduous & Coniferous forests, near open water

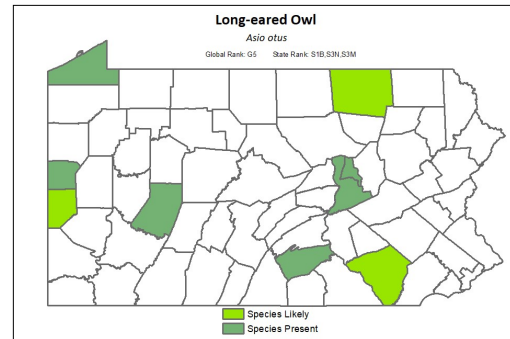
Long-eared Owl

Description: Long-eared owls are medium-sized owls, about 15 inches long with tall, with narrow ear tufts and bright orange-yellow eyes in a buff face edged in black. They are about 1/5th the size of great horned owls (and have upward-pointing ear tufts) and about twice the size of the screech owl. They have a distinctive herringbone pattern on the front and streaks on the belly. Shy and reclusive, they freeze still to avoid detection. They are strictly nocturnal and feed on rodents. Long-eared owls nest by mid-April, utilizing abandoned stick nests. Males often zigzag in flight around a nesting area. Females lay an average of 4-6 eggs and incubate for 26-28 days. They are rarely seen in the winter, when they may form a communal roost.



Management Practices: Long-eared owls use a mix of wooded and open areas. They nest in dense evergreen or mixed forests, using a variety of conifers (native or not), including wind breaks and post-fire regrowth in scrub barrens. They are typically found closer to forest edges and foraging places such as meadows, woods openings, edges, and wetlands. Fewer farms with woodlots and a transition from softwoods to hardwoods may have led to decline. Maintaining conifer component and a proximity to open areas for foraging is important for this species. It is key to protect winter roosts, when they are known.

Sources: PA Game Commission, NatureServe Explorer



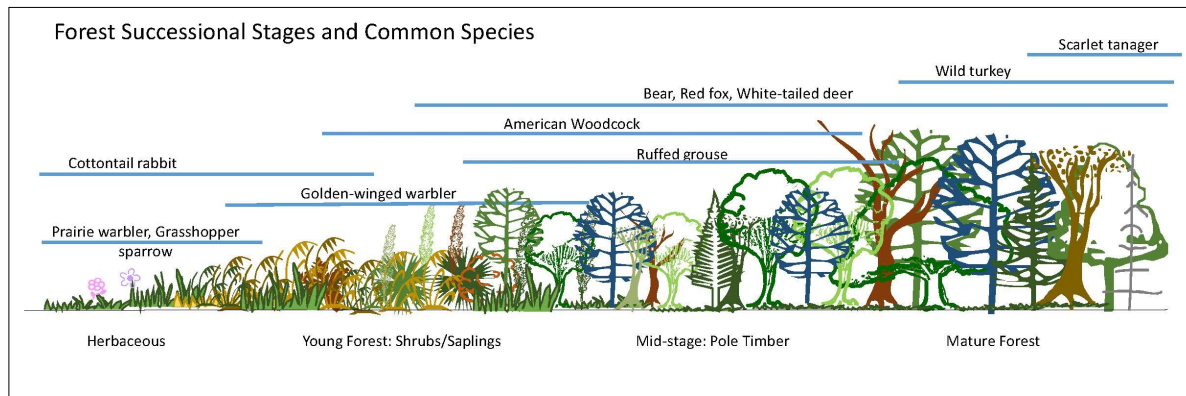
Long-eared owl (*Asio otus*)

Status: State Threatened, Federally Protected (G5, S1)

Habitat: Deciduous & Conifers, Grassland, Young forests, Open areas

Early Successional Ground Nesters

Maintaining a variety of habitats is beneficial for many species. Different species prefer different ages or successional stages of plant communities. Early successional habitat is often referred to as “young forest.” Some birds nest on the ground in young forests, while others thrive in mature timber. Disturbances naturally take place within forests and create openings that receive more direct sunlight and stimulate new growth. Many wildlife species take advantage of these openings. Timber management can mimic natural disturbances like windthrow, lightning strike, and blowdowns to create these openings.



