

**A Species Action Plan for the
Pine Barrens Treefrog
*Hyla andersonii***

**Final Draft
November 1, 2013**



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EXECUTIVE SUMMARY

The Pine Barrens treefrog (*Hyla andersonii*) is comprised of 3 disjunct populations in the eastern United States: 1) New Jersey, 2) southeastern North Carolina and north-central South Carolina, and 3) northwestern Florida and southern Alabama. In Florida, this species inhabits acidic shrub and herb seepage bogs, and has been recorded at over 200 sites in Santa Rosa, Okaloosa, Walton, and Holmes counties. Although treefrog populations have presumably declined due to fire exclusion and conversion of bogs into pastures and real estate developments, the majority of known occurrences are in areas where human development is limited. While the treefrog was initially listed as a State-designated Species of Special Concern in Florida because it was thought to have a limited range, additional survey work resulted in the discovery of several additional treefrog sites, and thus it is more widespread in Florida than previously thought.

Based on information received from the public, biological review group findings, and peer-review input, the Florida Fish and Wildlife Conservation Commission recommended that the Pine Barrens treefrog not be listed as a Threatened species, and that it be removed from the Species of Special Concern list.

To ensure that the conservation status of the Pine Barrens treefrog remains the same or is improved as to not warrant listing on Florida's Endangered and Threatened Species List, 4 objectives are proposed: 1) maintain or enhance habitat quality of $\geq 50\%$ of sites within $\geq 70\%$ of locations that currently support the treefrog, 2) monitor sites where the treefrog has been documented, 3) protect the treefrog from unsustainable collection and sale, and 4) promote education and outreach among stakeholder groups. These objectives will be achieved by the following actions:

- Conduct prescribed burns at sites where the treefrog occurs.
- Eliminate or reduce invasive vegetation and control feral hogs from $\geq 50\%$ of sites within $\geq 70\%$ of locations that currently support the treefrog.
- Identify and mitigate factors impacting hydrology at sites occupied by the treefrog through coordination with National Resource Conservation Service, Eglin Air Force Base, Blackwater River State Forest, and private landowners.
- Conduct call surveys for treefrogs from April through July every 3 to 5 years at a subset of historic sites.
- Document occurrence of the treefrog at potential sites as time and resources permit (this action may be incidental to conducting other activities).
- Use geospatial technologies to improve management decisions by producing landscape level models of treefrog habitat.
- Limit collection of the treefrog to prevent overexploitation.
- Manage or improve treefrog habitat on private lands by providing technical assistance and utilizing incentive and conservation easement programs.
- Educate law enforcement and the public on the identification, distribution, biology, and threats to the treefrog.
- Collaborate with local governments regarding implementation of this plan.
- Establish partnerships across multiple states to share and exchange information and technology pertaining to the treefrog.

EXECUTIVE SUMMARY

This plan details the actions necessary to maintain or improve the conservation status of the Pine Barrens treefrog. A summary of this plan will be included in the Imperiled Species Management Plan (ISMP), in satisfaction of the management plan requirements in Chapter 68A-27, Florida Administrative Code, Rules Relating to Endangered or Threatened Species. The ISMP will address comprehensive management needs for 60 of Florida's imperiled species and will include an implementation plan; rule recommendations; permitting standards and exempt activities; anticipated economic, ecological, and social impacts; projected costs of implementation and identification of funding sources; and a revision schedule. The imperiled species management planning process relies heavily on stakeholder input and partner support. Any significant changes to this plan will be made with the continued involvement of stakeholders.

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GLOSSARY OF TERMS AND ACRONYMS

BMPs: Best Management Practices. Generally, BMPs represent methods, measures, or practices that are developed, selected, or approved by various agencies to protect, enhance, and preserve natural resources, including wildlife habitat. They include, but are not limited to, engineering, conservation, and management practices for mining, agriculture, silviculture, and other land uses that are designed to conserve water quality and quantity, soil, and associated nutrients, and to simultaneously control nonpoint and point source pollution and other impacts to natural resources, including aquatic and terrestrial wildlife habitat.

BRG: Biological Review Group, a group of taxa experts convened to assess the biological status of taxa using criteria specified in Rule 68A-27.001, Florida Administrative Code, and following the protocols in the Guidelines for Application of the International Union for Conservation of Nature (IUCN) Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1).

BRSF: Blackwater River State Forest

BSR: Biological status review report, the summary of the biological review group's findings. Includes a Florida Fish and Wildlife Conservation Commission (FWC) staff recommendation on whether or not the species status meets the listing criteria in Rule 68A-27-001, Florida Administrative Code. These criteria, based on the IUCN criteria and IUCN guidelines, are used to help decide if a species should be added or removed from the Florida Endangered or Threatened Species List. In addition, FWC staff may provide within the report a biologically justified opinion that differs from the criteria-based finding.

Deme: A local population of closely related interbreeding individuals

DOD: Department of Defense

EAFB: Eglin Air Force Base

FFS: Florida Forest Service, formerly the Florida Division of Forestry

FNAI: Florida Natural Areas Inventory, a non-profit organization administered by Florida State University and dedicated to gathering, interpreting, and disseminating information critical to the conservation of Florida's biological diversity.

F.S.: Florida Statutes

FWC: The Florida Fish and Wildlife Conservation Commission, the state agency constitutionally mandated to protect and manage Florida's native fish and wildlife species.

GLOSSARY OF TERMS AND ACRONYMS

FWC-LE: The Florida Fish and Wildlife Conservation Commission's Division of Law Enforcement

GCPEP: Gulf Coastal Plain Ecosystem Partnership, an organization committed to conserving and restoring the longleaf pine ecosystem.

GIS: Geographic Information System

ISMP: Imperiled Species Management Plan

IUCN: International Union for Conservation of Nature, a professional global conservation network.

IUCN Red List: (IUCN Red List of Threatened Species) An objective, global approach for evaluating the conservation status of plant and animal species, the goals of which are to identify and document those species most in need of conservation attention if global extinction rates are to be reduced, and to provide a global index of the state of change of biodiversity.

Locations: Geographically or ecologically distinct areas in which a single threatening event can rapidly affect all individuals of the subject species. In the case of the Pine Barrens treefrog, watershed sub-basins are designated to represent locations.

NRCS: Natural Resources Conservation Service, a branch of the United States Department of Agriculture.

NWFWMD: Northwest Florida Water Management District

Site: A place where a species has been found to occur and may be expected to occur in the future based on habitat preferences and dispersal capabilities.

SMZs: Special Management Zone. The SMZ is a BMP that consists of a specific area associated with a stream, lake, or other waterbody that is designated and maintained during silviculture operations. The purpose of the SMZ is to protect water quality by reducing or eliminating forestry-related inputs of sediment, nutrients, logging debris, chemicals, and water temperature fluctuations that can adversely affect aquatic communities. SMZs provide shade, streambank stability, and erosion control, as well as detritus and woody debris that benefit the aquatic ecosystem in general. In addition, the SMZ is designed to maintain certain forest attributes that will provide specific wildlife habitat values. Snags, den, and cavity trees as well as mast-producing trees, left in the SMZ, are necessary to meet habitat requirements for certain types of wildlife.

