

**A Species Action Plan for the
Florida Pine Snake
*Pituophis melanoleucus mugitus***

**Final Draft
November 1, 2013**



Florida Fish and Wildlife Conservation Commission
620 South Meridian Street
Tallahassee, FL 32399-1600
Visit us at MyFWC.com

FLORIDA PINE SNAKE ACTION PLAN TEAM

Team Leader: Clinton Smith, Division of Habitat and Species Conservation (formerly)

Team Members: Anna Farmer, Fish and Wildlife Research Institute
Tom Ostertag, Division of Habitat and Species Conservation

Acknowledgements: Laura Barrett, Division of Habitat and Species Conservation
Claire Sunquist Blunden, Office of Policy and Accountability
Kevin Enge, Fish and Wildlife Research Institute
Brie Ochoa, Division of Habitat and Species Conservation
William M. Turner, Division of Habitat and Species Conservation
(formerly)
Brian Beneke, Fish and Wildlife Research Institute

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EXECUTIVE SUMMARY

The Florida pine snake (*Pituophis melanoleucus mugitus*) is a relatively large snake that lives in close association with gopher tortoises (*Gopherus polyphemus*) in xeric (well-drained), upland habitats throughout Florida. Although there have been no recent surveys, this species may be declining in parts of its range and in some parts of the state. This plan addresses known threats to the species and the need for further investigation of potential threats to the species, as well as gaps in our understanding of species life history and ecology.

Based on the biological review group (BRG) findings, input from peer reviewers, and information received from the public, the Florida Fish and Wildlife Conservation Commission (FWC) recommended the Florida pine snake be removed from the Species of Special Concern list and be listed as Threatened on the Florida Endangered and Threatened Species List.

The goal of this plan is to maintain or improve the conservation status of the Florida pine snake to the point that the species is secure within its historic range and no longer needs to be listed. Conservation objectives are to: 1) maintain and increase the amount of habitat for Florida pine snakes in the state, 2) fill data gaps in our understanding of the species and identify and address factors causing population declines, 3) determine and track the statewide population status, and 5) encourage public understanding of the species and support for conservation actions.

Much about the biology and ecology of this species is unknown, so achieving the conservation objectives will require substantial research and monitoring efforts by the FWC and cooperating agencies on both public and private lands. Priority actions proposed are to increase the amount of protected Florida pine snake habitat, increase the amount of appropriately managed Florida pine snake habitat on public and private lands, fill data gaps in Florida pine snake life history, initiate studies to determine the status of the species and of Southeastern pocket gophers (*Geomys pinetus*) in the state, reevaluate the habitat suitability model for the Florida pine snake, conduct a statewide genetic study, conduct a study to evaluate the impacts of translocation on Florida pine snake movement and behavior, and provide outreach to increase public support for species conservation.

This plan details the actions necessary to improve the conservation status of the Florida pine snake. 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. This level of involvement and support is also critical to the successful implementation of the ISMP. Any significant changes to this plan will be made with the continued involvement of stakeholders.

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GLOSSARY OF TERMS AND ACRONYMS

Amelanistic: Individuals of a species that lack dark skin pigment.

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 IUCN Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1).

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, F.A.C. These criteria, based on IUCN criteria and IUCN guidelines, are used to help decide if a species should be added or removed from the Florida Endangered and Threatened Species List. In addition, FWC staff may provide within the report a biologically justified opinion that differs from the criteria-based finding.

CCA: Candidate Conservation Agreement, a voluntary agreement between the U.S. Fish and Wildlife Service and one or more parties to address the conservation needs of one or more candidate species, or species likely to become candidates in the near future, for federal listing under the Endangered Species Act

CCAA: Candidate Conservation Agreement with Assurances, a voluntary agreement between the U.S. Fish and Wildlife Service and a private party that allows a property owner to voluntarily implement conservation measures on lands that benefit the species in the agreement, while providing regulatory assurances to the landowner should the species become federally listed under the Endangered Species Act.

Commensal: An organism living in a relationship in which one animal derives food, refuge, or other benefits from another animal without hurting or helping the other animal.