Graphic: DCNR, adapted from PSU and other sources.

Ruffed Grouse

Description: Ruffed grouse are small birds weighing only about 1.5 pounds and 15-19 inches long. Their plumage is rich brown sprinkled with white and black above and white with horizontal dark brown bars on the breast and undersides. The tail is wide and brown with a black band outlined by narrow gray bands. They have a “ruff” of iridescent black feathers at the neck. Two color phases exist: gray phase or “silver” birds with gray in the tail, and “cinnamon” grouse with rusty feathers and a chestnut ruff and tail band. They are solitary birds with most contact between the sexes only occurring during spring mating season.



Male (above) and female (below) ruffed grouse.

Mating includes “drumming,” where males beat their wings vigorously (up to 50 times in 10 seconds) atop low hollow stumps or logs making a sound like a drum. **Drumming cover** includes dense small-diameter saplings or shrubs with logs greater than 13” in diameter and 20’ long. After mating, a hen will find a hollow on the ground, usually within dense cover at the base of a tree trunk or stump and lay 10 to 14 eggs, which hatch about 3 weeks later. **Nesting cover** is in older forest stands with mostly open understory, close to sapling and/or brood areas. **Brood cover** includes dense and diverse forb cover (not grass) that is more than 6” tall, inter-mixed in areas of high seedling/sapling or shrub thickets. Chicks stay with the hen until late September, until about 4 months old. They forage for insects, berries and other fruits in the summer; acorns, bechnuts, and other fruits in fall; and buds from aspen, birch, beech, maple, and other trees in winter. They also require visible water sources to obtain moisture in their diet.



Ruffed Grouse (*Bonasa umbellus*)

Habitat: Deciduous & Conifers, Open, Young forests,

Status: Species of Greatest Conservation Need (G5, S3)

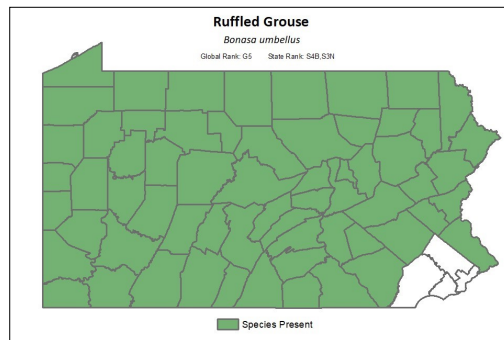
Access to water

Management Practices: Healthy young forests provide multiple benefits to ruffed grouse, which use different habitat types in each season of the year. Essential habitat components include drumming cover, brood cover, and nesting cover. Creating a variety of age classes mixed together is the goal of grouse habitat management at the landscape scale. Grouse will begin using an area 3-5 years after a timber harvest and remain until stem exclusion begins at 15-20 years post-harvest depending on site quality. Site planning and preparation that allows for approximately 10% or more of a compartment to be regenerated every 15 years help maintain young forest habitats remain on the landscape for species, such as ruffed grouse, that require them. Spacing these compartments on a landscape scale to allow for a mosaic of a variety of age classes is best.

Sources: PA Game Commission, American Bird Conservancy



Along with young forests, important habitat components for ruffed grouse include mast producing trees, water sources and downed logs for drumming.



