



# National Fish and Wildlife Foundation

## Draft Business Plan for the Bog Turtle

March 24, 2009

# What Is a Business Plan?

---

A business plan serves two broad, primary functions. First, it provides specific information to those (e.g., prospective investors) not familiar with the proposed or existing business, including its goals and the management strategy and financial and other resources necessary to attain those goals. Second, a business plan provides internal guidance to those who are active in the operation of the business, allowing all individuals to understand where the business is headed and the means by which it will get there. The plan helps keep the business from drifting away from its goals and key actions through careful articulation of a strategy.

In the context of the National Fish and Wildlife Foundation's conservation efforts, business plans represent the strategies necessary to meet the conservation goals of Keystone and other initiatives. Each business plan emphasizes the type(s) and magnitude of the benefits that will be realized through the initiative, the monetary costs involved, and the potential obstacles (risks) to achieving those gains. Each of the Foundation's business plans has three core elements:

**Conservation Outcomes:** A concrete description of the outcomes to which the Foundation and grantees will hold ourselves accountable.

**Implementation Plan with Strategic Priorities and Performance Measures:** A description of the specific strategies that are needed to achieve our conservation outcome and the quantitative measures by which we will measure success and make it possible to adaptively revise strategies in the face of underperformance.

**Funding and Resource Needs:** An analysis of the financial, human and organizational resources needed to carry out these activities.

The strategies and activities discussed in this plan do not represent solely the Foundation's view of the actions necessary to achieve the identified conservation goals. Rather, it reflects the consensus or majority view of the many federal, state, academic or organization experts that we consulted with during plan development.

In developing this business plan, the Foundation acknowledges that there are other ongoing and planned conservation activities that are aimed at, or indirectly benefit, keystone targets. This business plan is not meant to duplicate ongoing efforts but, rather, to strategically invest in areas where management, conservation, or funding gaps might exist in those broader conservation efforts. Hence, the aim of the business plan is to support the beneficial impacts brought about by the larger conservation community.



# Summary

---

This business plan maps out a 10 year plan to protect and restore bog turtle populations and the early successional wetlands they inhabit. It was created in active collaboration with universities, agencies, and non-profit organizations involved in the bog turtle's conservation. The bog turtle is one of four species — New England cottontail, American woodcock, and golden-winged warbler — that the National Fish and Wildlife Foundation is targeting as part of a broader effort to conserve early successional habitat.

This business plan will guide every aspect of the Foundation's anticipated \$5.3 million in grant-making associated with this species and its habitat. Ultimately we hope that the strategy and activities described herein are adopted by the broader community of agencies and organizations working on the same goals and responsible for the additional \$9.8 million of investments identified as necessary to conserve the bog turtle and make significant progress toward recovery in this timeframe.

The bog turtle has disappeared from approximately half of its known sites over the past thirty years, and has been listed as a threatened species under the Endangered Species Act. Monitoring for the species demonstrates that declines in the species distribution continue. The ten-year goal of this plan is to manage and significantly improve status of at least half of the sites in two important recovery units: the Hudson/Housatonic (H/H) and Susquehanna/Potomac (S/P) recovery units. To accomplish this goal, resources need to be focused on the following strategies:

- **Restoring and managing early successional wetland habitat.** Bog turtles need open early successional wetland habitat for breeding and basking. They have too little remaining early successional habitat and that which remains is of low quality. *Activities* — Restore, create and maintain at least 200 acres of high quality early successional wetland habitat on 40 H/H and 50 S/P sites. Seek opportunities to restore hydrology throughout bog turtle watersheds to ensure continual creation of new bog turtle habitat.
- **Protecting and ensuring compatible management of adjacent uplands and wetlands.** Uplands and wetlands surrounding wet meadow nesting areas are important as a source of groundwater and spring flow in wetlands, provide over-wintering sites for bog turtles, and if managed appropriately can help buffer and protect core habitat. *Activities* — Ensure core wet meadow habitat and at least 20 acres of adjacent lands are protected from incompatible development and managed to sustain the core habitat at each site. Monitor and address unsuitable development and projects in or adjacent to bog turtle habitat.
- **Identify site specific buffer zones and mitigating threats within those zones.** Incompatible land use activities within the buffer zone can seriously threaten the quality of core habitat and the health of populations. Buffer zones include terrestrial uplands and wetland recharge zones, so activities affecting surface and groundwater must be examined to ensure suitable water quality and quantity. Anticipated threats can be prevented through land protection, while existing threats (for example, sediment loading from row crop agriculture) can be minimized or managed. *Activity* — Eliminate or manage major threats to bog turtle sites within buffer zones and prevent new threats from emerging.
- **Incentives for local livestock agriculture.** Long-term maintenance of many bog turtle wetlands will include light, managed grazing in those wetlands — the same activity that maintained the habitat over much of the 20<sup>th</sup> century. *Activity* — Secure long-term contracts with farmers to manage habitat to be suitable for bog turtle nesting, through grazing and other forms of vegetation management.



# Contents

---

What Is a Business Plan? . . . . .	i
Summary . . . . .	iii
Early Successional Habitat . . . . .	1
Conservation Need . . . . .	2
Range Map . . . . .	3
Logic Framework — Goals, Threats and Strategies . . . . .	4
Focus on Two Recovery Regions . . . . .	5
Conservation Outcomes . . . . .	6
Implementation Plan . . . . .	8
Funding Needs . . . . .	14
Evaluating Success . . . . .	16
Long-Term Foundation Support . . . . .	18
Ancillary Benefits . . . . .	19
Glossary . . . . .	20
Appendix A. Sample tracking sheets to monitor progress . . . . .	21
Acknowledgements . . . . .	26



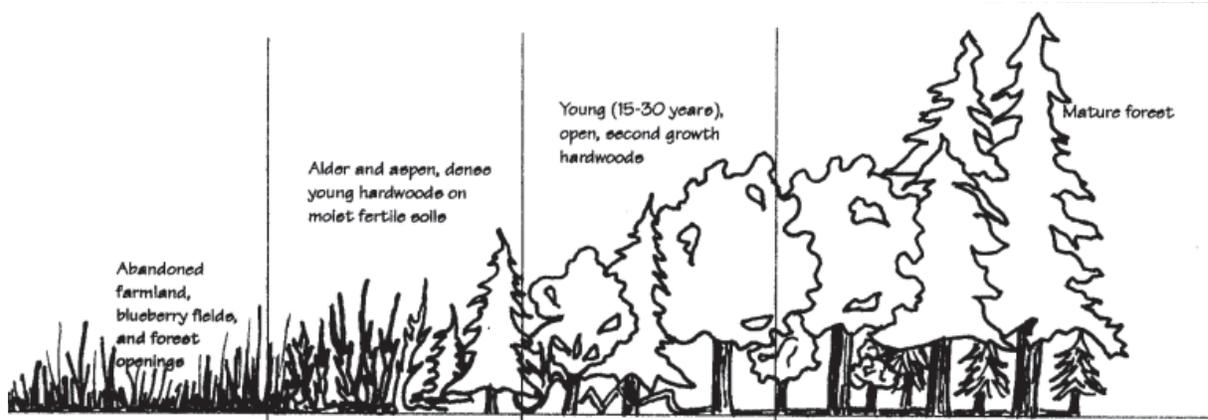
# Early Successional Habitat

---

**Habitat succession** is the gradual replacement of one community of plants and associated wildlife with another community (Figure 1). In the Northeastern U.S. and Canada, gaps in the forest canopy created by fire, pest outbreaks, logging, agriculture, or beaver activity create important wetland, grassland, shrub and young forest habitats which are collectively called 'early successional habitats.' These early successional habitats are indicators of healthy dynamic stream and forest systems and are in decline throughout the region.