ESA: Federal Endangered Species Act of 1974

F.A.C.: Florida Administrative Code. The Department of State's Administrative Code, Register and Laws Section is the filing point for rules promulgated by state regulatory agencies. Agency rulemaking is governed by Chapter 120, Florida Statutes, and the Administrative Procedures Act. Rules are published in the Florida Administrative Code.

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

Fossorial: Reference to habits or structural adaptations related to burrowing, digging, or subterranean life beneath ground vegetation or substratum.

GLOSSARY OF TERMS AND ACRONYMS

FNAI: The 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.

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

FWCG: Florida Wildlife Conservation Guide

GIS: Geographic Information System

HCP: Habitat Conservation Plan, planning documents that are developed during the application process for an incidental take permit for a federally listed species. These plans outline the effects of anticipated future impact and proposed actions to be undertaken to minimize and mitigate such impacts.

Intergrade: An individual produced by the interbreeding of closely related species or subspecies in the wild.

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 provide a global index of the state of change of biodiversity.

LAP: Landowner Assistance Program, a federal cost-share program administered in Florida by the Florida Fish and Wildlife Conservation Commission.

NGO: Non-Governmental Organization

SDM: Species Distribution Models. A GIS-based analysis that combines species occurrence locations and environmental parameters, such as landcover type, to determine habitat associations for that species.

SSC: Species of Special Concern. Protected under 68A-27.005, F.A.C., which declares that "no person shall take, possess, transport, or sell any species of special concern included in this subsection or parts thereof or their nests or eggs except as authorized by permit from the executive director, permits being issued upon reasonable conclusion that the permitted activity will not be detrimental to the survival potential of the species. For purposes of this section, the definition of the word take in Rule 68A-1.004, F.A.C., applies."

GLOSSARY OF TERMS AND ACRONYMS

Take: As defined in 68A-27.001(4), F.A.C. “To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct.”

USFWS: United States Fish and Wildlife Service, the federal agency mandated to protect and manage the nation’s native wildlife resources.

INTRODUCTION

Life history of the Florida pine snake is summarized in this section; for more detailed information on the biology and conservation status, see the [Biological Status Review \(BSR\)](#).

Biological Background

Taxonomy

There are currently 3 recognized subspecies of the pine snake in the southeastern United States; 2 of these occur in Florida. The Florida pine snake (*Pituophis melanoleucus mugitus*; Barbour 1921) is found east of the Escambia River, whereas pine snakes west of the river are intergrades between the Florida pine snake and the black pine snake (*Pituophis melanoleucus lodingi*; Blanchard 1924; Franz 1992, Crother 2008).

Identification

The Florida pine snake is a large, non-venomous snake with dark brown to reddish blotches on a gray to sandy-colored background ([Figure 1](#)). The scales on the upper part of the body are strongly keeled (ridged), and the anal scale is undivided. The head and snout are distinctly cone-shaped and adapted for burrowing ([Figure 2](#)) (Franz 1992). Florida pine snakes range in length from 380 to 610 mm (15 to 24 in) at hatching and 122 to 168 cm (48 to 66 in) as adults, with a maximum recorded length of 228.6 cm (90 in) (Conant and Collins 1998, Hipes et al. 2000). Newly hatched Florida pine snakes resemble adults, but their patterns are often brighter and bolder ([Figure 3](#); Tuberville and Mason 2008, Miller et al. 2009). These snakes are well known for their impressive defensive displays, which include hissing loudly, inflating the body, vibrating the tail noisily against leaf litter, raising the front of the body, and even striking with the mouth closed or partially open



Figure 1. Juvenile Florida pine snake, head close-up. Photograph by Kevin Enge, FWC.



Figure 2. Adult Florida pine snake. Photograph by Kevin Enge, FWC.

(Tuberville and Mason 2008). The loud hiss is produced by the exhaled air being passed over a flap of tissue that stretches across the air opening in the mouth (Ashton and Ashton 1981). In Florida, the only other snake species that will emit “hissing” noises are the southern and eastern hognose snakes (*Heterodon* sp.). These species are easily distinguished from the Florida pine snake by their shorter length (51 to 84 cm [20 to 33 in] for *H. platirhinos* and 36 to 51 cm [14 to 20 in] for *H. simus*) and by having an upturned snout (Conant and Collins 1998, Tennant 2003).

