



New Jersey Bog Turtle Project

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Introduction

Bog Turtle (*Clemmys muhlenbergii*)

Status: Federally Threatened

State Endangered

The bog turtle, *Clemmys muhlenbergii*, is an inhabitant of fens, bogs, and wet meadows that are characterized by substrates of mucky, organic soil that is kept saturated by groundwater discharge. Plant communities associated with bog turtle habitats vary in species composition but are almost always dominated by low-growing grasses (e.g. rice-cut grass, tufted hair grass), sedges (e.g. tussock sedge, spike rush, wool grass), rushes (e.g. soft rush), mosses (e.g. sphagnum), ferns (e.g. royal fern, cinnamon fern, marsh fern, sensitive fern), scattered cattails, and myriad ephemeral and perennial forbs (e.g. New York ironweed, joe-pye weed, blue vervain, turtlehead). Shrub and tree cover in bog turtle habitats is very low, and physical features of habitats include spring-derived rivulets, shallow, mucky pools, and abundant hummocks in the form of tussock-forming sedges or raised mounds of moss.

These palm-sized, elusive turtles spend much of their lives hidden in the cool, soft muck which provides them with cover and aids in thermoregulation during hot summer days. Emerging from subterranean hibernacula in the spring, bog turtles spend much of spring and early summer basking on hummocks, matted vegetation, or in open mucky pools and rivulets.

Mating occurs primarily in May and June. Six to eight weeks following copulation gravid females begin their quest for egg-laying sites in drier microhabitats within the soggy marsh including, sedge and moss hummocks, rotted tree stumps, or raised islands of ground which allow for proper gas exchange of the developing embryos.

Throughout much of the summer bog turtles remain concealed within the dense wetland vegetation, only emerging to bask when cool late-summer mornings arrive. By mid to late October bog turtles return to their hibernacula, which is often within the ground water-washed root systems of woody plants.

Diets primarily consist of invertebrates, particularly slugs, which are abundant in most bog turtle habitats due to the presence of preferred plants such as skunk cabbage, jewelweed, and boneset. However, bog turtles will feed on a wide variety of items including carrion, small berries, sedge seeds, young cattail shoots, and duckweed.

The Status of the Bog Turtle in New Jersey

Once abundant throughout New Jersey, bog turtles are now primarily restricted to the remaining rural portions of the state including Sussex, Warren, Hunterdon, and Salem counties. Bog turtles are habitat specialists, relying on abundant groundwater resources, organic soils, diverse herbaceous vegetation, and contiguous tracts of land for dispersal. Intense land-uses such as urbanization or industrial farming destroy bog turtle habitats through direct wetland alteration/destruction and through secondary impacts (i.e. stormwater inputs, local draw down of water tables, and nutrient enrichment).

Bergen, Camden and Middlesex counties are the best of examples of how intense land-use effects bog turtles. According to historic records pre-1970, these counties at one time supported bog turtle populations in most of the watersheds that occur within

each county. However, the urbanization of these counties over the past four decades coincided with the extirpation of bog turtles from Bergen, Camden, and possibly Middlesex. (There is one questionable bog turtle occurrence remaining in Middlesex County.)

Nevertheless, where bog turtles still occur in New Jersey they appear to be doing well. As of 2001 there are 168 known bog turtle populations (defined by the limits of gene flow amongst individual wetlands supporting bog turtles) in New Jersey, making our state one of the largest strongholds in the bog turtle's range. Of the 168 populations, 28 are considered "metapopulations," which are defined by a complex of interconnected wetlands that contain two or more bog turtle demes (colonies) and/or suitable habitats.

From the perspective of long-term viability the metapopulations are the conservation priority for they can facilitate the normal biological dynamics i.e., dispersal, colonization, gene flow, etc., that keep populations functionally viable. Fragmented or isolated populations, while still important to protect, are vulnerable to random events such as severe floods, disease and collection, and are also potentially at risk of becoming genetically impoverished over time.

Bog Turtle Conservation Initiative

The [Endangered and Nongame Species Program](#) has created and is implementing a comprehensive management initiative to provide long term conservation of the important bog turtle populations identified in New Jersey. The management initiative consists of four main actions:

1. [Developing relationships with private landowners](#) that possess bog turtles on their land.
2. [Facilitating the acquisition of sites](#) threatened by adjacent land use activities.
3. [Performing habitat management](#) and experimenting with new management techniques to control and reverse habitat succession and invasive exotic plant proliferation
4. [Facilitating long term protection](#) of bog turtle wetlands by working with local communities to implement land use planning changes through the Landscape Project

1. Landowner Contacts

Since many of the priority bog turtle sites are on private land, the success of any conservation activities will depend on the development of relationships with landowners. The landowner contact initiative is well under way. Mostly through personal contacts, landowners are being educated about bog turtles and the ecological value of their habitats.