Early successional wetlands are dominated by grasses, wildflowers, ferns and other herbaceous plants, and shrubs like willow and alder. Bog turtles, especially in the northern end of their range, are also found in calcareous fens in which soil and water chemistry allow special plant communities to thrive that also provide the open conditions that bog turtles need to thrive.

Every northeastern state wildlife agency in the region has identified the conservation of early successional habitat as a top priority through their state wildlife action plans. It is a priority for the Ruffed Grouse Society, Environmental Defense Fund, The Nature Conservancy, National Audubon Society, Wildlife Management Institute, Ducks Unlimited, American Woodcock Working Group, and the Xerces Society among others. Restoring and protecting early successional habitat provides open space, buffers important drinking water supplies, and helps maintain high wildlife diversity close to some of the most densely populated parts of America.



**Figure 1.** Succession is the gradual replacement of one community of plants and associated wildlife with another community.

# Conservation Need

---

The bog turtle (*Glyptemys clemmys muhlenbergii*) is the smallest turtle in North America and one of the smallest turtle species in the world. It has disappeared from approximately 50 percent of wetlands in which it occurred thirty years ago and populations north of Virginia have been listed as a threatened species under the federal Endangered Species Act.

It is also recognized as an endangered species under most state endangered species laws in which it occurs. Its conservation is a priority for the U.S. Department of Agriculture's Natural Resource Conservation Service in New York, New Jersey, Pennsylvania and Maryland and this agency has spent many hundreds of thousands of dollars conserving it. Among the thousands of plants and animals that are imperiled or at risk, the U.S. Fish and Wildlife Service (USFWS) has recently designated this as one of 190 'spotlight species.'

The USFWS Recovery Plan for the Bog Turtle, Northern Population calls for long-term protection and restoration of the bog turtles wetland habitat and 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.

The Recovery Plan outlines 10 major tasks for recovering this species in its northern range. Figure 3 summarizes these tasks, with a subgroup of tasks highlighted that NFWF financial support could most effectively address. This subset of tasks focuses on protecting and managing extant populations and habitat in bog turtle watersheds; securing long-term site protection; monitoring of populations, habitats, watersheds, and threats; and focused outreach and education.

The bog turtle is a model species for conservation action on both public and private lands because 1) nesting habitat for the species is easily managed for at relatively small spatial scales, 2) the turtle is most associated with a vegetative state that can be readily restored in a short timeframe, with fairly low intensity maintenance, and 3) restoration methods are compatible with ongoing farming practices, including livestock grazing.

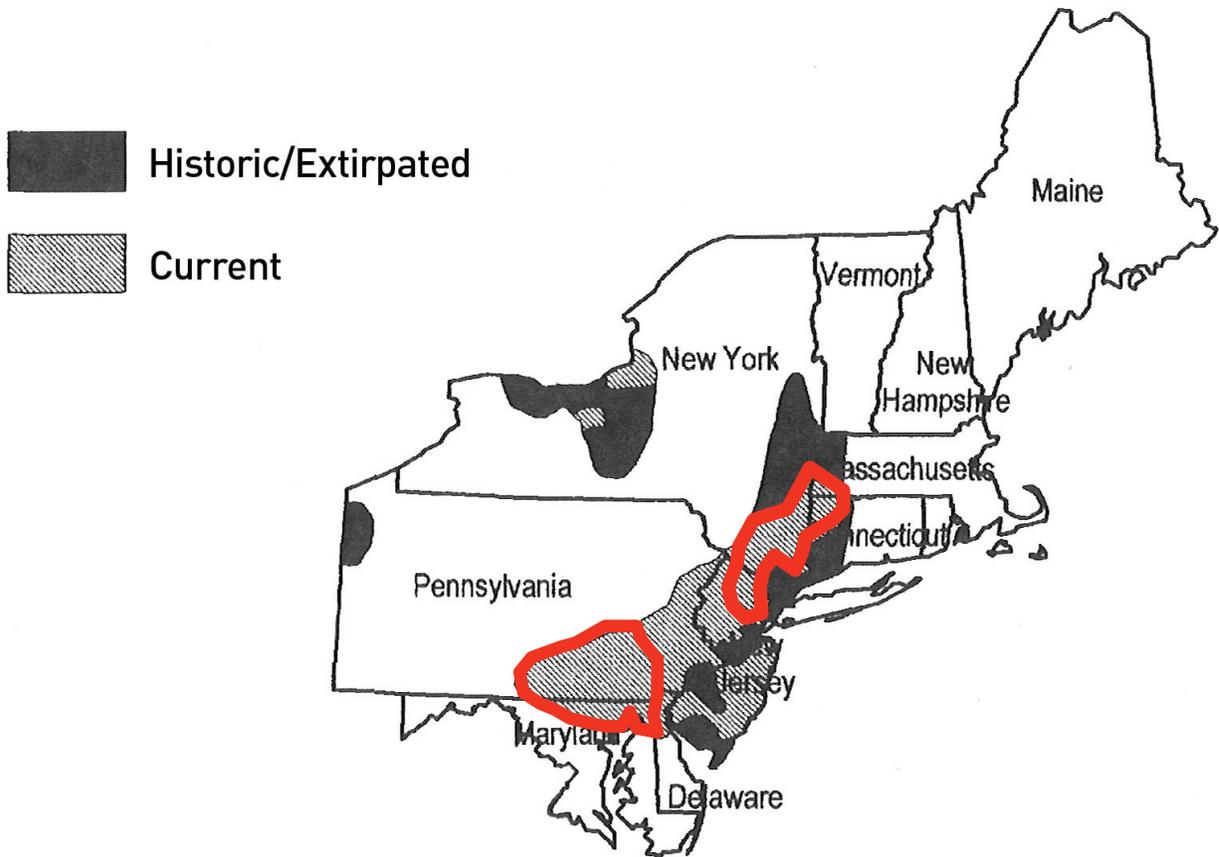
The major threats to the persistence of early successional habitat and bog turtle populations in its northern range (Figure 2) — New York/Massachusetts to Maryland — are:

- Loss of natural or agricultural disturbance processes which once created and maintained suitable wet meadow habitat, resulting in encroachment by trees and shrubs.
- Introduction and spread of exotic invasive plants that uptake excessive water and change habitat structure.
- Expanding land development and human disturbance that:
  - ◇ Affects aquatic habitat by increasing non-point source pollution and nutrient runoff, drawing down the water table, and altering surface and groundwater dynamics through diversions, wells, pipelines, impoundments, draining, and impervious surfaces;
  - ◇ Increases mortality from higher native and introduced predatory mammal populations, increased vehicle traffic and more frequent poaching for the illegal pet trade;
  - ◇ Destroys wetland habitat outright;
  - ◇ Spreads exotic weedy vegetation; and
  - ◇ Increases genetic isolation and risk of local extirpation of local turtle populations by creating barriers to turtle movements among wetlands.