Habitat and Life History

Florida pine snakes occupy a variety of upland habitats, but seem to prefer dry habitats with a moderate to open canopy cover and well-drained sandy soils (Franz 1992, Hipes et al. 2000, Ernst and Ernst 2003). The most common natural habitat of Florida pine snakes is sandhill (Figure 4), but they are found in other natural communities including: scrub, xeric hammock, scrubby flatwoods, mesic pine flatwoods, and dry prairie with dry soils, old fields, and pastures (Figure 5 and Figure 6; Allen and Neill 1952, Enge 1997, Ernst and Ernst 2003, Franz 2005). Altered fire regimes in sandhill and resulting hardwood encroachment presumably create less favorable habitat conditions for the species (FWC 2011). Florida pine snakes can tolerate degraded habitats (to some degree) but may not use habitats where succession has led to closed-canopy forests (Hipes et al. 2000).



Figure 3. Juvenile Florida pine snake. Photograph by Kevin Enge, FWC.



Figure 4. Example of Florida pine snake sandhill habitat at Eglin Air Force Base, Okaloosa County. Photograph by Dan Hipes, Florida Natural Areas Inventory (FNAI).

Florida pine snakes are active from March through October but show the greatest activity in May, June, July, and October when they move more frequently and travel farther distances (Franz 1992). Miller (2008) estimated average home range size to be 70.1 ha (173 ac) for males and 37.5 ha (93 ac) for females in southern Georgia. These home range estimates were similar to home range estimates found by Franz (1986) in northern Florida. Eggs are usually laid from June to August, and hatching occurs in September and October (Franz 1992, Hipes et al. 2000). Although nesting has not been observed, wild pine snake females are believed to nest inside the burrows of other animals (Lee 1967, Franz 2005).



Figure 5. Example of Florida pine snake scrub habitat at Lake June-in-Winter State Park, Highlands County. Photograph by Dan Hipes, FNAI.

Florida pine snakes can spend 70% to 80% of their time in underground refuges (Franz 1992, Miller 2008). Pine snakes use refuges to forage, nest, and escape adverse weather conditions or fire. In Florida, Georgia, and South Carolina, Florida pine snakes primarily use pocket gopher (*Geomys pinetus*) burrows as refuges. However, areas where pocket gophers are absent can support populations of the species. Florida pine snakes will also use stump holes, gopher tortoise burrows, and the burrows of nine-banded armadillos (*Dasypus novemcinctus*) and mice (Franz 1992, Hipes et al. 2000, Franz 2005, Miller 2008).



Figure 6. Example of Florida pine snake xeric hammock habitat at Lake Wales Ridge State Forest, Polk County. Photograph by Gary E. Schultz (FNAI).

Florida pine snake prey consist of ground-dwelling birds and their eggs, mice, pocket gophers, immature rabbits, woodrats (*Neotoma floridana*), and other small mammals (Franz 1992). Predators known to prey on the species include short-tailed shrews (*Blarina brevicauda*), raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), red foxes (*Vulpes vulpes*), dogs (*Canis lupus familiaris*) and cats (*Felis catus*). Scarlet snakes (*Cemophora coccinea*) are known to eat their eggs (Burger et al. 1992, Ernst and Ernst 2003).

Geographic Distribution

The Florida pine snake is restricted to the Atlantic and Gulf Coastal Plains, from southeastern South Carolina to South Florida, and west to Mobile Bay, Alabama (Jordan 1998). In Florida, this species historically occurred throughout the state except for the Everglades and the Florida Keys (Figure 7). Museum records indicate the distribution of this snake in South Florida is patchy (Franz 1992).