Ruffed Grouse (*Bonasa umbellus*)

Status: Species of Greatest Conservation Need (G5, S3)

Habitat: Deciduous & Conifers, Open, Young forests,

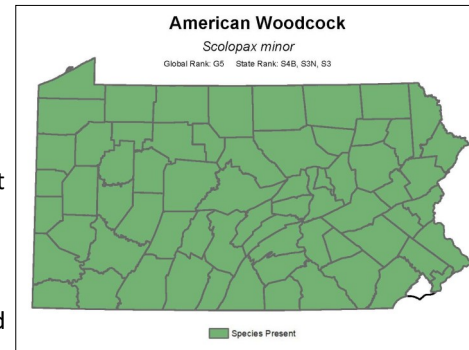
Access to water

American Woodcock

Description: The American woodcock, also known as the timberdoodle, is a short-legged, ground-dwelling bird that feeds mainly on earthworms caught by probing the soil with its long, prehensile bill. Woodcock breed in eastern North America, but most migrate to the southern states for the winter. They breed early in spring, with males beginning their courtship displays as early as December in the southern part range and as early as March in the north. Males mate with several females and give no parental care. Females provide very little maternal care, brooding the nestlings for only a few hours before the young fledge. Mothers feed the young for a week until they begin to probe for food on their own. Broods become independent, moving around as individuals, rather than with their siblings, after about a month. Outside of the nesting season, woodcocks are generally solitary individuals. The species' population has fallen in recent years as the amount of young forest has dwindled in the northeastern U.S.



Management Practices: Woodcock need diverse habitats to survive, including small clearings for courtship, dense shrubland or young forest thickets for diurnal foraging for earthworms, early successional forests for nesting and brooding, and clearings for summer roosting. Nests consist of slight depressions in the ground with leaves. Favored nesting sites include moist woods or hillsides near water, low ground cover and



American Woodcock (*Scolopax minor*)

Status: Species of Greatest Conservation Need (G5, S3)

Habitat: Deciduous, Open areas, Young forests, Access to water

briar patches, or 10 to 12 year old shrub thickets and edges. Cover can vary in nesting sites from scanty to 25' tall, but average is 12' cover height. Important habitat characteristics for American woodcock include open herbaceous ground cover, including scattered small shrubs and trees, in close proximity to dense hardwood cover. On a landscape scale, the goal of habitat management is to create a mosaic of quality habitat.

Sources: PA Game Commission, Wildlife Management Institute, Ruffed Grouse Society



Above, hatched American woodcock eggs in a nest. Left, a site like this that is nearby a stream is potential habitat.

Reptiles and Amphibians

Reptiles and amphibians are under the jurisdiction of Pennsylvania Fish and Boat Commission. Reptiles and amphibians are cold-blooded animals, meaning they cannot regulate their own body temperature but must use the environment to warm or cool themselves. Reptiles have scales while amphibians lack scales and respire at least partly through their skin. Amphibians have an aquatic phase in their life cycle. Both reptiles and amphibians are sensitive to changes in their environment including habitat manipulation, chemical use, and are vulnerable to car strikes.

Bog Turtle

Description: Bog turtles are small, semi-aquatic turtles only reaching about 4 inches maximum shell length at adulthood. Their shells are dark brown to black and they have a bright yellow or orange mark on the side of the head behind the eye. They can live up to 30 years in the wild. They overwinter in wetlands from late September or October through the winter and emerge in April. From April through June, bog turtles eat, bask, and mate in boggy wetlands. Nests are built on hummocks above the water level, constructed of sphagnum or tussock sedges. One to six eggs are laid in June and July; young turtles hatch by early September. Starting in late September and October, adult and juvenile bog turtles bury themselves in the mud and go dormant until the following April.



Management Practices: Ideal bog turtle habitat consists of open wet meadows, shallow marshes, spring seeps, riparian wetlands, bogs and fens. The key components are a mixture of wet and dry areas and deep, soft mucky soil

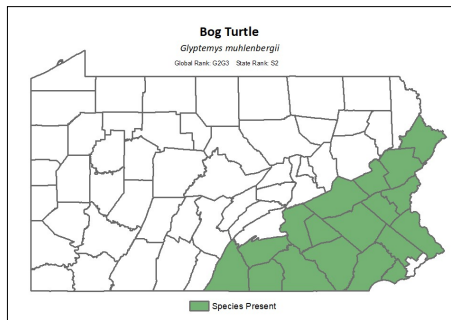
Bog Turtle (*Glyptemys muhlenbergii*)