# Range Map

---

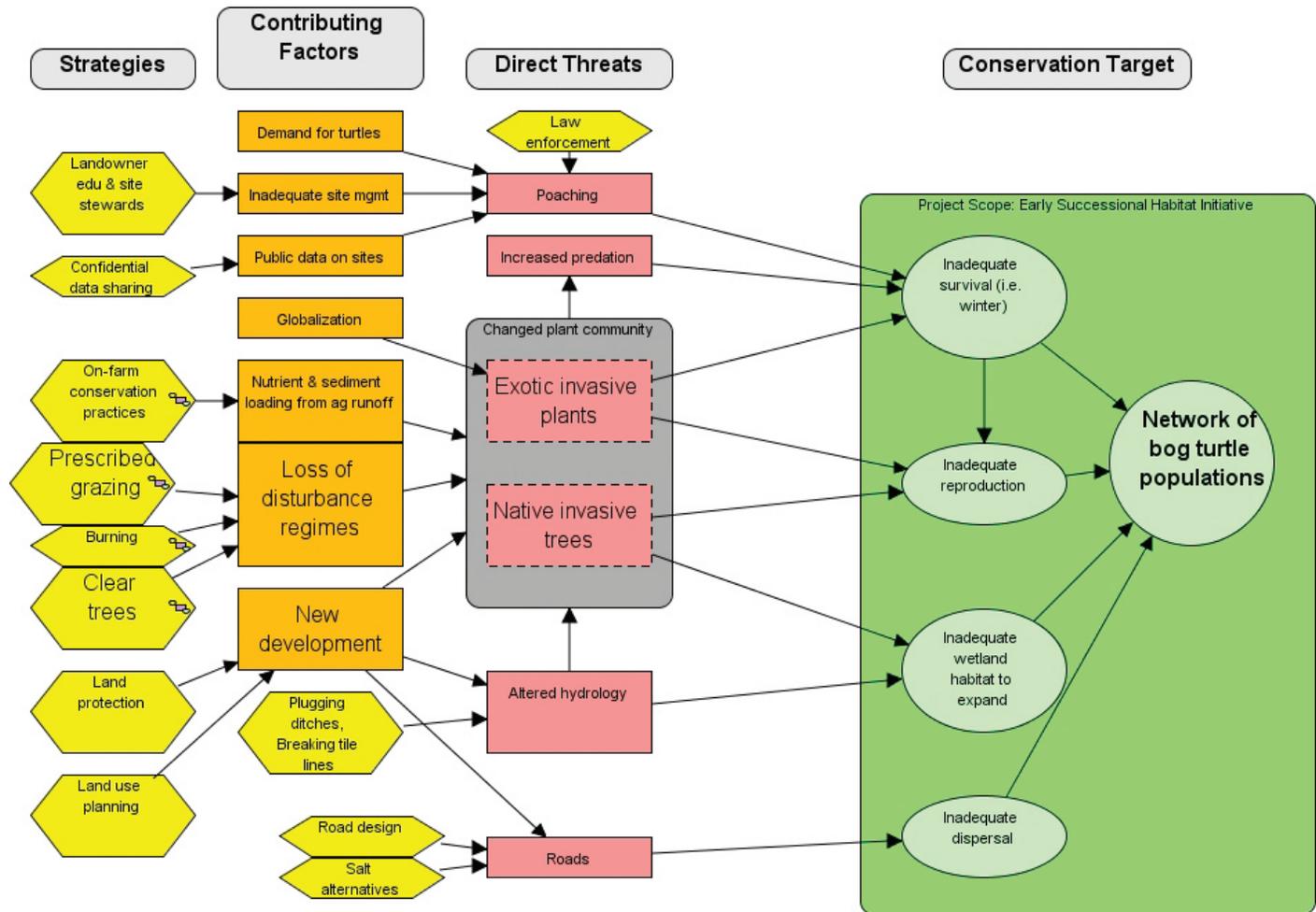
## Northeast Bog Turtle Range



**Figure 2.** Current and historic range of northern bog turtle population and illustration of Hudson/Housatonic and Susquehanna/Potomac Recovery Units (red) that are the priority of this plan.

# Logic Framework — Goals, Threats and Strategies

A logic framework (Figure 3) is a diagram of a set of relationships between certain factors believed to impact or lead to a conservation target (species representing Keystone Initiatives). Logic frameworks are typically composed of several chains of logic whose arrows are read as “if-then” statements to help better understand how threats contribute to conservation target declines. Logic frameworks are used to define the conservation problem, assess limiting factors, and prioritize key strategies.



**Figure 3.** Logic framework for bog turtle.

## Focus on Two Recovery Regions

---

After the bog turtle was designated as a federally protected species, the US Fish and Wildlife Service Recovery Plan developed for the northern population identified 5 separate geographic areas that had somewhat independent subpopulations of bog turtles and in which conservation goals must be achieved to secure the future of the turtle. The Foundation is interested in making investments in two of these regions — the Hudson/Housatonic recovery unit and the Susquehanna/Potomac recovery unit. Our decision on whether and how to invest in one or both of these Units will be based on the assessments provided by experts and that are described in detail in the sections of this plan that follow and the relative success of initial grants. Experts have developed goals, implementation plans and budgets for these recovery units. The Foundation will look to prioritize investments based on:

- The ability of experts to estimate the current status of turtle populations.
- The ability of experts to set explicit goals that will indicate that necessary conservation activities for specific populations are complete.
- The cost to achieve these goals in proportion to the contribution to recovery they provide.
- Partner's progress in implementing conservation actions and achieving interim goals.

# Conservation Outcomes

---

After the bog turtle was designated as a federally protected species, the US Fish and Wildlife Service Recovery Plan developed for the northern population identified 5 separate geographic areas that had somewhat independent subpopulations of bog turtles and in which conservation goals must be achieved to secure the future of the turtle. The Foundation is interested in making investments in two of these regions — the Hudson/Housatonic recovery unit and the Susquehanna/Potomac recovery unit.

In 1997, there were a total of 87 documented population analysis sites (PAS) reported in the USFWS Recovery Plan in Hudson/Housatonic recovery unit ("H/H"; New York, Massachusetts, New Jersey and Connecticut) and 92 in the Susquehanna/Potomac recovery unit ("S/P"; Pennsylvania and Maryland).

Population analysis sites are individual patches or wetland complexes that are thought to support turtle bog subpopulations, with likely dispersal of individual turtles among the wetland patches. Today, there are even fewer than reported in 1997 in the Hudson/Housatonic recovery unit, with an estimated 39 remaining in New York, 4 in Massachusetts, 5 in Connecticut and 20 in northern New Jersey. Such sites may be occupied by bog turtles, but many of these may not be viable in their present condition. This represents a 21 percent decline in the number of occupied population analysis sites. Many of these habitats are declining in quality and are isolated from other areas of wetland habitat or are otherwise in need of management. Remaining individuals at these sites may not be reproducing or may be highly vulnerable to depredation or other mortality factors.

According to the federal Recovery Plan for the bog turtle, the species will be considered "recovered" in each unit when 40 population analysis sites in H/H and 50 in S/P have all been afforded long-term protection status, secured from external threats (e.g. predation, poaching, habitat loss), and are determined to support stable or increasing subpopulations over a 25 year period.

Experts estimate that the best breeding habitat will support 10-40 bog turtles/acre when bog turtle populations are at their peak of above-ground activity. The average size of core habitat in the 87 occupied sites in the H/H Unit in 1997 was approximately 3 acres. Thus, the estimated population size in that unit at the time was probably less than 2,600 turtles and certainly less than 10,000 turtles. Past and ongoing investments in bog turtle conservation in this area have likely stabilized populations in approximately 11 population analysis sites in NY and 2 in MA. Many wetlands in both units are receiving little attention and we estimate that at least 25% percent of these sites will cease to support viable, reproducing bog turtle subpopulations in the next 10 years.