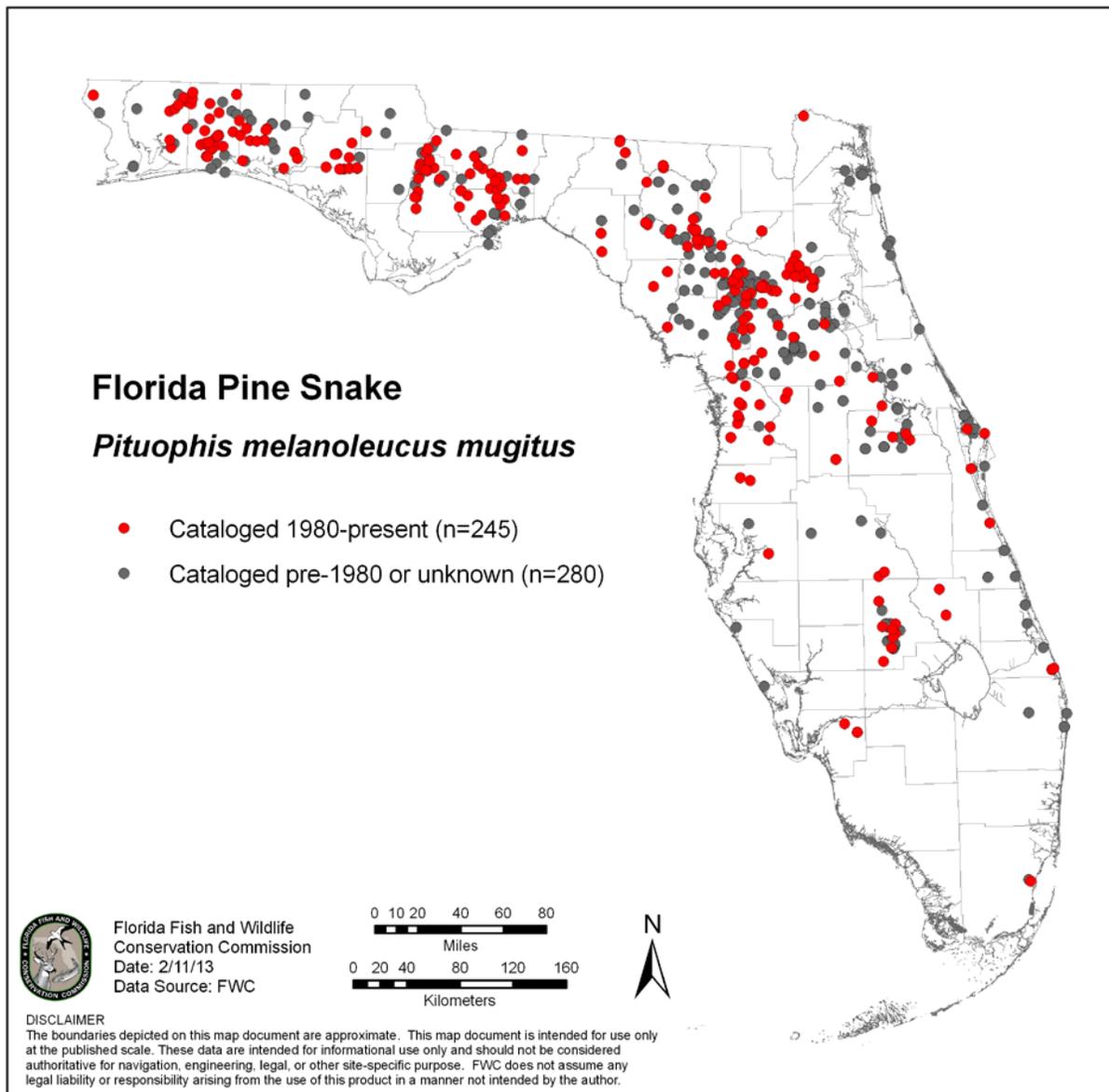


Figure 7. Cataloged voucher specimens and unverified records of Florida pine snake (*Pituophis melanoleucus mugitus*) from pre-1980 and 1980 to the present in Florida. Specific localities are from Krysko et al. (2011).

Conservation History

The pine snake (*Pituophis melanoleucus*) is classified as a species of “Least Concern” on the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (Hammerson 2007). Currently, the Florida pine snake subspecies is considered uncommon to rare and possibly in decline over most of its range (Franz 1992, Miller et al. 2009). In 1985, the Florida Game and Fresh Water Fish Commission (predecessor of the FWC) listed the Florida pine snake as a Species of Special Concern (SSC). This status made it illegal to take, possess, transport, or sell these snakes or their parts, nests, or eggs except as authorized by permit issued by the FWC (68A-27.005, F.A.C.). Possession of a single Florida pine snake without a permit is allowed (68A-25.002(10), F.A.C.); however, albino or amelanistic specimens can be possessed without limit.