INTRODUCTION

Biological Background

The Pine Barrens treefrog (*Hyla andersonii*) is approximately 3.8 cm (1.5 in) long, primarily greenish in color, with dark brownish-purple lateral bands extending from the nostril to hind legs, and bright yellowish-orange spots in the groin region and lower sides (Means 1992; [Figure 1](#)). In Florida, adult males call from early March to late September, and larvae are present from late May to late August, completing metamorphosis by the end of September (Means 1992). The treefrog is comprised of 3 disjunct populations in the eastern United States: 1) New Jersey, 2) southeastern North Carolina and north-central South Carolina, and 3) northwestern Florida and southern Alabama (Means 2005; [Figure 2](#)). In Florida, the treefrog is primarily confined to acidic shrub and herb seepage bogs (Means and Moler 1979, Enge 2002), which typically support one or both species of titi (*Cliftonia monophylla*, *Cyrilla racemiflora*), sphagnum moss, and other herbaceous and woody plant species (Means 1992).



Figure 1. Pine Barrens treefrog.
Photograph by Kevin Enge.

The Pine Barrens treefrog has been recorded at over 200 sites within a total of 88 locations in Santa Rosa, Okaloosa, Walton, and Holmes counties in the western Panhandle of Florida (records compiled by Kevin Enge, Tom Gorman, and Kenney Krysko; [Appendix 1](#)). Although direct evidence is lacking, treefrog populations have presumably declined due to fire exclusion and subsequent succession of bogs into unsuitable hardwood forest habitat, as well as conversion of bogs into pastures and real estate developments (Means and Longden 1976, Means and Moler 1979, Means 2005). However, the majority of treefrog sites in Florida occur on Eglin Air Force Base (EAFB) and Blackwater River State Forest (BRSF) ([Figure 3](#); [Appendix 1](#)), where human development is limited. While the treefrog was initially listed as a Species of Special Concern in Florida because it was thought to have a limited range (Means and Longden 1976), additional survey work resulted in the discovery of several additional treefrog sites, and thus it is more widespread in Florida than previously thought (Moler 1981). However, the treefrog remained State-listed because of concerns about its management and collection for the pet trade (P. Moler, Florida Fish and Wildlife Conservation Commission [FWC], personal communication).

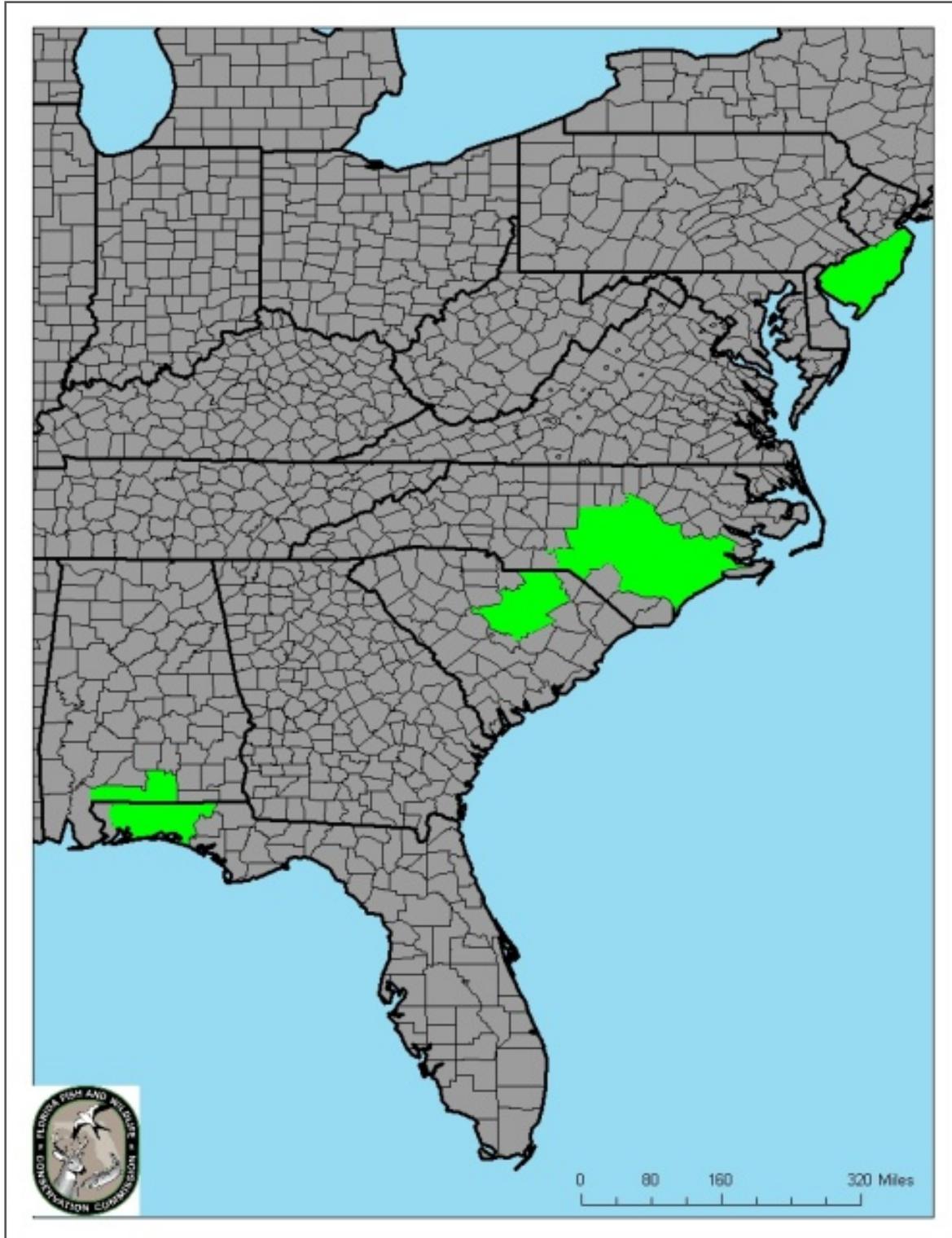


Figure 2. Counties in which the Pine Barrens treefrog is historically known to occur.

Conservation History

In 2010, the FWC directed staff to evaluate the status of all species listed as State-designated Threatened or Species of Special Concern that had not undergone a status review in the past decade. To address this charge, staff conducted a literature review and solicited information from the public on the status of the Pine Barrens treefrog. The FWC convened a biological review group (BRG) of experts on the treefrog to assess its biological status using the following:

1. criteria specified in Rule 68A-27.001, Florida Administrative Code (F.A.C.),
2. protocols in the Guidelines for Application of the International Union for Conservation of Nature (IUCN)
3. Red List Criteria at Regional Levels (Version 3.0), and
4. protocols in the Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1).

FWC staff developed an initial draft of a Biological Status Review report (BSR), which included the BRG's findings and a preliminary listing recommendation from staff. The draft was sent out for peer review, and the reviewers' inputs were incorporated into a [final report](#).

Threats and Recommended Listing Status

Based on the literature review, information received from the public, the BRG findings, and peer-reviewed input, FWC staff recommended that the Pine Barrens treefrog not be listed as a State-designated Threatened species, and that it be removed from the State-designated Species of Special Concern list. However, the BRG also identified a number of threats that could lead to a return of the treefrog to Florida's Endangered and Threatened Species List. Therefore, to address these threats, and thus ensure that the conservation status of the treefrog remains the same or is improved as to not warrant future listing, FWC staff recommends 1) maintaining or enhancing treefrog habitat quality, 2) monitoring treefrog sites, 3) protecting the treefrog from unsustainable collection and sale, and 4) promoting education and outreach among stakeholder groups about treefrogs in this plan.