To achieve maximum cost-effective gain toward population recovery, we will focus conservation work on restoring, protecting, and monitoring a subset of at least half of the population analysis sites targeted in each recovery unit over the next ten years (20 for the Hudson/Housatonic, and 25 in Susquehanna/ Potomac). Assuming that turtle density in these sites is currently no more than half (5-20 turtles/acre) of density in the best breeding habitat, the goal of this plan is a long-term increase in turtle population size for these sites from 675-2,700 turtles to 1,350-5,400 turtles after 25 years.

Today, we are about a third of the way toward achieving all recovery goals for the bog turtle throughout these two recovery units. We believe that success in implementing this plan will result in completion of approximately two thirds of total conservation needs for the bog turtle in these recovery units, although formal indication of progress is dependent on USFWS status review.

## Additional Goals

The following Recovery Region-specific goals are also important to this initiative, as is the establishment of a database of bog turtle restoration sites and ecological conditions in core habitat and buffer zones.

**Hudson/Housatonic Recovery Unit:** A collaborative planning meeting was hosted in Albany, NY in February 2009 to discuss recovery goals and conservation priorities for this unit. As a product of that meeting, data sheets have been compiled for New York sites based on best expert knowledge of bog turtle PAS's (Appendix A). This process generated useful background information for prioritizing H/H sites based on restoration potential and current protection status, and helped with generating cost estimates.

- ◇ *New York/Massachusetts/Connecticut goals:* Ensure that bog turtles persist in approximately 30 wetland sites that comprise an estimated 15 reproducing subpopulations.
- ◇ *New Jersey goals:* Ensure that bog turtles persist in 10 suitable wetland sites that comprise an estimated 5 reproducing subpopulations.

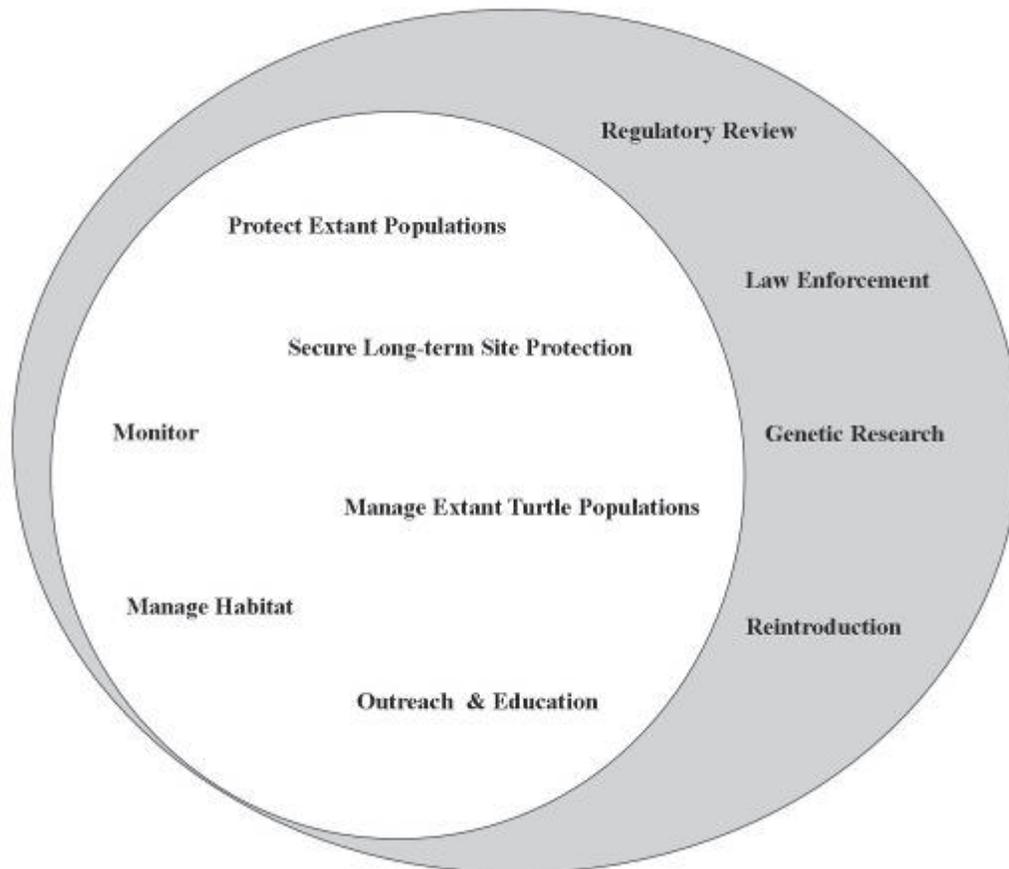
**Susquehanna/Potomac Recovery Unit:** A similar collaborative planning meeting is yet to be held for this recovery unit, but strong partnerships already exist among state and federal agencies and conservation NGO's working toward bog turtle conservation in this recovery unit and restoration work is underway in both states, with financial and in-kind support from NFWF, NRCS, and USFWS.

- ◇ *Pennsylvania/Maryland goals:* Ensure that bog turtles persist on 50 sites in 25 reproducing subpopulations.

# Implementation Plan

---

The following strategies describe the threats that bog turtle and early successional habitat face in Hudson/Housatonic and Susquehanna/Potomac recovery units. This section also describes the activities that are important to address these threats and secure viable populations of the species. The strategies and outputs described are intended to take place over 10 years. Although additional threats affect the bog turtle, the group of experts who helped develop this plan prioritized threats and the emphasis of this plan is on the highest priority threats. In each state, we will support the establishment of Cooperative Conservation Partnerships through which these activities will be carried out.



**Figure 4.** Tasks outlined by USFWS for recovery of bog turtle northern population. Tasks highlighted in the smaller circle represent a subset of activities that would be most effectively addressed with NFWF financial support. Each recovery unit may require its own unique prioritization of tasks as more information becomes available and landscape conditions change over time.

## ADDRESSING THREAT 1 — Low reproductive success

Bog turtles are disappearing from early successional habitat wetlands because wetlands fill in with native shade trees and non-native invasive plants that eliminate sunny breeding locations, such as sedge tussocks the turtles prefer as nest sites. As trees and shrubs encroach upon and shade wet meadows, sunny locations disappear, turtle eggs no longer receive enough heat to allow embryos to mature, and reproductive rates slow. Taller vegetation that creates more ground shading and reduces ground vegetation that turtles depend upon likely also can affect food resources for hatchling and adult turtles. In some places, hydrology has been altered so as to dramatically change wetland

characteristics by diverting or impounding surface waters or disrupting subsurface water flow. Alien invasive plants uptake substantial amounts of water, converting wetlands to dry lands. At sites with declining habitat conditions and/or impaired water quality/quantity, aging adult turtles may still be present, but with low reproductive success and little recruitment of younger generations.

Natural and anthropogenic factors once maintained many of these wetlands in an early successional state with appropriate hydrologic conditions. Beaver activity, fire, grazing by native ungulates, grazing by livestock, agriculture and logging have all helped keep these wetlands open and dominated by herbaceous and shrubby vegetation through past decades and centuries. Conversion to livestock agriculture, followed by its decline throughout much of the region has largely eliminated grazing that helped maintain many of these wetlands. Also, dynamic, meandering stream systems and unpaved, permeable upland soils allow for the frequent creation and recharge of wetland zones suitable for bog turtles, but these processes have been disrupted in many places throughout the northeastern range.

### *Strategy 1. Habitat restoration and creation*

Habitat restoration and creation within designated habitat units is the fundamental activity that will allow bog turtle populations to increase and successful reproduction to occur. This strategy addresses USFWS Recovery Tasks 3, 6, 7, and 9 to monitor bog turtle populations and threats, manage bog turtle habitat, manage extant bog turtle populations, and conduct education and outreach to landowners in bog turtle watersheds.