Status: Federally Threatened, PA Endangered (G2, S2)

Habitat: Wetlands, Sunny, Wet, Open areas

into which they can bury themselves. Tussock sedge and sphagnum are important plants in their habitat. In Pennsylvania, bog turtles are limited to the southeast. An open canopy allowing sunlight to reach the ground is important for basking and thermoregulation. Maintaining good water quality and quantity in wetlands will benefit bog turtles. This includes avoiding/preventing spills of chemicals, oils, or other substances from entering waterways or wetlands; avoiding damming wetlands or creeks entering or exiting wetlands; avoiding diverting culverts from roads into wetlands causing pollution or invasive plant species infiltration. Poaching and habitat loss are the two biggest threats. Encroachment of woody vegetation or invasive plants can increase shade level and change the hydrology of the wetland, making it unsuitable. Invasive plant or shrub removal from wetlands can benefit bog turtles. Do not remove turtles from natural habitat; it is unlawful under federal and state law to sell, trade, barter, possess, import, export, catch, take, or kill bog turtles.

Sources: PA Fish and Boat Commission, NatureServe Explorer, US Fish and Wildlife Service



Open bogs like this with hummocks and deep, peaty muck, may be potential habitat for bog turtle.

Bog Turtle (*Glyptemys muhlenbergii*)

Status: Federally Threatened, PA Endangered (G2, S2)

Habitat: Wetlands, Sunny, Wet, Open areas

Timber Rattlesnake

Description: Timber rattlesnakes are famous for the loud rattle of their tail, a warning to intruders so the snake does not waste energy and venom on non-prey. Their colors can vary, but generally consists of bands or blotches of dark brown/black crossing a sulfur yellow, gray, brown or black background, outlined with a lighter color, and a black tail. The young are lighter gray with dark crossbands. Adults average 35-47 inches long; males are longer than females. They are a long-lived species (30 years or more), do not mature until after 5 years, and reproduce slowly. Historic hunting, habitat loss and a low reproductive rate are reasons why it is a species of concern. Annually, snakes emerge from the overwintering site, called dens or hibernacula, in April. Mating occurs mid-July through September. Young are born live mid-August-September. They return to the dens beginning in late September. Different habitat features are important to timber rattlesnakes: holes in the ground or crevices in rock used for denning, overwintering or hibernacula; large flat rocks with sun exposure for basking; gestation sites where young are born; and forests used for foraging for small mammals.

Management options: One general management option includes timing of timber operations between Nov. 1 and April 15, when snakes are still hibernating. **Basking/Gestation:** These are rocky areas, outcrops, or loose rocky slopes, with an open canopy (less than 20% canopy closure) that receive 6 or more hours of direct sunlight a day. They will be active from April 15-Nov. 1. To avoid human-snake interactions near these sites or other areas with large snake concentrations, place a minimum 50-foot no disturbance buffer during April 15 – Nov. 1. Within this buffer, avoid disturbing large rocks (> 2' diame-



Timber Rattlesnake (*Crotalus horridus*)

Status: Species of Greatest Conservation Need (G4, S3)

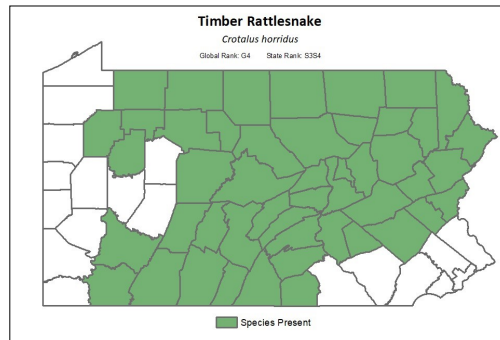
Habitat: Sunny, Rocky, Deciduous, Open areas, Young forests