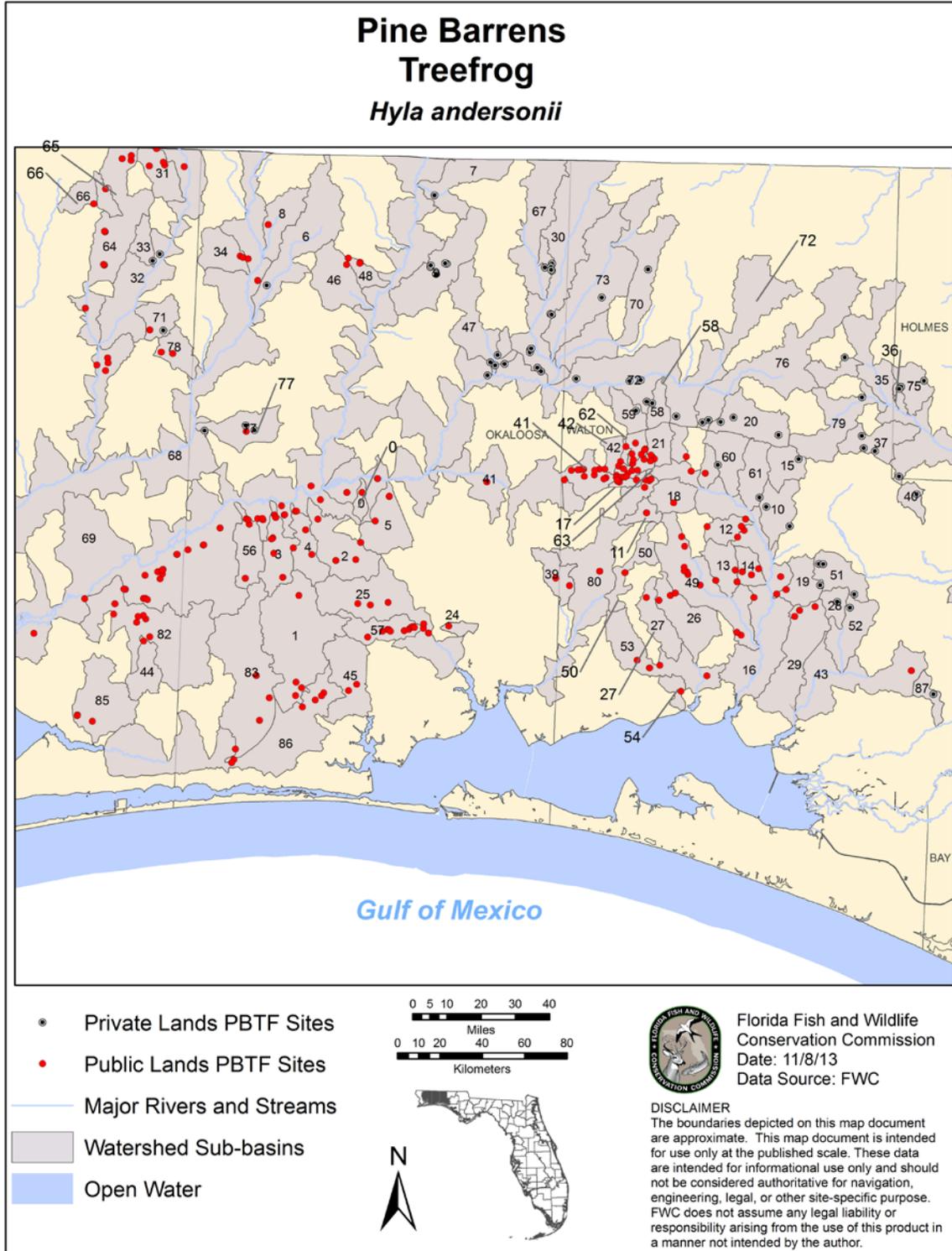


Figure 3. Sites occupied by the Pine Barrens treefrog. Private land (black points) and public land (red points) within watershed sub-basins (gray areas with ID #) in Florida. See [Appendix 1](#) for list of each watershed sub-basins by ID#.

CONSERVATION GOALS AND OBJECTIVES

Goal

The conservation status of the Pine Barrens treefrog remains the same or is improved so that it does not warrant listing on Florida's Endangered and Threatened Species List by accomplishing the following 4 objectives.

Objectives

I. Maintain or enhance habitat quality of $\geq 50\%$ of sites within $\geq 70\%$ of locations that currently support the Pine Barrens treefrog.

Rationale

The most effective means of preventing reductions of Pine Barrens treefrog populations is by maintaining or enhancing the quality of their habitat. FWC listing Criterion A (3) (Population Size Reduction) is triggered if a population size reduction of $\geq 30\%$ is suspected or projected over the next 10 years. Although population sizes of treefrogs undoubtedly vary among different sites, it is not feasible to accurately determine population size variability throughout its Florida distribution. Therefore, we propose that maintenance or enhancement of habitat quality at $\geq 70\%$ of sites that currently support the treefrog should result in avoidance of triggering Criterion A (3).

Avoidance of triggering Criterion B (b) 1 and Criterion B (b) 2 is not possible because the extent of occurrence and area of suitable Pine Barrens treefrog habitat is substantially less than the minimum amount required to not trigger this criterion (see the [BSR](#) for details). However, the triggering of only Criterion B does not result in the FWC listing of the treefrog. Criterion C (2) is not triggered unless sub-criterion C (2) (a) and C (2) (b) are also triggered. Current management practices on EAFB should continue to preclude sub-criterion C (2) (a) and C (2) (b) from being triggered. Therefore, Criterion B (b) and Criterion C (2) are not addressed in the objectives.

II. Monitor sites where Pine Barrens treefrogs have been documented.

Rationale

Determination of many of the historic occurrence sites was based on Pine Barrens treefrog call surveys conducted during the 1970s and 1980s. Since that time, ongoing changes in land use and habitat management (or lack thereof), especially on private lands (e.g., fire exclusion), have resulted in a decline of habitat quality and potential loss of treefrogs from some locations. Treefrog-population monitoring is necessary to determine trends and the overall effectiveness of the management actions outlined in this plan.

III. Protect the Pine Barrens treefrog from unsustainable collection and sale.

Rationale

The Pine Barrens treefrog is desirable to pet collectors. Because the treefrog is restricted to a small number of distinctive and geographically limited habitat types, it tends to occur as small, isolated demes. Thus, protection of the treefrog from the potentially serious threats posed by unsustainable collection and sale is necessary.

CONSERVATION GOALS AND OBJECTIVES

IV. Promote education and outreach among stakeholder groups.

Rationale

To effectively manage for the Pine Barrens treefrog as outlined in this plan, it will be essential to educate law enforcement and the public about the identification, biology, management requirements, and threats to this species. Similarly, outreach efforts with landowners, land management agencies, and wildlife agencies will be necessary to accomplish the objectives outlined above.

CONSERVATION ACTIONS

The following sections describe the conservation actions that will make the greatest contribution toward achieving the conservation objectives. Actions are grouped by category (e.g., Habitat Conservation and Management, Population Management). The Conservation Action Table ([Table 1](#)) provides information on action priority, urgency, potential funding sources, likely effectiveness, identified partners, and leads for implementation.

Habitat Conservation and Management

Selection of Pine Barrens treefrog sites at which the habitat is to be maintained or enhanced, and methods of implementation, will depend on the status of each site and the resources available to land managers. The FWC can assist managers, using information in [Figure 3](#) and [Appendix 1](#) of this plan, as well as the Eglin Integrated Natural Resource Management Plan (Department of Defense [DOD] 2012), to prioritize areas for management. Priority areas include locations with numerous known sites (e.g., Titi Creek on EAFB), and sites on the periphery of the species range. Additionally, efforts should be made to maintain or enhance sites from as many different locations as feasible.