USDA's Natural Resources Conservation Service is likely to be able to support a significant portion of restoration costs over 10 years, with an additional in-kind contribution of labor, equipment and materials from USFWS Partners for Fish and Wildlife program. The Foundation may provide non-federal match to some of these projects and will explicitly seek habitat restoration projects that offer the lowest per dollar total restoration cost for the greatest potential gain for bog turtle populations.

- **Activity 1: Restore at least 200 acres of degraded wetland in at least 40 sites**  
**\$850,000**

At least 200 acres of habitat need to be restored in areas where degraded habitat still exists. Restoration work on about 20 sites is already underway but not yet complete. We estimate that habitat restoration costs based on 2008 costs may range from \$1,000/acre for light brush or herbaceous plant control to \$5,000/acre or more if extensive mechanical and chemical control of trees or dense invasive vegetation is needed over a several acre area. Prescribed grazing projects typically require \$10,000/acre to establish, for fencing materials and labor. Restoration of hydrology and flows by removing tile drains and other obstructions and diversions may add cost to restoration projects, but may be necessary in some sites. At all priority sites, it will be necessary to identify and seek to correct pollution and nutrient runoff issues.

- **Activity 2: Maintain 250 acres of current and restored habitat**  
**\$250,000**

Approximately 250 acres of habitat will require follow-up maintenance on an annual or less frequent basis. Maintenance done through prescribed grazing is expected to cost up to \$2,000/site annually. Other mechanical or chemical treatments may cost \$ 500 /acre to \$2,500/acre for follow-up maintenance.

- **Activity 3: Enroll landowners in conservation incentive programs**  
**\$350,000**

Incentive payments additional to what is available through NRCS programs may be necessary for private landowner participation in voluntary cooperative stewardship programs, providing extra cash payments to landowners who enroll their lands in a bog turtle conservation program. While we will strive to minimize these costs, they could be necessary to conserve some sites with prime habitat or high restoration potential. We estimate \$2,000 per acre for additional incentive payments.

- **Activity 4: Protect nests from predators.**  
**\$350,000**

Crows and jays and raccoons, skunks and other small mammalian predators often occur at high densities in areas inhabited by bog turtles, especially in areas near existing housing and other development. High predation may forestall any response by bog turtles to habitat restoration from occurring. Thus, in many areas it will be advantageous to allocate resources to search for turtle nests and, if predation is determined to be a problem, erect enclosure fencing around nesting areas or predator enclosure cages around nests especially in the smallest and therefore most vulnerable populations. Outreach to landowners in bog turtle watersheds about predator management would be a cost-effective preventative measure.

*Strategy 2. Ensure long-term persistence of bog turtle habitat*

For USFWS to declare this species “recovered,” it must be afforded long-term protection through permanent protection of a subset of sites, referred to as “population analysis sites” (PAS), where turtle subpopulations are “secured from external threats” and deemed viable (stable or increasing) over a 25 year period. Such long-term protection can include a combination of voluntary landowner management agreements, conservation easements and/or acquisition. We will prioritize work on sites where some form of protection has been initiated, either restoration or formal protection status, efforts which can be supplemented by NFWF funds, with the goal of moving each site closer to long-term protection status and thus triggering the 25 year USFWS recovery monitoring period for each site. This strategy addresses Recovery Plan Task 2: Secure long-term site protection.

- **Activity 1: Ensure long-term management will occur in targeted wetlands**  
**\$250,000**

Such activities may require establishing voluntary cooperative stewardship agreements, conservation easements, and where necessary, acquisition. Restoration plans should examine a variety of management options, including prescribed grazing, fencing, burning, cutting, biological control, and/or hydrologic restoration.

- **Activity 2: Establish site-specific buffer zones around occupied bog turtle sites – develop buffer zone management plans, monitor and manage threats in these zones**  
**\$250,000**

Buffer zones should encompass groundwater recharge zones, streams, wetlands, and surrounding terrestrial upland landscapes and need management plans that describe how threats will be monitored and managed within these zones. The bulk of these resources are for actual management efforts.

- **Activity 3: Restore local hydrology**  
**\$150,000**

Healthy functional wetlands depend upon surface and groundwater dynamics. In some locations, agriculture, transportation, or development projects have resulted in water diversion, inundation, impoundment, or water quality impairment. Opportunities to restore hydrologic function or avert disruption should be sought throughout bog turtle watersheds.

## ADDRESSING THREAT 2 — Future threat from development

Bog turtles live in areas that have recently undergone rapid development. Housing construction and roads have eliminated wetland habitat and fragmented and degraded remaining areas. Efforts to protect land through acquisition, easement, zoning or long-term voluntary agreements will be needed to prevent continued deterioration of many bog turtle wetlands. However, these actions are likely to

be incredibly expensive and so strategies to address this threat have the most risk of creating unsustainable costs for bog turtle recovery efforts. Thus, it is essential to narrow, as precisely as possible, the land protection costs to the minimum that is necessary to allow the bog turtle to recover.

### *Strategy 1. Maximize protection from existing regulations*

Although some bog turtle wetlands are protected under the federal Clean Water Act others are not. State statutes or regulation provide additional protection for many of the same sites as well as sites not protected by the Clean Water Act. However, impacts from development in uplands or areas where water recharges into spring wetlands may provide the most widespread threat to bog turtles because they affect the water quality, temperature and flow regime upon which the turtles' wetlands depend and wetlands are afforded relatively little protection from this threat.

- **Activity 1: Evaluate state/local regulatory protection for each wetland targeted**  
**\$66,600**

Maryland, Pennsylvania, New Jersey and New York have designated many bog turtle wetlands on public or private lands as special resources. An analysis is needed to determine the extent to which these protections prevent future impacts to core habitat and buffer habitat.

- **Activity 2: Designate additional wetlands as wetlands of special significance**  
**\$266,000**

In all cases where it is possible to do so, efforts should be made to extend special protections provided under state law for wetlands inhabited by endangered species to bog turtle wetlands that have not yet been designated.

- **Activity 3: Seek USFWS Region 5 solicitor guidance on value of state law protections**  
**\$66,600**

Formal guidance should be secured from regional legal staff who represent the U.S. Fish and Wildlife Service as to whether varying protection afforded under state and local law throughout these recovery areas is sufficient to meet the protection goal established in the recovery plan.

### *Strategy 2. Land acquisition and easements*

Identify the best areas to support and protect viable populations and manage units in which habitat will be continuously maintained over time, seeking permanent protection through easements or acquisition. This Strategy addresses Recovery Plan Task 2: Secure long-term site protection.

- **Activity 1: Map and prioritize value of land for bog turtles**  
**\$350,000**

Analysis needs to be completed so that the value of properties for bog turtle conservation can be prioritized based on ecological priorities. This work is needed in New York and New Jersey but is less critical in Massachusetts and Connecticut because of the much smaller number of turtle populations in those states. Many bog turtle sites in Pennsylvania are owned by Amish farmers, and are thereby afforded a higher than typical level of long-term stewardship, as long as these cultural values remain in place. Ecological priorities and real estate values for non-Amish farms and current levels of conservation protection need to be systematically assessed in the S/P recovery unit.

- **Activity 2: Develop land protection strategy that minimizes cost**  
**\$250,000**

Land is very expensive in this region of Hudson/Housatonic recovery unit, ranging in price from \$4,000 to \$80,000 per acre (or greater). Wherever possible, we will seek to secure long-term protection through conservation easements and long-term management agreements as an alternative to acquisition on at least two-thirds on the sites in this unit. We propose targeting protection of

25 acres at each site through an NRCS easement, the payment rates for which will be increasing considerably in the near future for this region. Assuming that we may still need an additional \$2,000/acre incentive payment to supplement the NRCS offer, we propose contracting with a real estate expert to promote the package to landowners. One-third of the sites may require acquisition of the core wetland habitat and buffer zone, if landowners are not interested in the easement option. Under this scenario, the total for land protection payments, in addition to regular NRCS easement payments, would be close to \$3.4 million over 10 years.