ter) and remove treetops from large rock structures after a timber harvest. Basking habitat can be created by placing large flat rocks (4'x6' minimum) to the north or east sides of openings in forests approximately 5-10 yards from the tree line. Since basking habitat requires sun exposure, timber activity may benefit this habitat. **Denning:** Potential dens typically have exposures between 135° (SE) through 270° (W), and a slope greater than 10°. Dens are often, but not always, associated with rocky habitat. They may be simply a hole in the ground. Do not destroy underground structures as they cannot be recreated. Dens are generally located in deciduous, hardwood, or mixed forests with a dense overstory. Maintaining canopy over denning areas and connectivity to other habitats is important. **Foraging:** Snakes forage in denser deciduous forests, averaging 70% canopy closure. Availability of ambush sites such as fallen logs, rock piles, or other features are important. Leaving tops and down woody material in forests where snakes are known to occur will also improve foraging habitat. Maintaining patches of denser forests with open areas and promoting native vegetation that will support their prey can benefit timber rattlesnakes.



Nuisance snakes can be removed by PA Fish and Boat Commission's Waterways Conservation Officers who are trained to handle venomous snakes. It is prohibited by law to kill timber rattlesnakes.

Sources: PA Fish and Boat Commission, NatureServe Explorer



Timber Rattlesnake (*Crotalus horridus*)

Status: Species of Greatest Conservation Need (G4, S3)

Habitat: Sunny, Rocky, Deciduous, Open areas, Young forests

Green Salamander

Description: Salamanders are amphibians with long, slender bodies, blunt snouts and long tails as adults. They have an aquatic larval phase. They may look like lizards, but salamanders lack scales and have smooth, moist, thin skin used in respiration. The green salamander is a lungless, terrestrial amphibian. It has green blotches on a darker, brownish or black background on its back, head, legs and tail, and a plain, lighter underside. The green blotches camouflage and mimic the appearance of lichens that grow on the boulders and rock crevices in which they live. They have a slightly flattened overall appearance and have square-tipped toes. Adults grow to 3-5 inches long total, with the tail the



same length or longer than the body. They have 14 or 15 costal grooves along their sides. Green salamanders hibernate in rock crevices beginning in early November through late March or early April. They can be active during the day and night but are very secretive. They have a relatively small home range (about 10-100 ft. diameter) but occasionally travel up to 300 feet to disperse to new areas. Prey includes insects, mostly small beetles, ants, and mosquitoes. They mate in the spring and females lay an average of 17 eggs in early June, attached to the underside of rocks. The females stay with the eggs until they hatch in September. They reach their maximum size at 7-8 years of age.

Management Practices: Green salamanders are an Appalachian Mountain region species, with its range just reaching into southern Pennsylvania. Habitat for green salamander is very restricted, utilizing shaded gaps in rock crevices, outcrops and boulders that are damp but not wet. The sites are generally located in hemlock forests.

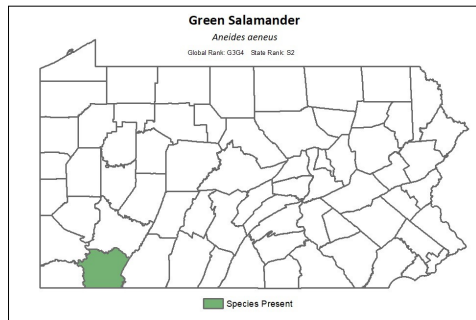
Green Salamander (*Aneides aeneus*)

Status: PA Threatened (G3, S2)

Habitat: Rocky, Shady, Mature Coniferous forests

cover and connective corridors allow movement between rock outcrops. They may utilize loose bark of dead trees, or under cover of rhododendrons, mountain laurel or down woody material. Habitat loss and fragmentation, and dense stands of invasive plants are major threats to the green salamander. Maintain intact, healthy hemlock forests around rocky outcrops in Fayette County. Treat hemlock woolly adelgid if possible. Avoid opening up the forest adjacent to rock outcrop habitats, as it dries out green salamander habitat, making it unsuitable. Maintain connectivity and a forested buffer around rocky outcrops and corridors between rock areas. Since recreational rock climbing can also disturb habitat, educate climbers to be good stewards of the land and habitat and to not remove vegetation. Contact the Fish and Boat Commission if you believe you have spotted this species.