Efforts to protect the gopher tortoise in Florida have undoubtedly benefitted the Florida pine snake. The take of gopher tortoises has been regulated in Florida since 1972. The Gopher Tortoise Management Plan was initially approved by the FWC in 2007 and revisions to the plan were approved in 2012. This plan lists conservation actions for both gopher tortoises and commensals including the Florida pine snake (FWC 2012) (see [Appendix 1](#)). Currently, both gopher tortoises and their burrows are protected, and a state permitting system provides for the relocation of tortoises from development sites and for the mitigation of tortoise habitat lost to development. An interim policy for commensal species relocation currently limits relocations to on-site movements only, until the effects of translocations on commensal species are studied. In 2008, many entities including the Department of Defense, U.S. Forest Service, U.S. Fish and Wildlife Service, FWC, Georgia Department of Natural Resources, South Carolina Department of Natural Resources, Alabama Division of Wildlife and Freshwater Fisheries, tribal organizations, and several non-governmental organizations (NGOs) entered into a Candidate Conservation Agreement (CCA) for the gopher tortoise in order to coordinate and implement range-wide conservation activities. This CCA is expected to continue or improve protections for the species.

The Florida pine snake has also benefitted from state efforts to protect and restore xeric uplands. State land acquisition programs such as Preservation 2000 and Florida Forever have greatly increased the acres of conservation land over the past 2 decades. Currently, Florida has over 3.7 million ha (9.3 million ac) of non-submerged public conservation lands (FNAI 2012). Statewide, numerous public and private land managers are actively engaged in the restoration of natural habitats. According to a recent report on state lands management, state land managers completed restoration projects on over 18,000 ha (45,000 ac) between 2010 and 2012 (Land Management Uniform Accounting Council 2012). In addition to work on public lands, several state and federal programs assist private landowners with habitat restoration, including the FWC’s Landowner Assistance Program, the Florida Forest Service’s (FFS) Forest Stewardship Program, the U.S. Fish and Wildlife Service’s Partners for Fish and Wildlife Program, and multiple U.S. Department of Agriculture Natural Resources Conservation Service programs. Several organizations (the Florida Department of Environmental Protection, FFS, The Nature Conservancy, and the Longleaf Alliance) also currently operate “fire strike teams” in Florida. These teams provide additional trained personnel and equipment for assisting land managers with prescribed fire and other habitat restoration activities. Efforts to re-establish longleaf pine (*Pinus palustris*) forests and restore degraded longleaf pine habitats such as the America’s

Longleaf Restoration Initiative will also improve and increase the amount of habitat available for Florida pine snakes.

Threats and Recommended Listing Status

Threats

The Florida pine snake prefers fire-maintained, dry habitats with a moderate to open canopy cover and well-drained sandy soils (Franz 1992, Hipes et al. 2000, Ernst and Ernst 2003). Because of this habitat specificity, the major threat to the species is loss and degradation of habitat caused by conversion to other uses (e.g., development, agricultural use, and mining) and insufficient management (e.g., fire suppression) (Hipes et al. 2000, FWC 2011).

Florida has experienced significant losses in sandhill and scrub habitat (Kautz et al. 1993, Enge et al. 2003). This loss is suspected to be among the main sources of Florida pine snake population declines (Franz 1992, Hipes et al. 2000). Further habitat loss may lead to increased isolation of remaining Florida pine snakes as populations become separated by roads and unsuitable habitat.

Because the Florida pine snake is dependent on underground refuges, it is vulnerable to the loss or decline of burrowing species. It has been estimated that gopher tortoise populations in Florida have declined 50 to 60% over the past 60 to 93 years (Enge et al. 2006). Pocket gopher populations are also suspected to be declining throughout in Alabama, Georgia and Florida (Georgia Department of Natural Resources 2008, Miller et al. 2008). These declines could be significant as pocket gopher burrows are preferentially used for shelter and foraging by Florida pine snakes in some parts of the state (Ashton and Ashton 1981, Franz 1992, Franz 2005). Forestry-related practices (e.g., stump removal, root raking, and soil compaction from heavy equipment operating on site) could be eliminating Florida pine snake habitat as this species and many others use stump holes, rotting root canals, and other animal burrows as underground refuges (Means 2005).