Over 50% of known Pine Barrens treefrog locations and sites in Florida occur on EAFB and BRSF ([Figure 3](#); [Appendix 1](#)); thus, achieving the goal of this plan depends on partnerships with the DOD and Florida Forest Service (FFS). The FWC is not the lead management agency on any lands where treefrogs are known to occur, but serves as a cooperator within EAFB and BRSF. Moreover, the FWC can provide technical assistance and management support by securing additional sources of funding for habitat management such as Aquatic Habitat Restoration and Enhancement, Conserve Wildlife Tag, and State Wildlife Grant programs. The FWC can also lead efforts to enhance the habitat of sites on private lands through technical assistance and incentives, including the Landowner Assistance Program (see [Incentives and Influencing](#) section, [Action 10](#)).

Action 1 Conduct prescribed burns at $\geq 50\%$ of sites within $\geq 70\%$ of locations that currently support the Pine Barrens treefrog.

Conducting prescribed burns is essential towards maintaining habitat quality and preventing declines that could lead to relisting of the Pine Barrens treefrog. Periodic fires that carry through treefrog breeding sites (e.g., herbaceous bogs/wet prairies) are necessary to prevent encroachment by woody plants that alter water levels through increased evapotranspiration; these plants include black titi (*Cliftonia monophylla*), titi (*Cyrilla racemiflora*), peelbark St. John's wort (*Hypericum fasciculatum*), gallberry (*Ilex glabra*), and wax myrtle (*Myrica cerifera*) (Means and Moler 1979, Florida Natural Areas Inventory [FNAI] 2010). Additionally, periodic fires are essential for maintaining open, early successional, herb-dominated conditions consisting of wiregrass (*Aristida stricta*), plumed beaksedge (*Rhynchospora plumosa*), featherbristle beaksedge (*Rhynchospora oligantha*), Baldwin's nutrush (*Scleria baldwinii*), slenderfruit nutrush (*Scleria georgiana*), longleaved threeawn (*Aristida palustris*), pitcher plants (*Sarracenia* spp.), sundews (*Drosera* spp.), butterworts (*Pinguicula* spp.), and bladderworts (*Utricularia* spp.; FNAI 2010). [Figure 4](#) illustrates desired habitat conditions at a typical treefrog breeding site as a result of regular prescribed burning.

Growing-season burns (May through September) conducted at least every 4 years are ideal because they mimic historic fire regimes and are more effective at controlling woody plants than are winter burns (Means 2006, 2008). However, growing-season burns may not always be feasible due to high fuel loads, particularly on private lands. On such sites, annual or biannual dormant-season burns may be necessary to reduce fuel loads before implementing the recommended burn schedule. Fire breaks should not be installed through sites where the Pine Barrens treefrog occurs, or between treefrog sites and the adjacent uplands, because they would prevent burns originating in the uplands from reaching the treefrog sites.

BRSF’s resource management plan makes provisions for the Pine Barrens treefrog, including burning seepage slopes every 2 to 4 years (FFS 2012). EAFB has a large-scale prescribed fire program that benefits local treefrog populations (DOD 2012); however, neither the FFS nor DOD receives direct funding for management of this species. For details on prescribed burning on private lands, see [Incentives and Influencing](#) section, [Action 10](#)).



Figure 4. An herbaceous seepage bog, Blackwater River State Forest. FWC photograph.

Action 2 Eliminate or reduce invasive vegetation from $\geq 50\%$ of sites within $\geq 70\%$ of locations that currently support the Pine Barrens treefrog.

The quality of seepage wetland habitats in which the Pine Barrens treefrog occurs is degraded by encroachment of invasive plants such as cogon grass (*Imperata cylindrica*) and Chinese tallow (*Triadica sebifera*), and excessive growth of certain native plants such as black titi and titi (FNAI 2010). A combination of low-impact mechanical or manual removal, herbicide, and prescribed fire can be used to control these species. Application of any herbicide must follow label requirements. The surfactants used in glyphosate and other herbicides have been potentially identified as the primary ingredient causing toxicity to amphibians (Govindarajulu 2008); therefore, only aquatic-labeled herbicides should be used in wetlands where the treefrog occurs. Regardless of the method used to control vegetation, the use of heavy machinery should be minimized to prevent soil compaction and rutting, especially when sites are wet. The FWC should coordinate with exotic plant control programs at both BRSF and EAFB in order to enhance control of invasive non-native plants at treefrog sites (DOD 2012, FFS 2012). For details on invasive vegetation management on private lands, see [Incentives and Influencing](#) section, [Action 10](#)).

Action 3 Control feral hogs from $\geq 50\%$ of sites within $\geq 70\%$ of locations that currently support the Pine Barrens treefrog.

Feral hogs (*Sus scrofa*) damage seepage wetlands by rooting, which negatively impacts plant communities, soil characteristics, and hydrologic patterns (Means and Travis 2007). The control of hogs through trapping and hunting at sites where the Pine Barrens treefrog occurs is recommended (Engeman et al. 2007). Both BRSF and EAFB actively manage hogs using these methods, as well as using additional contract and permit measures (DOD 2012, FFS 2012); coordination should be undertaken to prioritize feral hog control at treefrog sites. For details on controlling feral hogs on private lands, see [Incentives and Influencing](#) section, [Action 10](#)).

Action 4 Identify and mitigate factors impacting hydrology at sites occupied by the Pine Barrens treefrog through coordination with the National Resources Conservation Service (NRCS), EAFB, BRSF, and private landowners.

Several activities (e.g., fire exclusion and stream impoundment) can cause changes in water chemistry and flow, thereby leading to the alteration of hydrology where the Pine Barrens treefrog occurs (Means 2005, Bunnell and Ciraolo 2010). Moreover, activities and structures that draw down the aquifer (e.g., irrigation and wells) may further alter the hydrology by reducing seepage water at treefrog breeding sites. Bunnell and Ciraolo (2010) reported that treefrogs were negatively affected by simulated groundwater withdrawals at breeding sites. Further studies are necessary, however, to investigate the impacts of groundwater withdrawals (Means 2011). Coordination with the NRCS to encourage implementation of high-efficiency irrigation and other water conservation measures within the watersheds containing treefrogs should be undertaken. Where feasible, structures such as ditches, impoundments, and turnouts that disrupt the natural flow of surface water to and from treefrog habitats should be removed, and should be avoided in future planning efforts; these goals could be addressed on private lands through NRCS programs, and on public lands through coordination with EAFB and BRSF.

In 2011, the FFS revised their best management practices (BMPs) manual (FFS 2011). The manual establishes minimum standards and describes silvicultural BMPs for maintaining water quality and wildlife habitat, while performing silvicultural operations in Florida (FFS 2011). The BMPs apply to all forested land cover types, including wetlands. According to the BMP manual, streams and associated wetlands (e.g., seepage slopes and bogs) can also be designated as Special Management Zones (SMZs). Special BMPs apply to SMZs that further protect the water quality of these habitats from certain forestry-related activities, including drainage and conversion, road construction, harvesting, and skidding. The FWC recommends the use of FFS BMPs to reduce impacts to hydrology in Pine Barrens treefrog sites.

In addition to enhancing habitat for Pine Barrens treefrogs, restoring hydrology of isolated wetlands provides a suite of benefits that support and increase the biodiversity of other rare, threatened, or endangered species. Additional benefits include establishing ecological linkages to downstream receiving waters, increasing capacity to store floodwaters and recharge groundwater supplies, and removing excess nutrients and sediment.

Population Management

There are no Pine Barrens treefrog-specific actions proposed under Population Management at this time.

Monitoring and Research

Action 5 Conduct call surveys from April through July every 3 to 5 years for the Pine Barrens treefrog at a pre-determined subset of historic sites.