An analysis is needed that combines the earlier analyses of biological value of properties for bog turtle conservation with an analysis that estimates land protection costs; the intent of the analysis should be to prioritize areas for bog turtle conservation that seeks to minimize land costs. Without doing so, land protection costs are likely to far exceed the budget available for the species.

- **Activity 3: Acquire and secure easements or other protections on land**  
**\$3,450,000**

Acquisition and easement must always move forward on an opportunistic basis as willing sellers make properties available. However, once investments have been initiated in a habitat block, subsequent investments should be focused on securing remaining land protection in this block that comprises a population analysis site, until completed.

*Strategy 3. Early project review in bog turtle watersheds*

- **Activity 4: Conduct early screening of municipal-level projects**  
**\$450,000**

Participate in early screening of municipal-level and state transportation projects in bog turtle watersheds. Identify potential bog turtle threats in the early phases of local project planning; alert planners to bog turtle habitat considerations; press for independent hydrologic review and negotiate establishment of bog turtle buffer zones; alert agencies to pending local projects that might require review in earliest stages; collaborate with transportation departments to direct mitigation funds to beneficial bog turtle projects such as wetland enhancement, acquisition, culverts, stormwater remediation. This strategy relates to Recovery Plan Task 1: Protect known extant populations and habitats using existing regulations.

## ADDRESSING THREAT 3 — Degraded hydrology

*Strategy 1. Protect and restore hydrologic dynamics*

NFWF funding would ideally support proactive activities such as seeking opportunities for local or watershed level repairs outside of currently occupied sites and reviewing hydrologic analyses of projects planned in bog turtle landscapes and assisting in directing transportation and stormwater mitigation funds to projects that benefit priority bog turtle habitat. This strategy applies most directly to Recovery Tasks 1, 6 and 9: Project review, manage bog turtle habitat and outreach and education to watershed stewards.

- **Activity 1: Establish landscape coordinators to identify restoration opportunities**  
**\$450,000**

- **Activity 2 Direct transportation and other mitigation funds to hydrology restoration opportunities for bog turtles**  
**\$750,000**

Landscape coordinators will collaborate with local watershed associations, land trusts, and transportation agencies on activities 1 and 2 to identify opportunities for hydrologic improvements and vegetation management. These coordinators will also participate in early municipal-level project review to prevent local ground or surface water impacts to bog turtle sites and sound early alerts to state

agencies where local projects may have bog turtle impacts or require additional hydrologic analyses. Monitor activities in upland buffer zones and wetland recharge zones that will affect water quality and quantity, and develop threat abatement strategies. Coordinate GIS mapping of hydrologic recharge zones of bog turtle habitats.

## ADDRESSING THREAT 4 — Inadequate wetland connectivity

*Strategy 1. Develop site level corridor management plans to connect wetland sites locally*

- **Activity 1: Map contiguous habitat and potential dispersal barriers.**  
**\$250,000**
- **Activity 2: Seek opportunities for reducing dispersal barriers**  
**\$275,000**

Identify practical opportunities (e.g. installing culverts or restoring habitat between wetland patches) to establish habitat connectivity between wetland bog turtle sites, in partnership with local NGO's and state agencies. Work with DOTs to evaluate quality of transportation mitigation projects and direct mitigation and surface transportation funds toward installing culverts or other types of turtle habitat corridors to reduce dispersal barriers and mortality risks. This strategy addresses Recovery Plan Task 6: Manage and maintain bog turtle habitat.

# Funding Needs

Success in achieving the goals of this business plan depends upon the Foundation raising and dedicating at least \$5.3 million over 10 years on the strategies described herein. It also depends upon government and non-government agencies and organizations providing an additional \$9.2 million over 10 years. USDA's Natural Resources Conservation Service is likely to make a major contribution to this effort of approximately \$1.0 to \$1.5 million. Other partners who are already committed to making investments to bog turtle conservation include the U.S. Fish and Wildlife Service, Environmental Defense Fund, Doris Duke Charitable Foundation, and Sand County Foundation.

**Table 1.** Cost estimates for first 10 years of bog turtle conservation in two recovery units. These are estimated costs for achieving recovery status at half of the target levels in the USFWS recovery plan for bog turtle northern populations.

Threat	Strategy	Activity	Estimated Costs		
			Y1-Y5	Y6-Y10	Total
Low reproductive success	Habitat restoration and creation	Restore 200 acres of degraded habitat on 40 sites in each RA	\$825,000	\$825,000	\$1,650,000
		Maintain 250 acres of current and restored habitat in each RA	\$250,000	\$250,000	\$500,000
		Enroll landowners in conservation incentive programs	\$175,000	\$175,000	\$350,000
		Protect nests from predators	\$75,000	\$75,000	\$150,000
	Ensure long-term persistence of bog turtle habitat	Ensure long-term vegetation management in targeted wetlands	\$125,000	\$125,000	\$250,000
		Establish and manage buffer zones	\$187,500	\$62,500	\$250,000
		Restore local hydrology	\$75,000	\$75,000	\$150,000
Future development	Maximize protection from existing regulations	Evaluate state and local regulations for targeted wetlands	\$66,600	\$0	\$66,600
		Designate additional wetlands of special significance	\$66,600	\$0	\$266,600
		Seek USFWS Solicitor guidance on state law protections	\$66,600	\$0	\$66,600
	Land acquisition and easements	Map and prioritize land according to bog turtle habitat value	\$262,500	\$87,500	\$350,000
		Develop cost-minimizing land protection strategy	\$187,500	\$62,500	\$250,000
		Acquire or secure easements or other protections	\$1,725,000	\$1,725,000	\$3,450,000
	Early project review	Screen municipal level projects	?	?	?
Degraded hydrology	Protect and restore hydrology	Establish landscape coordinators to identify opportunities	\$125,000	\$125,000	\$250,000
		Direct transportation and other mitigation funds to hydrologic restoration	\$175,000	\$175,000	\$350,000

Threat	Strategy	Activity	Estimated Costs		
			Y1-Y5	Y6-Y10	Total
Inadequate wetland connectivity	Develop site level corridor management plans	Map contiguous habitat and dispersal barriers	\$125,000	\$125,000	\$250,000
		Seek opportunities to remove barriers through mitigation projects	\$137,500	\$137,500	\$275,000
Monitoring and evaluation			550,000	\$550,000	\$550,000
			<b>Total</b>		<b>\$9,974,800</b>

# Evaluating Success

---

All conservation investments are made with a desire to have something change. Monitoring tells us whether that change is occurring. Evaluation tells us whether the combined set of investments being made are being designed and implemented to maximize that change.

The Foundation will work with outside experts to prioritize proposals based on how well they fit in with the results chains and priorities identified in this plan. Success of funded projects will be evaluated based upon success in implementing proposed activities and achieving anticipated outcomes. As part of each project's annual (for multi-year awards) and final reports, individual grantees will provide a summary of completed activities and key outcomes directly to NFWF. These would likely include outcome metrics identified at the initiative scale.

Periodic expert evaluation of all investments funded under this initiative will occur and will help grantees to monitor key indicators to ensure that data across individual projects can be scaled up to programmatic and initiative levels. Findings from monitoring and evaluation activities will be used to continuously learn from our grantmaking and inform future decision-making to ensure initiative success.