The ENSP takes time to walk properties with landowners and addressing their questions and concerns on a range of wildlife and conservation topics. The ENSP has been highly successful in establishing landowner relationships at most of our best sites. This has led to our ability to manage habitats, which is discussed in more detail under the habitat management section.

2. Acquisition

Several conservation priority bog turtle sites are located on properties that are either slated for development or likely to be developed in the near future. These sites have been proposed as priority acquisition sites. The ENSP has created a partnership with government and private land conservation organizations to preserve bog turtle sites. Partners include [NJDEP Green Acres Program](#), the [US Fish and Wildlife Service](#), and the [Ridge and Valley Conservancy](#). To date, two bog turtle sites have been acquired and several are pending negotiations.

3. Habitat Management

The majority of bog turtle habitats are in dire need of management and/or restoration. Succession of woody species, invasion by purple loosestrife, phragmites, multiflora rose, cattail, Japanese stiltgrass, and reed canary grass are the primary threats to habitat quality, and most of these plants are extremely difficult to control. However, as aggressively as these plants invade, the ENSP is combating these floristic invaders with equivalent ferocity through several methods.

Comprehensive Habitat Management through Grazing

Grazing in bog turtle habitats has been demonstrated to retard natural succession, control invasion by fast-growing invasive species, augment hydrological regimes through reducing above-ground vegetative matter and breaking up peat accumulation, create microhabitats for bog turtles in the form of footprints, and encourage the growth of hummocky vegetation that bog turtles use for nesting (Herman 1999). In the Kittatinny Valley of Sussex and Warren counties, 107 of 108 bog turtle sites are either grazed or were grazed in recent years. It has been theorized that livestock are the contemporary analogs of the elk, bison, and

mastodons that grazed pre-colonial fens and swamps (Lee and Norden 1996).

With funding from the [Natural Resources Conservation Service](#)'s Wildlife Habitat Improvement Program (WHIP) and the [U.S. Fish and Wildlife Service](#)'s Partners for Wildlife Program, in 1998 the ENSP began introducing sheep, goats, and cattle to bog turtle habitats that are heavily infested by invasive plants. There are currently 10 prescribed grazing projects in progress.

A review of this project is contained in the PDF document* [Restoring Wetland Habitats With Cows and Other Livestock](#), published in [Conservation Biology In Practice](#) • Spring 2001/Vol.2 No.2.

(* Documents in PDF format can be viewed and printed using the Adobe Acrobat Reader, available free from [Adobe's Website](#).)

Woody Vegetation Control

The frill methodology is being used to control unwanted successional trees, primarily red maples (*Acer rubrum*), by scoring the bark with a machete and spraying the wound with a 80% solution of Rodeo. We feel the herbicide is necessary for controlling species such as red maples, which if simply cut or girdled, will respond by generating several suckers just below the wound, transforming the tree into a multi-stemmed plant that is capable of producing more shade than the original tree.

Cutting can be an effective management method but it is both labor intensive and requires annual management, which is not feasible given the vast number of bog turtle habitats that ENSP working to preserve. Currently, herbicidal treatment appears to be the most effective and timely method of arresting succession.

To date, herbicidal woody vegetation management has been effectively used at over 40 bog turtle sites to kill thousands of woody plants, including red maple, alder, arrowwood, willow, poison sumac and multiflora rose. The multi-stemmed species were treated with Rodeo near the base of the shrub at the main stem.

Purple Loosestrife Control

Through a partnership with the [New Jersey Department of Agriculture](#)'s [Beneficial Insect Lab](#), *Gallerucella pusilla*, a natural grazer of the invasive European wetland plant, purple loosestrife (*Lythrum salicaria*), has been released at 17 bog turtle sites since 1998. (For more detailed information on purple loosestrife biocontrol see www.state.nj.us/agriculture/plant/biolab.htm.) It is estimated to take three to five seasons for beetles to build up a population significantly large enough to impact the purple loosestrife population at a site.

The ENSP and [Department of Agriculture](#) entomologists will monitor the beetle's progress over the next several years. Funding for the purchase of beetles has been made possible through the [Natural Resources Conservation Service](#)'s Wildlife Habitat Improvement Program (WHIP) and the [U.S. Fish and Wildlife Service](#)'s Partners for Wildlife Program.