A suggested Pine Barrens treefrog call-survey protocol is provided in [Appendix 2](#). This protocol is modeled after the United States Geological Survey's North American Amphibian Monitoring Program and the standard monitoring methodology for gopher frogs (*Lithobates capito*) developed by the FWC's Wildlife Conservation, Prioritization, and Recovery Program. The call-survey protocol outlines the basic data necessary to achieve the second objective of this plan. The specific methodologies used to conduct call surveys may vary, depending on surveyor experience, preferences, and other factors. Surveys will include solicitation of calls by either vocally imitating the call of the treefrog or by playing a pre-recorded call. Additional data (e.g., habitat variables) may be collected depending on the goals of the surveyors. Opportunistic surveys may also include searches for tadpoles.



Figure 5. Pine Barrens treefrog in a white-topped pitcher plant (*Sarracenia leucophylla*).

Photograph by Kevin Enge.

Action 6 Survey for the Pine Barrens treefrog at previously undocumented sites as time and resources permit.

Surveys for Pine Barrens treefrogs at previously undocumented sites can be conducted at the discretion of the surveyors. Treefrogs detected at such sites while conducting other activities should be documented as incidental observations.

Action 7 Use Geographic Information Systems (GIS) to improve management decisions by producing landscape level models of Pine Barrens treefrog habitat.

Recent advances in GIS allow researchers to associate biological data with geographic locations (e.g., spatial modeling). These new geospatial technologies have the potential to distill large amounts of data into biologically meaningful patterns (Turner 1990). GIS models can provide landscape-scale guidance to decision makers involved in land use planning, public land acquisition, and other land conservation efforts to further benefit the Pine Barrens treefrog.

Each organism perceives the elements of a landscape (e.g., size, shape, area, scale) differently (Wiens 1976), which for the Pine Barrens treefrog, may consist of a mosaic of habitat patches within a single seepage bog. Landscape modeling can help visually assess and make future decisions regarding the following aspects of wildlife management:

- Habitat availability (e.g., patch size, fragmentation, corridors)
- Anthropogenic disturbance (e.g., development, timber harvest)
- Genetic distribution
- Conservation lands acquisition
- Predictions of occurrence
- Distributions of pathogens

Endries et al. (2009) generated a potential habitat model for the Pine Barrens treefrog. They selected bay swamp, cypress/pine/cabbage palm, and mixed wetland forest vegetation classes from the FWC 2003 land-cover image to best represent habitat for this species. They limited potential habitat to those subwatersheds that contain a treefrog location. They further restricted the model to all forested habitats within 90 m (295 ft) of a site ([Figure 6](#)).



Figure 6. Potential habitat of the Pine Barrens treefrog in Florida. Potential habitat is colored in black. From Endries et al. 2009.

The potential habitat identified by this map can assist surveyors in more efficiently determining where Pine Barrens treefrogs are expected to occur, both historically and potentially, which further illustrates how landscape ecology, when combined with GIS modeling, can become a powerful conservation tool.

Rule and Permitting Intent

Action 8 Limit personal possession of the Pine Barrens treefrog to prevent overexploitation.

Commercialization of species gives an economic incentive for collecting, leading to increased collection pressure. Because commercial collection of Pine Barrens treefrogs is prohibited throughout its 5-state range, it is recommended that commercialization be prohibited in Florida to prevent populations from receiving unsustainable commercial collection pressure as the sole source of wild Pine Barrens treefrogs when the species is removed from Florida's Endangered and Threatened Species List. Pine Barrens treefrogs are desirable as pets and are easily collected during their breeding season. Therefore, limitations on the personal possession of treefrogs are recommended to protect against unsustainable levels of take, once the species is removed from Florida's Endangered and Threatened Species List. Florida's treefrogs may be able to tolerate a limited amount of recreational possession. Of the states with natural populations of Pine Barrens treefrogs, only North Carolina allows recreational possession. Allowing possession of Pine Barrens treefrogs would result in the collection and loss of individuals from natural populations, and is thus counter to conservation efforts for this species. However, if recreational possession of this species were allowed in Florida, a limit of 1 male treefrog for each person is recommended. If female treefrogs remain prohibited from recreational possession and resultant take from the wild, then the need to regulate offspring from captive breeding will be eliminated, while allowing people to possess the gender of this species they are most likely to find while searching

for frogs. Males of this species are easily distinguished from females by their darker throats (Figure 7), and are more easily collected because they call.

Protections

General Prohibitions (Rule 68A-4.001.F.A.C.). —When the Pine Barrens treefrog is removed from Florida’s Endangered and Threatened Species List, it will be subject to Rule 68A-26.002, F.A.C., whereby take of treefrogs is allowed throughout the year by gigs, clubs, blowguns, and hook and line during the day or night, and by firearms during the day. Therefore, if the suggested protections above are not implemented, year-long unlimited, most likely unsustainable harvest (including commercial harvest if the harvester possesses a Florida freshwater fish dealer’s license) of this species in Florida would be legal, except where local regulations limit or prohibit harvest.



Figure 7. Male (left) and female (right) Pine Barrens treefrogs. Note differences in throat coloration. Photographs by Alexa Warwick.

Permitting

Permits to Take Wildlife or Freshwater Fish for Justifiable Purposes (Rule 68A-9.002, F.A.C.). — Provisions for permits to take the Pine Barrens treefrog (beyond the suggested personal possession limit of 1 male per person), including incidental take, are provided in Rule 68A-9.002, F.A.C. Specifically, this rule authorizes the Executive Director to issue permits authorizing intentional take or possession of the treefrog for scientific, educational, exhibition, propagation, conservation, management, or other justifiable purposes that will benefit the survival potential of the species.

Requirements for permit requests must include an assessment of the following:

- Adequate justification for taking the Pine Barrens treefrog from the wild
- Probable direct or indirect effects on wild Pine Barrens treefrog populations
- Potential conflicts with other activities or programs intended to enhance the survival of Pine Barrens treefrogs in the wild

- Potential for the proposed work to increase the threat of extinction to Pine Barrens treefrog populations in the wild
- Input from subject matter experts on the Pine Barrens treefrog
- Whether the expertise, facilities, or other resources available to the applicant are adequate to successfully accomplish the objective(s) stated in the permit application

Criteria for granting permit requests include considerations of the following:

- Foreseeable long-range impacts on the Pine Barrens treefrog
- Impacts to other fish and wildlife species
- Extent of injury, harm, or loss to the Pine Barrens treefrog
- Reasonable steps taken to avoid, minimize, or mitigate incidental take (e.g., using BMPs during agricultural activities, as defined in s. 570.02, Florida Statutes [F.S.], adopted by the Department of Agriculture and Consumer Service, pursuant to ss. 403.067 and 597.004, F.S.) of the Pine Barrens treefrog
- Land management activities that benefit wildlife, and are in accordance with this plan
- Fire suppression actions necessary to ensure public safety during emergency circumstances, including setting backfires, removing fences and other obstacles, digging trenches, cutting fire lines, or using water from public and private sources
- Other factors relevant to the conservation and management of the Pine Barrens treefrog

Law Enforcement

Action 9 Educate FWC's Division of Law Enforcement (FWC-LE) about the Pine Barrens treefrog.

The FWC's Division of Law Enforcement, in conjunction with federal, state, and local partners, is responsible for enforcing Florida's wildlife and fisheries laws. FWC biologists and other subject matter experts will educate FWC-LE officers through the development, circulation, and interpretation of Pine Barrens treefrog species and gender identification tools, and distribution maps. In turn, one of the most important components of an enforcement strategy is ensuring compliance through public education.

