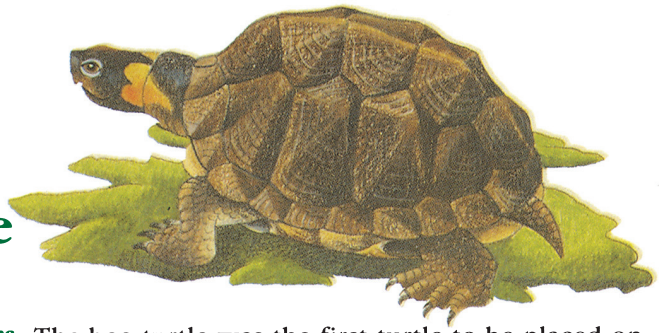
Food. Although omnivorous, the wood turtle is partial to vegetation, feeding voraciously on wild fruit. It favors strawberries and low-bush blueberries. Other plants, such as dandelion and sorrel with its heart-shaped leaflets, also are favored. The wood turtle eats slugs, insects and tadpoles and can be seen searching newly plowed ground for worms, especially after a cool spring rain.



Bog Turtle

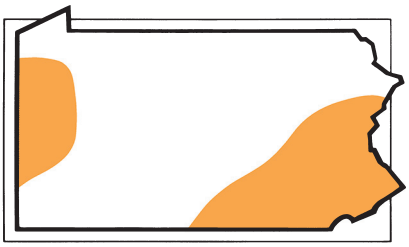
Clemmys muhlenbergii

Endangered Species

General characteristics. The bog turtle was the first turtle to be placed on the Pennsylvania List of Endangered Species. It now appears only in isolated populations. Loss of habitat has been the biggest factor in its decline. Mankind's propensity for draining bogs, marshes and swampland has taken its toll on the bog turtle. Its habitat left high and dry, the bog turtle simply had no place to go. Some years ago, the pet trade also was a factor in the decline in populations of this species.

The bog turtle, sometimes referred to as Muhlenberg's turtle, is a secretive reptile. Scientists actively engaged in restoration efforts find that the bog turtle's retiring attitude makes it a difficult animal to study. In spite of its shy nature, it still likes to bask in full sunlight, often atop tufts of grass or perched on a log. The bog turtle is active from April through mid-October, perhaps a bit longer period than some turtles. It may bury itself and become inactive during the hot days of summer. The bog turtle is a small turtle, never reaching more than three or four inches long along its shell.

Identification. The bog turtle's carapace, or upper shell, is light brown to mahogany. Its large scutes sometimes have a tinge of yellowish or reddish marks in their centers. The plastron, which is hingeless, is brownish black with some yellow along the mid-line. The head is black and marked with a yellow, orange or red blotch on each side, an important identification characteristic. The male has a medium-thick tail.



Range. The bog turtle has been found in separated ranges across parts of New York and extending southward to the western border of North Carolina. Its range includes New Jersey. The bog turtle's distribution in Pennsylvania splits into two separate historic ranges—two areas where this turtle was once found in stable populations. The largest range includes southeastern Pennsylvania as far west as Franklin County and north to near the Pocono Mountains. The smaller of the two original ranges includes portions of three counties in the northwestern part of the state near the Ohio border. However, it's doubtful whether the species still occurs in this range.

Habitat. Wetlands, such as bogs, marshes and swamps, are preferred, but wet pastures also have been known to hold populations of the bog turtle. It likes narrow, shallow, slow-moving rivulets of unpolluted spring water flowing over a soft mucky bottom. The bog turtle seeks relief during periods of extremely hot weather and buries itself in mud or vegetative debris. It hibernates during the coldest winter months buried deeply in mud flooded over by water.

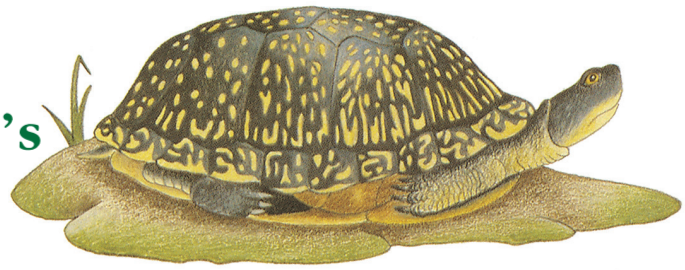
Reproduction. The bog turtle matures sexually at five to seven years of age. Mating occurs during the first warm days of spring. Nesting is completed in June when the female lays a clutch of one to six eggs in a two-inch deep cavity. The eggs, barely more than one inch in length, are elliptical and flexible. They hatch in August or September after a six to nine-week incubation period.