Sources: PA Fish and Boat Commission, NatureServe Explorer, PA Natural Heritage Program



Potential habitat for green salamander consists of big rocks with crevices surrounded by rich, thick forests, usually with hemlock. Maintain shady conditions in habitat like this.

Green Salamander (*Aneides aeneus*)
Status: PA Threatened (G3, S2)

Habitat: Rocky, Shady, Mature Coniferous forests

Summary

Pennsylvania is an exceptionally biodiverse state, with eleven ecoregions. A wide variety of species find habitat among the 16.6 million acres of forest land that stretch across our state, whether permanent or temporary. Forest landowners, foresters, loggers, and other resource professionals can therefore play an important part in preserving and enhancing that biodiversity.

Privately-owned forestlands provide important habitats for many at-risk species including rare, threatened, or endangered wildlife and plants. Forest management that considers species presence, habitat needs, and potential threats can benefit these species. Sometimes, simple changes in management decisions such as timing of a timber sale or buffering a rocky outcrop can make a big difference for species' survival.

This booklet was developed by DCNR in partnership with the Pennsylvania SFI Implementation Committee to provide basic information on protecting Pennsylvania's forest biodiversity, including the legal framework regarding timber management, available online tools, certain species, and some options for management decisions. The species represented in this booklet are not an exhaustive list of rare, threatened, endangered or at-risk species in Pennsylvania. Rather, this gives a few examples of species that might be encountered in different habitats and recommended management practices that might also benefit a wider array of species. Careful forest management practices are important to ensure the continuous supply of quality wood products in an ecologically sound way. This includes consideration of threatened, endangered, rare or at-risk plants and animals in Pennsylvania.

While the recommendations contained in this booklet are intended to support species protection, they do not replace the need for permits, environmental review, or consultation with jurisdictional agencies. All parties are responsible for avoiding illegal take of threatened and endangered species associated with timber and other operations. The information presented here is meant to be educational and helpful.

For additional guidance on any of the species presented in this booklet or other at-risk species, please contact the following:

PA Game Commission, Headquarters:

2001 Elmerton Avenue, Harrisburg, PA 17110-9797

Phone: 833-742-4868 or 833-742-9453

www.pgc.pa.gov

PA Fish and Boat Commission, Headquarters:

1601 Elmerton Avenue, PO Box 67000, Harrisburg, PA 17106-7000

Phone: 717-705-7800

www.fishandboat.com

PA DCNR Bureau of Forestry, Central Office:

400 Market Street, P.O. Box 8552, Harrisburg, PA 17105-8552

Phone: 717-787-3444

www.dcnr.pa.gov

US Fish and Wildlife Service, Pennsylvania Field Office

Phone: 814-234-4090

Credits:

PA SFI



Community Grant awarded by the Sustainable Forestry Initiative (SFI) and the Pennsylvania SFI Implementation Committee.

The Sustainable Forestry Initiative® (SFI) advances sustainability through forest-focused collaborations. They are an independent, nonprofit organization that leverages four interconnected pillars of work: standards, conservation, community, and education. SFI works with the forest sector, conservation groups, academics, researchers, brand owners, resource professionals, landowners, educators, local communities, Indigenous Peoples, and governments. Collaborating with this network, they leverage SFI-certified forests and products as powerful tools to help solve sustainability challenges such as climate action, conservation of biodiversity, education of future generations, and sustainable economic development.

Authored by: DCNR, Bureau of Forestry, Rebecca Bowen, Ben Livelsberger, Emily Domoto, Abby Jamison

September 2024.

All images are by DCNR unless noted below.

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- P. 22. Shale-barren evening-primrose by Doppelbrau, CC BY-SA 4.0, Wikimedia Commons.
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- P. 50. Green salamander habitat by Charlie Eichelberger, PA Natural Heritage Program.