FWC-LE officers understand the importance of explaining wildlife laws to the public to avoid unintentional violations. However, officers actively pursue and recommend prosecution for those who intentionally violate wildlife laws. Officers also educate the public on how to identify and report violations. The FWC-LE administers the Wildlife Alert program, to which the public can call about potential wildlife violations via a toll-free number (1-888-404-3922) that is answered 24 hours a day, 7 days a week. Cash rewards are offered to callers who provide information about any illegal activity resulting in an arrest. Callers may remain anonymous and are not required to testify in court.

Incentives and Influencing

Action 10 Manage Pine Barrens treefrog habitat on private lands by providing technical assistance and utilizing incentive and conservation easement programs.

Approximately 60 sites in Florida from which the Pine Barrens treefrog was historically documented are on privately owned lands ([Figure 3](#)). Although only a relatively small portion of the total documented sites occur on private lands, private lands comprise nearly half of the species' range in Florida. Therefore, effective management of habitat on private land sites will help to accomplish the goal of this plan.

Incentive programs provide funding for private landowners to perform management actions that may potentially benefit the Pine Barrens treefrog and its habitat. Working with state and federal agencies, efforts are currently underway to inform landowners of existing land management incentive programs. Key programs include the Environmental Quality Incentives Program, Landowner Assistance Program, and Private Stewardship Grants Program.

FWC staff will evaluate existing programs, develop new programs, and identify criteria to prioritize incentives for managing Pine Barrens treefrog habitat on private lands. Each landowner and situation may differ in their needs and how they fit with different programs, so it is likely that multiple programs will be used to meet the goals of this plan. FWC staff will work with private property owners on a case-by-case basis as necessary. Habitat restoration projects (preferably in conjunction with species occurrence surveys) should be considered when allocating funds. In addition, staff can develop a list of location-specific habitat management and implementation guidelines (e.g., prescribed burning of suitable areas at least every 4 years and during the growing season) to disseminate through booklets, brochures, pamphlets, and the internet.

Alternatively, conservation easements are more traditional, yet effective and permanent tools for conserving private lands in Florida. A conservation easement is a voluntary, legally binding agreement that allows a landowner to restrict land use for the protection of natural resources, while retaining private ownership. Newly instated landowner liability programs provide legal safeguards to the owner of the property under easement. Many landowners receive a federal income tax deduction as an incentive for putting their land into a conservation easement. Florida also provides tax incentives, including property tax exemptions for landowners who put a perpetual conservation easement on their land. Conservation easements offer great flexibility. For example, an easement on a farm containing rare wildlife species such as Pine Barrens treefrogs, or habitat such as seepage wetlands, might prohibit any land development (other than agricultural structures), while allowing continued farming practices. An easement may apply to all or a portion of the property, and need not require public access (Byers and Ponte 2005). Moreover, the Wetlands Reserve Program provides funds to purchase conservation easements and restore wetlands degraded by agricultural activities. Additional information on conservation easements and acquisition can be found in the [Florida Wildlife Conservation Guide](#).

Education and Outreach

Action 11 Educate the public on the identification, distribution, biology, and threats to the Pine Barrens treefrog.

The Pine Barrens treefrog is seldom encountered and little known by most people. Therefore, a biological species profile, including photos and distribution maps, is currently being developed on the [FWC's Imperiled Species webpage](#). Coordination with the FWC's community relations staff within the Division of Habitat and Species Conservation can broaden outreach efforts by using websites, social media, field trips, and workshops. In addition, the FWC will develop exhibits of this species for presentations, activities, and special events. Staffs at BRSF, EAFB, and the E.O. Wilson Biophilia Center regularly conduct education and outreach activities with various user groups (e.g., students, hunters, campers, and visitors of events such as Blackwater Heritage Day); such activities can include discussions emphasizing the treefrog. Potential partners for education and outreach on treefrogs include Partners in Amphibian and Reptile Conservation, Defenders of Wildlife, The Wildlife Society, Audubon, The Nature Conservancy, and the East Gulf Coastal Plain Joint Venture.

Action 12 Collaborate with local governments regarding implementation of this plan.

Opportunities exist to educate elected officials, such as municipal and county planners, through workshop presentations at regularly scheduled meetings. One site where the Pine Barrens treefrog occurs, for example, is owned by the Walton County School District in Defuniak Springs, which presents an ideal outreach opportunity. In turn, regional FWC staff will be further educated on existing conservation land management practices to enable them to more effectively work with local governments and other stakeholders on issues involving treefrogs.

Statute 163.3177, F.S., requires that county comprehensive growth management plans include a conservation element that identifies areas within the county that support important fish, wildlife, or habitat resources. This element must contain principles, guidelines, and standards for conservation that restrict activities known to adversely affect the survival of these resources. Further, local government land development regulations require specification of how land and water uses will be administered. The FWC is identified as a state agency authorized to review county growth management plans and plan amendments to ensure important state fish, wildlife, and habitat resources are adequately considered. Thus, the FWC will work with local governments to ensure that their county comprehensive growth management plans include appropriate provisions for the management and conservation of Pine Barrens treefrogs and their habitat.

Coordination with Other Entities

Action 13 Establish partnerships to share and exchange information and technology pertaining to Pine Barrens treefrogs.

Partnerships will facilitate accomplishment of the management objectives of this plan. For example, the Gulf Coastal Plain Ecosystem Partnership (GCPEP) is a collaboration among the

CONSERVATION ACTIONS

DOD, Florida Department of Environmental Protection, FFS, FWC, Gulf Islands National Seashore, Nokuse Plantation, Northwest Florida Water Management District (NFWFMD), The Nature Conservancy, and United States Forest Service. The purpose of the GCPEP is to develop a voluntary cooperative land stewardship strategy to sustain the long-term viability of native plants and animals, the integrity of ecosystems, the production of commodities and ecosystem services, and the human communities that depend upon them. The GCPEP operates across the entire potential habitat of the Pine Barrens treefrog in Florida and adjacent Alabama. Therefore, partnering with the GCPEP and land managers will further facilitate multi-state efforts to manage this species and its habitat in conjunction with other collaborative efforts.

Table 1. Pine Barrens Treefrog (*Hyla andersonii*) Conservation Action Table

NOTE: An explanation of acronyms used is below the table.