Table 2 presents metrics for evaluating success of bog turtle recovery strategies presented in this plan. In particular, the following targets are important indicators of progress in achieving these goals:

- Restore and manage suitable early successional wetland habitat of at least 1-5 acres.
- Protect and ensure compatible management of nesting habitat and hibernacula and adjacent uplands at each site. Adjacent lands can help buffer core wetland habitat, protect groundwater recharge, and provide over-wintering sites for bog turtles. Tools include NRCS and other conservation easements, public or NGO ownership, and long-term management agreements.
- Document successful reproduction and recruitment in a subsample of wetland sites to ensure that recovery goals are likely to be met for long-term protection and population stability.
- Monitor threats in core habitat, upland buffer zone, and groundwater recharge zone; including early project review at the municipal level. Specific threats to be monitored include development, ground and surface water impacts, and predation risks.
- Identify and maintain connecting habitat that is suitable for turtle dispersal among within wetland complexes.

**Table 2.** Possible indicators to measure success of bog turtle conservation strategies.

<b>Strategy</b>	<b>Possible Indicators</b>
Habitat restoration and creation	Invasive vegetation percent cover Presence/absence/density of tussock sedge Bog turtle reproduction: hatching rates; nest density; nest predation rates; recruitment; adult:juvenile ratio; hatchling sex ratio Bog turtle survival: Adult population size; mark-recapture surveys Bog turtle presence/absence, abundance
Hydrologic function	Perennial flow of surface water Water temperature, depth Sediment deposition Removal of tile drains, small dams, etc. Culverts installed Acres of wetland restored
Compatible buffer management	Percent of necessary buffer acreage in which threats are absent or managed
Long-term habitat maintenance	Invasive vegetation percent cover Acreage of open wetland habitat, native herbaceous vegetation N sites under multi-year management agreements
Regulatory protections	Percent of wetlands afforded special state protection Number of consultations annually Compatible use buffer zone acreage protected Number of projects reviewed early
Easements/acquisitions	Acres protected

# Long-Term Foundation Support

---

This business plan lays out a strategy to achieve clear outcomes that benefit wildlife over a 10-year period. At that time, it is expected that the conservation actions partners have taken will have brought about new institutional and societal standards and environmental changes that will have set the population in a positive direction such that maintaining those successes or continuing them will be possible with reduced NFWF funding after ten years. To help ensure that the population and other gains made in 10 years won't be lost after the reduction of NFWF funding, the partnership must seek development of solutions that are long-lasting, cost-effective, and can be maintained at lower levels of funding in the future. Therefore, part of the evaluations of this initiative will address that staying power and the likelihood that successful strategies will remain successful at lower management intensity and financial investment.

The adaptive nature of this initiative will also allow NFWF and partners to regularly evaluate the strategies behind our objectives, make necessary course corrections or addition within the 10 year frame of this business plan. In some cases these corrections and additions may warrant increased investment by NFWF and other partners. However, it is also possible that NFWF would reduce or eliminate support for this initiative if periodic evaluation indicates that further investments are unlikely to be productive in the context of the intended outcomes.

## Ancillary Benefits

---

This initiative will have a measurable benefit for a host of other imperiled species which all are to some degree dependent on early successional habitat. We do not plan to monitor progress in achieving benefits for these species, but will seek to monitor increase in overall native biodiversity. The majority of these species have only a small total habitat overlap with the bog turtle so our ability to create significant benefits for the global range of each species is limited. However, to the extent that healthy, vegetated wetlands produce abundant insects, these habitats should become valuable food sources and foraging areas for insectivorous bird species, as are most, if not all, Neotropical migrant songbirds.

Other species expected to directly benefit from management of early successional bog turtle habitat include American Woodcock (*Scolopax minor*), Bobolink (*Dolichonyx oryzivorus*), Common Yellowthroat (*Geothlypis trichas*), Golden-winged Warbler (*Vermivora chrysoptera*), Eastern Towhee (*Pipilo erythrophthalmus*), Prairie Warbler (*Dendroica discolor*), Ruby-throated Hummingbird (*Archilochus colubris*), Baltimore checkerspot butterfly (*Euphydryas phaeton*), showy lady's slipper (*Cypripedium reginae*), and dragon's mouth orchid (*Arethusa bulbosa*).

# Glossary

---

The following definitions are intended to clarify terms used in this business plan pertaining to bog turtle ecology and recovery efforts (Figure 5).

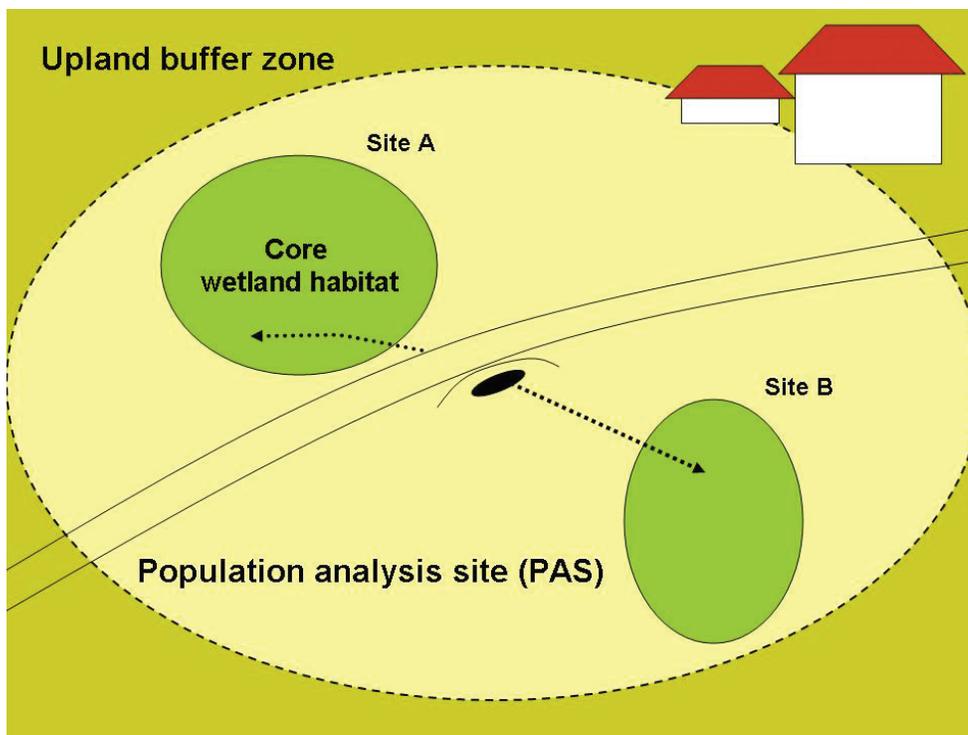
**Site** — Any wetland habitat patch in which bog turtles are known or thought to occur, the smallest unit of habitat management in this plan.

**Population analysis site (PAS)** — As described in the USFWS recovery plan for bog turtle northern population, a wetland site or complex of sites where bog turtles have been documented during breeding season and among which it is thought that individual turtles may disperse; may be subject to multiple ownership. This is the smallest biologically meaningful population unit in this discussion. USFWS recovery goals for this species are based on target numbers of population analysis sites.

**Core wetland habitat** — An area of primary usage for bog turtle life processes, especially breeding and hibernation.

**Buffer zone** — Designated area around core habitat managed to protect habitat conditions for the bog turtle. This zone is some portion of the entire landscape of influence around core habitat, including terrestrial upland or adjacent wetland and habitat corridors that may be used for dispersal, the water table and surface water flows that recharge the wetland.