Food. The bog turtle is omnivorous, allowing it to enjoy a varied menu. It eats wild berries and also feeds on slugs, tadpoles, snails, worms and insects. The diet also includes the shoots of tender plants.

Blanding's Turtle

Emydoidea blandingii

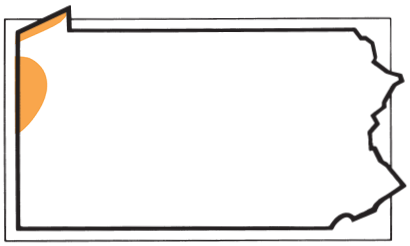
Candidate Species



General characteristics. This turtle, which has been placed on Pennsylvania's List of Candidate Species, was named for Dr. William Blanding, a nineteenth-century Philadelphia naturalist who first observed the species. It grows to an average adult shell length of five to just over seven inches. The Blanding's turtle is more tolerant of cold temperatures than most other turtles.

Identification. The Blanding's turtle has a carapace that is smooth and shaped like a helmet. It is sprinkled with a heavy profusion of pale-yellowish spots, which in some areas become connected to form vermiculations. The plastron, or lower shell, is yellow and accented with large black blotches. The chin and throat are both bright yellow. In Pennsylvania, only the softshell turtle has a longer neck. Large protruding eyes serve only to emphasize a flat head. The plastron is hinged so that it can be closed toward the carapace, but not to the extent the box turtle is able to close up.

Range. The Blanding's turtle extends from Nebraska eastward to Ohio and Ontario. Its range is spotty east of Ohio. Although perhaps not found at all today, the Blanding's turtle in Pennsylvania never occupied a large area. Its original range included the vicinity of Lake Erie and a portion of southwestern Crawford County. Conneaut Lake and the swampy



MAINTAINING WETLANDS FOR BOG TURTLES

With brush cutters and gardening loppers, the Pennsylvania Fish and Boat Commission (PFBC) and Mid-Atlantic Center for Herpetology and Conservation recently trimmed their way through some precious and rare wetland habitats in Pennsylvania. Shrub and tree overgrowth in wetlands limits suitable habitat for Bog Turtles.

A spring-fed meadow with low sedges, shrubs and soft mud makes a great home for the Bog Turtle, North America's smallest turtle. It needs mud to burrow in and, as a reptile, the ability to move in and out of the sun for temperature regulation. Sunlight is critical for growth, disease prevention and incubating eggs.

When the woody vegetation is cut, this gives the tiny turtle the right combination of sun and mucky soil to thrive. Without this management practice, eventually the habitat will become overgrown and change from an open wetland to forest.

"If the habitat is not great, they may hang on for a while but can't successfully reproduce. Some populations we currently see are only older ones," said Josh Brown, PFBC biologist.

This work is part of a 5-year multistate grant with the United States Fish and Wildlife Service aimed at recovering the Bog Turtle through habitat restoration, management and protection. Ultimately, the goal is to remove the Bog Turtle from the Pennsylvania List of Endangered Species.

Along the way, PFBC biologists and partners are also surveying habitats to better understand the impacts of the management practice and provide more support to Bog Turtles for the future.

Bog Turtles are illegal to possess. So, please don't pick them up or take them home. If a turtle is on the road, move it across the road in the direction it's headed. You, too, can make a difference in Pennsylvania wetlands.

World Turtle Day May 23:

worldturtleday.org/

photo–PFBC archives

Bog Turtle
Glyptemys muhlenbergii

Size: No more than 4 inches long (along its shell)

Field Notes: Bog Turtles inhabit wetlands including bogs, marshes, swamps and wet pastures. They eat berries, slugs, tadpoles, snails, worms, insects and plant shoots. The Bog Turtle's carapace (upper shell) is light brown to mahogany. Its large scutes (bony plates on the shell) sometimes have a tinge of yellow or red in the center. Its plastron (lower shell or "belly") is brown or black with yellow along the middle. The head is black and marked with a yellow, orange or red blotch on each side.

Did you Know? The Bog Turtle was the first turtle to be placed on the Pennsylvania List of Endangered Species. It only appears in isolated populations, and loss of habitat is the biggest factor in its decline. The Bog Turtle is a secretive and shy turtle, which makes it difficult to study. It is active from April through mid-October. A Bog Turtle may bury itself in mud or vegetative debris during periods of extremely hot weather, and it hibernates during the coldest winter months, deeply buried in mud with flowing springs.