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgent?
1	1	1	Conduct prescribed burns at ≥50% of sites within ≥70% of locations that currently support the Pine Barrens treefrog.	Habitat Conservation & Mgmt	EXPANDED	NO	NO	TBD	Existing budget, unknown	WHM, SCP, HSC	FFS, DOD	Very likely	Highly feasible and practical; practices ongoing in some areas	NO; Immediate survival is not under threat. However, this action is critical for long-term survival of the Pine Barrens Treefrog.
1	1	2	Eliminate or reduce invasive vegetation from ≥50% of sites within ≥70% of locations that currently support the Pine Barrens treefrog.	Habitat Conservation & Mgmt	EXPANDED	YES	YES	TBD	Existing budget, unknown	WHM, SCP, IPMS	FFS, DOD, CISMA	Very likely	Highly feasible and practical; practices ongoing in some areas	NO; Immediate survival is not under threat. However, this action is critical for long-term survival of the Pine Barrens treefrog.
1	3	3	Control feral hogs from ≥50% of sites within ≥70% of locations that currently support the Pine Barrens treefrog.	Habitat Conservation & Mgmt	EXPANDED	NO	NO	TBD	Existing budget, unknown	WHM, SCP	USDA, DOD	Moderately likely	Practical, but not as feasible; highly contingent upon availability of necessary resources and relationships	NO; Immediate survival is not under threat. May be completed following successful implementation of all higher priority actions, and availability of adequate resources.
1	3	4	Identify and mitigate factors impacting hydrology at sites occupied by the PBT through coordination with NRCS, EAFB, BRSF, and private landowners.	Habitat Conservation & Mgmt	EXPANDED	NO	NO	TBD	Existing budget, unknown	WHM, SCP	NWFWMD, DOD	Very likely	Highly feasible and practical; practices ongoing in some areas.	NO; Immediate survival is not under threat. However, this action is critical for long-term survival of the PBT.
2	4	5	Conduct call surveys from April through July every 3 to 5 years for the Pine Barrens treefrog at a pre-determined subset of historic sites.	Monitoring & Research	EXPANDED	YES	YES	\$0-25k	Existing budget, unknown	FWRI, SCP, WHM	Universities (e.g., VA Tech, FSU)	Very likely	Highly feasible and practical; practices ongoing in some areas.	NO; Immediate survival is not under threat. However, this action is critical for long-term survival of the PBT.
2	5	6	Survey for the Pine Barrens treefrog at previously undocumented sites as time and resources permit.	Monitoring & Research	NEW	YES	YES	TBD	Existing budget, unknown	FWRI, SCP, WHM	Universities (e.g., VA Tech, FSU)	Moderately likely	Practical, but not as feasible; highly contingent upon availability of necessary resources and relationships.	NO; Immediate survival is not under threat. May be completed following successful implementation of all higher priority actions, and availability of adequate resources.
2	4	7	Use Geographic Information Systems (GIS) to improve management decisions by producing landscape level models of Pine Barrens treefrog habitat.	Monitoring & Research, Population Mgmt	NEW	YES	YES	\$0-25k	Existing budget, unknown	FWRI	Universities	Likely	Feasible and practical with the proper resources and relationships.	NO; Immediate survival is not under threat. However, this action is beneficial for long-term survival of the PBT.
3	1	8	Limit personal possession of the Pine Barrens treefrog to prevent overexploitation.	Protections & Permitting, Law Enforcement	NEW	YES	YES	\$0-25k	Existing budget	LE	N/A	Likely	Feasible and practical with the proper resources and relationships.	NO; Immediate survival is not under threat. However, this action is beneficial for long-term survival of the PBT.
4	2	9	Educate FWC's Division of Law Enforcement (FWC-LE) about the Pine Barrens treefrog.	Law Enforcement, Protections & Permitting	NEW	YES	YES	\$0-25k	Existing budget	SCP	N/A	Likely	Feasible and practical with the proper resources and relationships.	NO; Immediate survival is not under threat. However, this action is beneficial for long-term survival of the PBT.
4	2	10	Manage Pine Barrens treefrog habitat on private lands by providing technical assistance and utilizing incentive and conservation easement programs.	Incentives & Influencing, Education & Outreach, Coordination with Other Entities	EXPANDED	NO	YES	TBD	Existing budget, unknown	CPS	Landowners	Moderately likely	Practical, but not as feasible; highly contingent upon availability of necessary resources and relationships	NO; Immediate survival is not under threat. May be completed following successful implementation of all higher priority actions, and availability of adequate resources.

Table 1. Pine Barrens Treefrog (*Hyla andersonii*) Conservation Action Table

Objective(s) Addressed	Team Assigned Priority Level	Action Item Number	Action Items	Conservation Action Category	Ongoing, Expanded or New Effort?	Authority	Man Power	Estimated Cost To Implement	Funding Source(s)	Lead for Implementation: FWC Program(s) and/or Section(s)	External partners	Likely Effectiveness	Feasibility	Urgent?
4	5	11	Educate the public on the identification, distribution, biology, and threats to the Pine Barrens treefrog.	Education & Outreach, Incentives & Influencing, Coordination with Other Entities	NEW	YES	YES	\$25-50k	Existing budget, unknown	SCP	Agencies, universities	Likely	Feasible and practical with the proper resources and relationships.	NO; Immediate survival is not under threat. However, this action is beneficial for long-term survival of the PBT.
4	4	12	Collaborate with local governments regarding implementation of this plan.	Education & Outreach, Incentives & Influencing, Coordination with Other Entities	NEW	NO	YES	TBD	Existing budget, unknown	CPS, SCP	Local governments	Moderately likely	Practical, but not as feasible; highly contingent upon availability of necessary resources and relationships	NO; Immediate survival is not under threat. May be completed following successful implementation of all higher priority actions, and availability of adequate resources.
4	4	13	Establish partnerships to share and exchange information and technology pertaining to Pine Barrens treefrogs.	Coordination with Other Entities, Incentives & Influencing, Education & Outreach	NEW	NO	YES	TBD	Existing budget, unknown	CPS, SCP	Agencies, local governments, organizations, universities	Likely	Feasible and practical with the proper resources and relationships.	NO; Immediate survival is not under threat. However, this action is beneficial for long-term survival of the PBT.

Acronyms used in this table:

- BRSF: Blackwater River State Forest
- CISMA: Cooperative Invasive Species Management Area
- CPS: Conservation Planning Services, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation
- DOD: Department of Defense
- EAFB: Eglin Air Force Base
- FFS: Florida Forest Service
- FSU: Florida State University
- FWC: Florida Fish and Wildlife Conservation Commission
- FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission
- HSC: Habitat and Species Conservation, a Division of the Florida Fish and Wildlife Conservation Commission
- IPMS: Invasive Plant Management, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation
- LE: Law enforcement
- NWFWMD: Northwest Florida Water Management District
- NRCS: Natural Resources Conservation Service
- PBT: Pine Barrens treefrog
- SCP: Species Conservation Planning, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation
- TBD: To be determined
- USDA: United States Department of Agriculture
- WHM: Wildlife and Habitat Management, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation

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APPENDICES

Appendix 1. Watershed sub-basins occupied by the Pine Barrens treefrog in Florida.

ID numbers identify each sub-basin on the Pine Barrens treefrog distribution map ([Figure 3](#)).

ID #	Location Name	# Documented Sites	Ownership
0	GOPHER CREEK	1	Eglin
1	TURTLE CREEK	4	Eglin
2	TURKEY GOBBLER CREEK	3	Eglin
3	MALONE CREEK	6	Eglin
4	MIDDLE CREEK	5	Eglin
5	TURKEY HEN CREEK	3	Eglin
6	PANTHER CREEK	1	Blackwater
7	BIG CREEK	1	Private
8	MARE CREEK	1	Blackwater
9	MURDER CREEK	5	Private
10	SCONIERS MILL CREEK	2	Private
11	SANDY MOUNTAIN BRANCH	1	Eglin
12	OAKIE CREEK	4	Eglin
13	BLOUNT MILL CREEK	2	Eglin
14	DAVIS BRANCH	3	Eglin
15	KISER BRANCH	1	Private
16	ALAUQA CREEK	4	Eglin
17	INDIGO BRANCH	5	Eglin
18	BEAR BAY BRANCH	1	Eglin
19	ALICE CREEK	3	Eglin
20	NARROWS CREEK	3	Private
21	LIVEOAK BRANCH	1	Eglin
22	BUCK BRANCH	1	Eglin
23	LOOKOUT CREEK	1	Eglin
24	ANDERSON BRANCH	1	Eglin
25	TURKEY CREEK	6	Eglin
26	BEAR BRANCH	3	Eglin
27	WATERING CREEK	1	Eglin
28	WHITE BRANCH	1	Private (Nokuse)
29	FOURMILE CREEK	3	Eglin
30	POND CREEK	9	Private
31	REEDY CREEK	4	Blackwater
32	SWEETWATER CREEK	2	Blackwater
33	CEDAR CREEK	1	Blackwater
34	BULLPEN BRANCH	2	Blackwater