All maps are produced courtesy of PA Natural Heritage Program.

Important Terms

Note that these are summarized in plain speech and should not be interpreted as legal definitions.

At-Risk species: A species that may or may not be state or federally listed as endangered, threatened, or rare, but may be declining in parts of its range and is a conservation concern in Pennsylvania. This includes species of greatest conservation need. This term does not carry any specific legal protection.

Endangered species: A species that meets a jurisdictional agency's criteria and has been legally listed, state or federally, as "endangered." A species at risk of extinction from the commonwealth (or nation) if action is not taken to manage and protect the species and its habitat.

Nature Serve Ranks (G- and S-ranks): a standardized way to describe the global and state rarity of a species. The lower the number, the more rare the species is. Globally, this is expressed as G1 at very high risk of extinction globally, to G5 common and widespread. Similarly, S1 is at high risk of extinction statewide, S5 is secure statewide.

Rare species: A legal classification used by DCNR, a plant species that is uncommon in this commonwealth because they are found in low numbers or restricted geographic areas. Also generally used to refer to uncommonness.





Species of greatest conservation need: a species that has met the criteria and been included in the PA Wildlife Action Plan. This term does not carry any legal protection







Take: To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. This can be used by state or federal agencies.










Threatened species: A species that meets a jurisdictional agency's criteria for this category and has been legally listed, state or federally, as "threatened." A species at risk of becoming endangered within the commonwealth (or nation) if action is not taken to manage and protect the species and its habitat.

Appendix 1: QR Codes Index

Please use this QR Code Index to access websites and digital resources mentioned throughout this document. To use, open the camera app on your mobile device. Hold your device so that the QR code appears in view. Tap the notification to open the link associated with the QR code.

Description & Code	Description & Code
 <p>P. 7.</p> <p>Forest Stewardship: Conserving Biological Wealth in Forests (psu.edu), https://extension.psu.edu/forest-stewardship-conserving-biological-wealth-in-forests</p>	 <p>P. 7</p> <p>Forest Biodiversity: Understanding Biological Health in Our Forests (psu.edu), https://extension.psu.edu/forest-biodiversity-understanding-biological-health-in-our-forests</p>
 <p>P. 7</p> <p>Forest Stewardship: Best Management Practices for Pennsylvania Forests (psu.edu), https://extension.psu.edu/forest-stewardship-best-management-practices-for-pennsylvania-forests</p>	 <p>P. 7</p> <p>Sustainable Forestry (psu.edu), https://extension.psu.edu/sustainable-forestry</p>

Description & Code	Description & Code	Description & Code
<p>P. 10</p>  <p>Forest Management and Timber Harvesting in Pennsylvania, https://extension.psu.edu/forest-management-and-timber-harvesting-in-pennsylvania</p>	<p>P. 11</p>  <p>PA Game Commission, https://www.pgc.pa.gov</p>	<p>P. 11</p>  <p>US Fish and Wildlife Service, https://www.fws.gov</p>
<p>P. 11</p>  <p>PA DCNR, https://www.dcnr.pa.gov</p>	<p>P. 11</p>  <p>PA Fish and Boat Commission, https://www.fishandboat.com</p>	<p>P. 13</p>  <p>PNDI, https://conservationexplorer.dcnr.pa.gov/</p>

Description & Code	Description & Code	
P. 14 Conservation Reports, https://conservationexplorer.dcnr.pa.gov/content/conservation-reports 	P. 23 White ash management (DCNR) 	P. 25 White pine management (DCNR) 
P. 14 Resources in PA Conservation Explorer, https://conservationexplorer.dcnr.pa.gov/content/resources 	P. 24 American beech management (DCNR) 	P. 25 Oak species management (DCNR) 
P. 23 Eastern hemlock management (DCNR) 	P. 24 Pine species management (DCNR) 	P. 53 PA SIC SFI, Pennsylvania Sustainable Forestry Initiative® (sfiofpa.org) 



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