Species Action Plan:
Bog Turtle
(*Glyptemys muhlenbergii*)

Purpose: This plan provides an updated five year blueprint for the actions needed to attain near-term and, ultimately, long-term goals for the conservation and recovery of the Bog Turtle. The action plan is a living document and will be updated, as needed, to reflect progress toward those goals and to incorporate new information as it becomes available.

Goals: The immediate conservation goal for the Bog Turtle is to significantly increase efforts towards recovery of the Bog Turtle through habitat restoration, management, and protection; and to continue to collect baseline data for long-term monitoring and assessment of the Pennsylvania Bog Turtle population. The long-term recovery goal is to increase viable, reproducing, and protected populations of Bog Turtle and ultimately, in cooperation with the US Fish and Wildlife Service (USFWS), to remove the Bog Turtle from the lists of Pennsylvania endangered, threatened and candidate species (58 Pa. Code §75).

Natural History

Taxonomy: Class Reptilia, Order Testudines (turtles), Family Emydidae (water turtles), Bog Turtle (*Glyptemys muhlenbergii*)

Figure 1. Bog Turtle (*Glyptemys muhlenbergii*. Photo-PFBC file.

Description: The Bog Turtle is a small, semi-aquatic turtle with a maximum carapace length of 114 mm (Figure 1). The Bog Turtle's brown or black carapace is slightly
sculpted, somewhat domed, and has a slight mid-dorsal keel. Growth rings are typically visible on the scutes of young to middle-aged Bog Turtles but often become smoothed by sediments in older specimens. The plastron is hingeless, posteriorly notched and connected to the carapace by a wide bridge. The coloration of the plastron is predominantly dark brown to black, with some individuals exhibiting tan or brownish markings that typically originate along the centerline. The background color of the skin is dark brown to black, with a mottled appearance on the head. An orange-colored blotch located behind the eyes on the dark skin of the neck and head is diagnostic (Hulse *et al*. 2001).

Habitat: The Bog Turtle is a habitat specialist that relies on early successional, groundwater-driven, emergent wetlands. Primary Bog Turtle habitat typically consists of wetlands with wet, mucky soils, and open, sunny, emergent vegetation. The classic example of Bog Turtle habitat is a spring-fed meadow with dominant vegetation consisting of low pedestal-forming grasses and sedges, often containing a scrub-shrub wetland component, and with soft mud or "mucky" soils. The turtles are often associated with tussock sedge (*Carex stricta*). This sedge and other pedestal-forming vegetation (*Scirpus*, *Cyperinus*, and *Carex* spp.) create a wide range of micro-climates. Reed canary-grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*) are invasive plant species that commonly occur in altered, disturbed or degraded sites. The Bog Turtle hibernates in spring seeps, most often under root masses and with maximum solar exposure (Ernst *et al.* 1989, Eichelberger 2005, Gress pers. comm.).

Life History: Bog Turtles in Pennsylvania typically emerge from hibernation in late March through April, dependent upon local weather conditions, and return to the hibernacula in October. Breeding occurs from late April through early June (Barton and Price 1955). Generally, nesting occurs 21 to 31 days after copulation and, in Pennsylvania, Bog Turtles generally nest from June through early July (Hulse *et al*., 2001, C. Urban, personal observation). An average of three (range 1-6) elliptical white eggs are typically deposited between the blades of tussock sedge or within a sphagnum mat above the water line (Hulse *et al*., 2001).

Hatchlings in the wild typically emerge from mid-August through September and overwinter at or near the nest site. The Bog Turtle is considered to be mature at a plastron length of 70 mm (Ernst 1977) (carapace length of approximately 75 mm) and an age of 6 to 10 years, depending on conditions.

Bog Turtles are omnivorous and will eat insects, slugs, worms, frogs, salamanders, C*arex* seeds, Japanese beetles, berries, cattails, skunk cabbage, snails, and carrion (Nemuras 1967, Zappalorti 1976, Holub and Bloomer 1977 as cited in Ernst *et al.* 1994, Ernst 1985).

Distribution and Status

National Distribution: Two separate geographical populations of *Glyptemys muhlenbergii* are recognized (USFWS 2001) (Figure 2). The northern population exists within New York, Massachusetts, Connecticut, Pennsylvania, New Jersey, Delaware, and Maryland. A disjunct southern population, separated by 250 miles from the northern population, exists in Virginia, North Carolina, Tennessee, South Carolina, and Georgia, primarily in the Blue Ridge Province (Lee and Herman 1999).