**Bog turtle watershed** — Any watershed within which bog turtles are known to occur.



**Figure 5.** Features of a bog turtle watershed include multiple scattered wetland patches that may be under different ownership and managed as individual “sites.” In some cases, disperse among these sites within a larger “population analysis site (PAS).” Activities in the upland “buffer zone” can affect habitat quality and quantity in the “core” wetland habitat, areas of primary habitat use where turtles nest and hibernate.

## Appendix A. Sample tracking sheets to monitor progress

---

The following is a sample of data sheets that summarize what is currently known about existing bog turtle sites in the Hudson/Housatonic recovery unit, as well as 10-year restoration goals and cost estimates based on 2008 costs. The "goals" page indicates current and desired habitat conditions, population demographics, and landscape context, using a green to red color gradient to indicate habitat quality (dark green = very good, light green = good, yellow = moderate, red = poor), based on a combination of TNC's viability assessment ranking system and expert opinion expressed by ecologists familiar with the sites. The "budget and tracking results" page displays annual estimates for the progress and expenses that are expected to achieve desired conditions at each site, within ten years. In some instances, information was lacking or inaccessible/confidential. Sites with enough known information were given importance rankings of Tier 1, 2, or 3, corresponding to the following criteria: Tier 1 includes sites with >20 adults captured and multiple age classes present, or sites within a PAS with another Tier 1 site; Tier 2 includes sites with 10-20 turtles likely present and recruitment documented or suspected; and Tier 3 includes sites that likely support <10 turtles. Sites with inadequate information to assign a ranking were placed into "Tier ?" until an appropriate ranking can be determined. Future NFWF funding will support development of a centralized database that can be updated as such information is collected and projections change.

## GOALS – Example Tier 1 site

This fen supports a large, viable bog turtle population. Nesting habitat is adequate. It is connected to 2 other known bog turtle sites. The surrounding landscape context is undeveloped but a portion of the land is in agricultural use and contributes substantial runoff into the fen. Resources are required to continue habitat restoration and management (livestock grazing) and address agricultural runoff.

### Habitat Conditions

	Current Quantity	Desired Quantity	Current Rating	Desired Rating
Core fen w/appropriate hydrology (acres)	>2	>2	Green	Green
Acres of suitable nesting habitat	>0.25 acre	>0.25 acre	Light Green	Light Green
N known suitable overwintering sites	>3	>3	Green	Green

### Population Size and Demographics

	Current Quantity	Desired Quantity	Current Rating	Desired Rating
Age class distribution	Adults and 3 juvenile age classes	Adults and 2 or more age classes of juveniles	Green	Green
Number of adult turtles	Between 40-50 adults	40-50	Light Green	Light Green

### Landscape Context

	Current Quantity	Desired Quantity	Current Rating	Desired Rating
Connectivity – Number of needed connections within population	1	1	Green	Green
Buffer – % natural cover within 165m buffer of wetland complex	76.8%	80-100%	Light Green	Green
*Proposed new criteria – Number of threats in buffer that are clearly threatening bog turtle habitat	1 (ag field)	0	Light Green	Green

## BUDGET AND TRACKING RESULTS – Example Tier 1 site

### Habitat Conditions

	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
Core fen w/appropriate hydrology (acres)	>2	>2	>2	>2	>2	>2	>2	>2	>2	>2
Acres of suitable nesting habitat	>0.25	>0.25	>0.25	>0.25	>0.25	>0.25	>0.25	>0.25	>0.25	>0.25
N known suitable overwintering sites	>3	>3	>3	>3	>3	>3	>3	>3	>3	>3
Cost to Achieve Desired Habitat (\$K)	0	0	0	0	0	0	0	0	0	0
Cost to Maintain Conditions (\$K)	0	4.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7

### Population Size and Demographics

	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
Age class distribution										
N adult turtles	40-50	40-50	40-50	40-50	40-50	40-50	40-50	40-50	40-50	40-50

### Landscape Context

	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
Connectivity – N needed connections within population	1	1	1	1	1	1	1	1	1	1
Buffer – % natural cover within buffer	76.8%	76.8 %	76.8 %	80-100%	80-100%	80-100%	80-100%	80-100%	80-100%	80-100%
*Proposed criteria – N threats in buffer	1	1	1	0	0	0	0	0	0	0
Buffer management cost (\$K)	0	1.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Land protection – 25 acres of site and adjacent lands (\$K)	0	0	87	0	0	0	0	0	0	0

## GOALS – Example Tier 3 site

---

### Habitat Conditions

	Current Quantity	Desired Quantity	Current Rating	Desired Rating
Core fen w/appropriate hydrology (acres)	<1	2		
Acres of suitable nesting habitat	<0.25 acre	>0.25 acre		
N known suitable overwintering sites	>3	>3		

### Population Size and Demographics

	Current Quantity	Desired Quantity	Current Rating	Desired Rating
Age class distribution	Only adults present	Adults and 2 or more age classes of juveniles		
Number of adult turtles	1	10-13		

### Landscape Context

	Current Quantity	Desired Quantity	Current Rating	Desired Rating
Connectivity – Number of needed connections within population	0	0		
Buffer – % natural cover within 165m buffer of wetland complex	81.7%	81.7%		
*Proposed new criteria – Number of threats in buffer that are clearly threatening bog turtle habitat	0	0		

## BUDGET AND TRACKING RESULTS – Example Tier 3 site

### Habitat Conditions

	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
Core fen w/appropriate hydrology (acres)	<1	<1	<1	<1	<1	2	2	2	2	2
Acres of suitable nesting habitat	<0.25	<0.25	<0.25	<0.25	<0.25	>0.25	>0.25	>0.25	>0.25	>0.25
N known suitable overwintering sites	>3	>3	>3	>3	>3	>3	>3	>3	>3	>3
Cost to Achieve Desired Habitat (\$K)	0	0	15	10	10	10	10	0	0	0
Cost to Maintain Conditions (\$K)	0	0	0	0	0	0	0	0	2.5	2.5

### Population Size and Demographics

	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
Age class distribution										
N adult turtles	1	1	1	1	1	5	5	5	5	10-13

### Landscape Context

	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17
Connectivity – N needed connections within population	0	0	0	0	0	0	0	0	0	0
Buffer – % natural cover within buffer	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7
*Proposed criteria – N threats in buffer	0	0	0	0	0	0	0	0	0	0
Buffer management cost (\$K)	0	0	0	0	0	0	0	0	0	0
Land protection – 25 acres of site and adjacent lands (\$K)	0	0	0	0	0	0	0	0	87	0

# Acknowledgements

---

Mark Hudy, Forest Service  
Elizabeth Macklin, Trout Unlimited  
Kathy Wolf, Trout Unlimited

**About NFWF** — The National Fish and Wildlife Foundation is a 501(c)(3) organization dedicated to funding sustainable conservation initiatives. Chartered by the United States Congress in 1984, NFWF leverages federal grants and private support to achieve maximum conservation impact. Recently, the Foundation — through its Keystone Initiatives — strategically repositioned itself to more effectively capture conservation gains by directing a substantial portion of its investments towards programs that had the greatest chance of successfully securing the long-term future of imperiled species. By leveraging innovative program design from scientific experts, the Foundation is able to structure conservation programs that consistently achieve measurable and meaningful outcomes. [[www.nfwf.org](http://www.nfwf.org)]



**Cover photo credits** (*clockwise from top right*): Bill Smejkal, Jason Tesauro, Conserve Wildlife Foundation, New Jersey