ID #	Location Name	# Documented Sites	Ownership
35	SANDY CREEK	1	Private
36	PARRISH CREEK	1	Private
37	BRIDGE CREEK	3	Private
38	UNNAMED STREAM	1	Private
39	MIDDLE ROCKY CREEK	2	Eglin
40	DAYS BRANCH	1	Private
41	TITI CREEK	27	Eglin
42	HOG CREEK	1	Eglin
43	LAFAYETTE CREEK	1	NFWFMD
44	INDIGO CREEK	1	Eglin
45	LIGHTWOOD KNOT CREEK	2	Eglin
46	DEADFALL CREEK	1	Blackwater
47	POVERTY CREEK	2	Private
48	BEAR BRANCH	3	Blackwater
49	LITTLE ALAQUA CREEK	10	Eglin
50	EAST ROCKY CREEK	1	Eglin
51	MILL CREEK	3	Private (1 on Nokuse)
52	MAGNOLIA CREEK	1	Private
53	BASIN CREEK	4	Eglin
54	LINTON SPRING BRANCH	1	Eglin
55	CLEAR CREEK	1	Private
56	METTS CREEK	4	Eglin
57	ROGUE CREEK	11	Eglin
58	BATTLE CREEK	1	Private
59	MOSSY HEAD BRANCH	1	Private
60	BEAR CREEK	1	Private
61	COSSON MILL CREEK	1	Private
62	HORSESHOW BRANCH	2	Eglin
63	CAWTHON BRANCH	5	Eglin
64	BIG JUNIPER CREEK	12	Blackwater
65	WOLF CREEK	1	Blackwater
66	BUCK CREEK	1	Blackwater
67	HORSEHEAD CREEK	1	Private
68	BLACKWATER RIVER	2	Blackwater
69	YELLOW RIVER	26	Eglin
70	LONG CREEK	1	Private
71	BLUE CREEK	2	Blackwater
72	SHOAL RIVER	10	Private and Eglin
73	PINE LOG CREEK	1	Private

ID #	Location Name	# Documented Sites	Ownership
74	HUCKLEBERRY CREEK	1	Private
75	PADGETT CREEK	2	Private
76	GUM CREEK	2	Private
77	BONE CREEK	4	Blackwater
78	MIDDLE CREEK	2	Blackwater
79	WEST SANDY CREEK	1	Private
80	ROCKY CREEK	5	Eglin
81	DESERTER CREEK	1	Eglin
82	BOILING CREEK	8	Eglin
83	LIVE OAK CREEK	4	Eglin
84	MC KINNON BRANCH	1	Private
85	DEAN CREEK	3	Eglin
86	EAST RIVER BAY	6	Eglin
87	LITTLE BLACK CREEK	1	Private

Appendix 2. Suggested Pine Barrens treefrog call survey protocol and datasheet.

Purpose: The purpose of this monitoring protocol is to document the presence of Pine Barrens treefrogs at historic and potential breeding sites. Monitoring is necessary to determine trends over time and gauge the effectiveness of the Pine Barrens treefrog Species Action Plan (SAP).

Seasonality: Pine Barrens treefrogs call most actively in Florida during April through July.

Repetition: Surveys conducted a minimum of every 3 to 5 years are recommended. More frequent (i.e., annual) surveys may be conducted, depending on time and resources available and specific goals of the surveyors.

Surveys: This protocol is modeled after the [United States Geological Survey's North American Amphibian Monitoring Program](#). The brief narrative below outlines data that should be collected to achieve objectives in the SAP, followed by tables of treefrog call index, wind code, and sky code rankings. Lastly, a call-survey datasheet is provided. Surveyors may choose to record additional data not outlined in this protocol (e.g., habitat variables) depending on their own monitoring goals.

- A. **Sites:** Preference should be given to monitoring historic sites that either already support high-quality Pine Barrens treefrog habitat or are being enhanced through active management efforts. It is recommended that surveyors refer to [Figure 3](#) and [Figure 6](#) of the SAP to choose sites from within as many locations as feasible. Sites on the periphery of the known range are also important to monitor in order to document any range contraction. Documenting new sites is not a requirement of the SAP; however, potential sites may be surveyed if time and resources allow. To lessen the probability of inadvertently sampling the same population of Pine Barrens treefrogs multiple times on the same night, each monitored site should be at least 0.8 km (0.5 mi) apart.

- B. **Nightly Surveying:**

Survey Conditions: Surveys should begin 30 minutes after sunset or later and be completed before 1 a.m. Acceptable sampling conditions are based on wind and sky conditions, and time since last heavy rain. Surveys should not occur during wind speeds over 12 mph, heavy rainfall, or temperatures below 45⁰ F. It is acceptable to conduct surveys in light rainfall that does not affect hearing ability. Surveys should preferentially be conducted within approximately 1 week of a rain event.

Surveying Procedure / Data Collection: At each site, the surveyor should listen for a total of 5 minutes and then record the calling index for Pine Barrens treefrogs heard. There is no initial waiting period prior to beginning the 5-minute survey period. Frogs can be stimulated to call by using a recorded call or imitation of their call. If frogs are not heard after the first 2 minutes, a tape or simulated call should be played for 5 to 10 seconds, followed by 2 minutes of listening. If a call index of 3 is documented prior to the 5 minutes, the monitoring at the site can be completed. The surveyor should record the number of cars that passed by the site during the listening period. He or she should

also record whether or not background noise impaired hearing ability (using the “yes/no” checkbox). If a major noise disturbance occurs that lasts 1 minute or longer, the surveyor can temporarily break the listening period to avoid sampling during this time. If this occurs, the surveyor should make note of it on the datasheet and then resume listening for the total time remaining after the noise passes. The noise during the time out should not be used for determining whether or not background noise affected hearing.

Data Submission: Call survey data should be submitted to the Florida Natural Areas Inventory (<http://www.fnai.org>).

Pine Barrens Treefrog Calling Index	
0	No individuals are heard
1	Individuals can be counted; there is space between calls
2	Calls of individuals can be distinguished but there is some overlapping of calls
3	Full chorus, calls are constant, continuous and overlapping
Beaufort Wind Codes	
0	Calm (<1 mph) - smoke rises vertically
1	Light Air (1 to 3 mph) - smoke drifts, weather vane inactive
2	Light Breeze (4 to 7 mph) - leaves rustle, can feel wind on face
3	Gentle Breeze (8 to 12 mph) - leaves and twigs move around, small flags extend
4*	Moderate Breeze (13 to 18 mph) - moves thin branches, raises loose papers * Do not conduct survey
5*	Fresh Breeze (≥ 19 mph) - small trees begin to sway * Do not conduct survey
Sky Codes (numbers 3 and 6 are not used)	
0	Few clouds
1	Partly cloudy (scattered) or variable sky
2	Cloudy or overcast
4	Fog or smoke
5	Drizzle or light rain (not affecting hearing ability)
7	Snow
8*	Showers (affecting hearing ability) *Do not conduct survey

Appendix 2, continued.

Pine Barrens Treefrog Call Survey Datasheet

Property Name: _____ Route ID _____ Survey Date: _____
 Survey Run: _____

<i>RUN INFORMATION</i>	Start	Finish
Overall Time (Military)		
# days since last rainfall		

Observer Name(s): _____

Page 1 of _____

<i>SITE INFORMATION</i> (note: number of sites subject to vary according to survey)										
Site Name or ID #	Start Time (Military)	Air Temp (°F)	Wind code	Sky code	Moon or moonlight visible? (Y/N)	Number of cars that passed by:	Noise a factor? (Y/N)	Timeout required? (Y/N)	Calling Index (see codes)	Notes