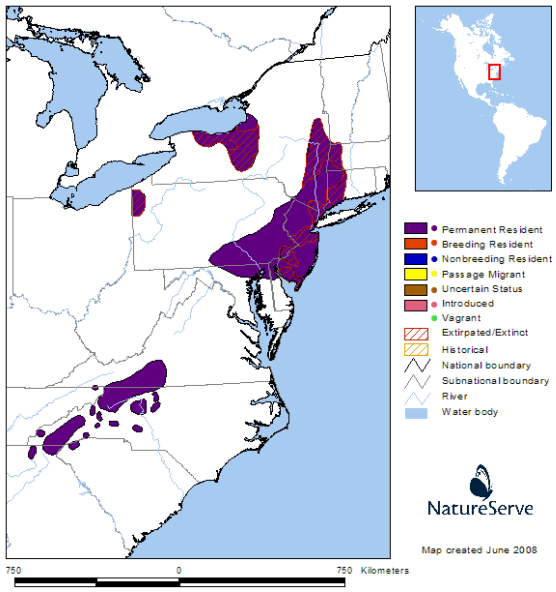


Figure 2. Distribution of *Glyptemys muhlenbergii* in North America (NatureServe 2010).

Pennsylvania Distribution: Within Pennsylvania, Bog Turtles are limited in distribution to portions of 15 southeastern and eastern counties and possibly other isolated areas in northwestern Pennsylvania (Figure 3). Fragmented populations occur from Adams and Cumberland Counties eastward to the Delaware River and northward to Monroe County. Historically, a western population existed in Crawford and Mercer Counties and is currently considered historic or extirpated. Although significant suitable habitat acreage exists, researchers have searched for and failed to confirm the northwestern population in the last 25 years (Ruhe 2009).

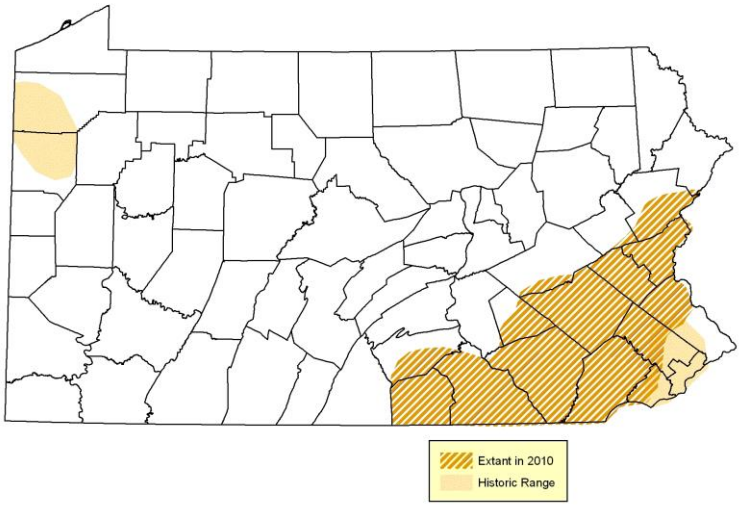


Figure 3. Distribution of *Glyptemys muhlenbergii* in Pennsylvania. (PFBC 2010).

Pennsylvania Legal Status: The Bog Turtle was listed as Endangered in Pennsylvania in 1974 (58 Pa. Code §75.1).
Federal Status: The US Fish and Wildlife Service (USFWS) listed the Bog Turtle as Threatened in 1997 (USFWS 1997).

Management Status

As of 2019, 178 extant Bog Turtle populations, including 23 true metapopulations (populations with genetic exchange feasible through occasional dispersal events) have been documented in Pennsylvania. Previously undocumented Bog Turtle sites continue to be discovered every year through *ad hoc* permitted surveys, surveys related to environmental review, incidental encounters and some targeted surveys (USFWS 2008). Limited targeted surveys have failed to find Bog Turtles within the historic range in northwestern Pennsylvania (Ruhe 2009).

In 2019 as the culmination of a five-year Competitive State Wildlife Grant to the states in the northern range of the Bog Turtle, a "Bog Turtle Conservation Plan for the Northern Population" was developed (Erb 2019). This Conservation Plan outlines the conservation strategies or actions needed to achieve the recovery criteria established in the 2001 Bog Turtle Northern Population Recovery Plan developed for the USFWS. Provided within this Conservation Plan for each of the five Northern population recovery units is an overview of the population status, descriptions and specific actions needed for all conservation strategies identified to date, and implementation tables regarding conservation actions.