4. Protecting Bog Turtles with the Landscape Project

The primary objective of the ENSP's [Landscape Project](#) is to preserve functioning metapopulations of rare wildlife species through preserving core habitats and critical connecting corridors. Landscape Project [GIS](#) generated mapping products identify critical habitats and habitats that should be protected and/or acquired in order to provide long term preservation of functional metapopulations. Landscape project mapping products will be made widely available and will eventually guide the regulatory and public planning processes so that land-use decisions will be compatible with the conservation of bog turtles and other wildlife populations.

The extensive amount of habitat evaluation, population sampling and population threat assessment performed during the past nine years (1993-2001) has provided the data necessary to determine the landscape level conservation status of bog turtle populations in New Jersey. This information is a valuable addition to the Landscape project data layers and will hopefully lead to the protection necessary to preserve the state's remaining populations.

Unfortunately, many migratory corridors between bog turtle colonies have already been severed through development, roads and increased road traffic. Bog turtle populations would have significantly benefited from Landscape level conservation if it had been initiated 25 years ago.

Aerial photography from 1973 suggests the majority of the isolated populations would have been associated with other habitats and/or colonies. At that time, agriculture was the dominant land use and human populations in and around bog turtle areas were much smaller. Dairy cattle grazed most wetlands, which provided greater amounts of suitable habitat that was maintained in a suitable condition on a relatively permanent basis. In addition, roads were much less traveled, allowing bog turtles to move successfully between suitable habitats throughout drainages.

However, in the 25 year interim the loss of farms, the growth of developments, the increase in road travel, and the degradation of habitats through primary wetland impacts and invasive plant encroachment has isolated many bog turtle colonies from former metapopulations and fragmented several large metapopulations comprising 8+ colonies into smaller 'sub' metapopulations comprising only 2 or 3 colonies.

Fortunately, where functioning metapopulations still exist, most appear to be safe from further fragmentation due to a combination of wetland protection regulations and federal, municipal, Non-Governmental Organization and state ownership. A large percentage of New Jersey's landscape has historically been wetland habitat.

Even after 300 years of Western inhabitation a large percentage of the landscape is still wetlands, including many acres that had been previously drained. Beginning in the early 1700s, many wetlands were drained for cropland and pasture. But in the mid-20th century, small-scale subsistence agriculture began to decline, and many agriculturally impacted wetlands returned to semi-natural state.

However, at this time another cultural force was at work: suburbanization. This force brought with it buildings and pavement that replaced native wetland soils and fragmented wetland complexes into smaller parcels. But before suburbanization engulfed the remaining large wetland tracts, public environmental awareness prompted legislators to enact laws to protect wetlands.

Since 1987, when the [New Jersey Freshwater Wetlands Protection Act](#) was enacted, many large wetland complexes have been protected from development and primary impacts. Additionally, large contiguous tracts of wetlands have been acquired as public open space within the last 20 years. Consequently, these large wetland systems support a majority of the extant bog turtle metapopulations.

Bog turtle habitats within these wetlands may represent only a small fraction of the total wetland size (habitats are usually ~2 acre seepage fens along the periphery of 100+ acre bottomland swamps). However, these large systems can easily facilitate movement between habitats, and they offer the potential for creation of additional habitat in the future through successional dynamics.

Provided our society and our government maintain a conservation ethic and continue to enforce wetlands and endangered species regulations these large metapopulations are safe from fragmentation and primary impacts. Developable land in and around individual bog turtle sites within metapopulations has been identified as priority acquisition sites. The acquisition of corridors may not be necessary since most corridors exist within large, protected wetland complexes for the most part can be adequately protected through wetland regulations.

Conclusion

We face many challenges as we endeavor to ensure the long-term preservation of bog turtle populations in New Jersey. Fortunately, we still have a significant amount of suitable habitat that still supports relatively large metapopulations of bog turtles. Also, we have made considerable progress in identifying conservation needs and priorities.

Conservation initiatives are also well under way and show promise for preserving and managing habitats into the future. The biggest challenge may be accomplishing enough land preservation and management in a timely enough fashion to stem or reverse the trend of disappearing and degrading bog turtle habitats in a dynamic and rapidly changing landscape.

Future trends in development, growth, open space conservation and land use planning and regulation may ultimately determine whether or not we are successful in our endeavor. However, the ENSP has made great strides in last several years in reversing the damaging effects of habitat degradation through active management of habitats. If we can continue on the established pace we should be able to successfully conserve at least a portion of our large functioning bog turtle populations.

Literature Citations

Herman, D.W. 1999. The Impacts of Livestock Grazing on Bog Turtle Habitat in the Piedmont and Mountains of the Southeast. Unpublished report submitted to the [United States Natural Resources Conservation Service](#), Wetlands Science Institute.

Lee, D.S. and A.W. Norden. 1996. The distribution, ecology and conservation needs of bog turtles, with special emphasis on Maryland. Maryland Naturalist 40:7-46.