Pennsylvania Bog Turtle populations are within the Delaware Recovery Unit and the Susquehanna-Potomac Recovery Unit designated by the USFWS Recovery Plan (2001). Appendices A and E of the Conservation Plan identify specific conservation strategies for these Recovery Units, including priority actions based on the strategies and their priority level within each recovery unit. This information can be used by partners to determine local actions of greatest need within a specific recovery unit. Each plan identifies populations in which specific actions are most needed, provides a timeline for completing each strategy, and identifies potential partners related to the implementation of each conservation strategy.

Threats

1) Habitat loss by anthropogenic alteration or destruction
   a. Historic and ongoing residential, commercial and industrial development, road construction, and agricultural practices
   b. Genetic isolation and risk of local extirpation are exacerbated by loss of habitat and its connectivity.

2) Habitat loss by natural succession and lack of habitat management
   a. Disturbance processes (e.g., beaver ponds, low density cattle grazing) are

needed at many sites to create and maintain suitable wet meadow habitat

b. Encroachment by trees and shrubs creates shading, thereby eliminating Bog Turtle nesting and basking habitat

3) Invasive plant species: Invasive plants such as reed canarygrass (*Phalaris arundinacea*), common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and narrow-leaved cattail (*Typha augustifolia*) can form dense homogenous stands thus eliminating or reducing basking and nesting areas, creating barriers to turtle movements, and can be responsible for excessive uptake of water from the wetlands.

4) Altered hydrology: Prior to the establishment of federal wetland laws, many fen/wet meadow habitats had been ditched for agriculture, roads, and residential or commercial development. Succession and invasive plant species can lead to reduced groundwater influence in the wetland. Prolonged droughts reduce availability of habitats.

5) Predation (especially of nests): Predominant predators of nests and juveniles are meso-mammals (i.e., raccoon, opossum, mink, fox), but small mammals such as shrews have been documented as egg predators (Zappalorti *et al.* 1995).

6) Illegal collection: Given their high black market value, Bog Turtles are in constant danger of illegal collection by poachers (Hulse *et al*. 2001, USFWS 2001).

Conservation and Recovery

Conservation Actions:

The USFWS Recovery Plan for the Bog Turtle, Northern Population calls for actions for the protection and restoration of Bog Turtle wetland habitat and the hydrologic processes that create and maintain it, protection of upland habitat buffers and dispersal corridors, and external threat abatement to minimize common mortality factors like poaching, predation, and roadkill (National Fish and Wildlife Foundation. 2009, USFWS 2009). Using the 2019 Bog Turtle Conservation Plan (Erb 2019) prioritized list of conservation strategies, the PFBC advocates implementation of the following:

1) Identify known Bog Turtle sites and develop management plans based upon priority of sites in 2019 Bog Turtle Conservation Plan.
   a. Determine the acreage and habitat improvement needs for each site.
   b. Complete management plans for state-protected sites. Manage habitat, through grazing and other forms of vegetation management, to improve suitability for Bog Turtle nesting.

   c. Manage habitat at priority sites on an annual basis through use of grant funding and partnerships.
   d. Plan for restoration of hydrology at priority sites and initiate design and review process for this restoration.

2) Monitor occupied Bog Turtle sites.
   a. Continue long-term monitoring program at priority sites
   b. Continue long-term monitoring program at sites undergoing habitat management to measure population response.
   c. Monitor habitat at prioritized sites, particularly in response to management actions.

3) Continue and expand ongoing protection measures for the Bog Turtle populations.
   a. Encourage private landowners to enroll in conservation incentive programs such as Wetlands Reserve Easements (WRE).
   b. Review and comment on permit applications that involve proposed temporary and/or permanent disturbances to known Bog Turtle habitat.
   c. Seek funding to assist with long-term protection and management of Bog Turtle sites.
   d. Develop and implement Best Management Practices (BMPs) to reduce impacts from development projects, pipeline projects, and roadside mowing practices.

4) Continue to survey for undocumented populations of Bog Turtle within their historically-occupied range.
   a. Use existing models to identify potential habitat
   b. Obtain landowner permissions for survey.
   c. Inventory sites.

5) Develop plans to establish Bog Turtle wetland connectivity corridors.
   a. Map contiguous habitat and potential dispersal barriers.
   b. Seek opportunities for reducing dispersal barriers.
   c. Work with partners to protect corridor habitats through easements.
   d. Work with partners (esp. DOT) to implement measures to reduce road impacts on populations.

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