Florida pine snakes are also preyed upon by a wide range of species. Some predators benefit from close association with people (e.g., raccoons), which may increase the threat of predation to this species as habitats become fragmented and natural areas are increasingly interspersed with developed areas. Florida pine snakes are large, slow-moving snakes and likely experience significant road mortality. This species is also killed by humans and their domestic pets (FWC 2011).

Recommended Listing Status

In 2010, the FWC directed staff to evaluate the status of all species listed as 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 Florida pine snake. The FWC convened a BRG of experts on the species to assess its biological status using criteria specified in Rule 68A-27.001, F.A.C. This rule required the BRGs to follow the Guidelines for Application of the IUCN Red List Criteria at Regional Levels (Version 3.0) and Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1). The BRG developed a draft biological status review (BSR) report that included a preliminary

listing recommendation. The FWC distributed the draft BSR for peer review and the reviewers' input was incorporated in a [final report](#).

The BRG concluded that the Florida pine snake met at least 1 listing criterion (a population size reduction of at least 30% projected or suspected to be met within the next 3 generations). The BRG projected a population size reduction of at least 30% in Florida pine snake populations within the next 3 generations (24 years) based upon: a projected 32% increase in Florida's human population by 2035, only 24% of the species' potential habitat being on public conservation lands, altered fire regimes on public and private lands, a continuing backlog of fire-suppressed habitats, suspected population declines in pocket gopher populations, and the species' susceptibility to habitat fragmentation and residential development (i.e., mortality from vehicles, landowners, and pets). After careful consideration and deliberation, FWC staff did not agree that the information supported a 30% projected decline in Florida pine snake populations over the next 24 years and initially recommended the species not be listed as a Threatened species. However, only 1 of 4 peer reviewers agreed with the staff recommendation to delist the species. Taking into account the BRG findings, peer reviews, and the uncertainty involved in projecting a population size reduction, FWC staff recommended that the Florida pine snake be listed as Threatened on the Florida Endangered and Threatened Species List.

CONSERVATION GOALS AND OBJECTIVES

Goal

The conservation status of the Florida pine snake is improved to a point that the species can be removed from the Florida Endangered and Threatened Species List and will not again need to be listed.

Objectives

I. Maintain and increase the amount of habitat for Florida pine snakes in the state.

Rationale

This objective addresses Criterion A 3, in the BSR findings. According to the BSR, this species is projected to decline by more than 30% over the next 24 years due to loss of habitat and habitat fragmentation, altered fire regimes (changes in the interval, season, or intensity of natural fire disturbance) on public and private lands, and pocket gopher declines. Efforts are needed to offset habitat losses by protecting additional habitat for this species. Only 24% of potential habitat is on public conservation lands and Florida's population is expected to grow by 31.8% in the next 25 years (Zwick and Carr 2006). Upland habitats required by the Florida pine snake are also in demand for development. These snakes will experience significant declines unless habitat loss and fragmentation are offset by providing additional suitable habitat through land acquisition, the restoration of degraded public and private lands, and improving habitat management on natural public and private lands.

II. Fill data gaps in our understanding of the species and identify and address factors causing population declines.

Rationale

Some aspects of Florida pine snake ecology are unknown or not well understood. In addition, there is poor understanding of the potential impacts of threats such as habitat fragmentation, gopher tortoise and pocket gopher declines, non-native species, and forestry management practices. Further research is needed to better understand the basic life history requirements and conservation needs of this species.

III. Determine and monitor the status of Florida pine snake populations.

Rationale

There have been no recent surveys of populations in Florida, so the status of this species in the state is unknown. In addition, no systematic monitoring program has been established to track the status of this species over time. If an effective survey method can be developed, surveys are needed to establish baseline population information, and a regular monitoring program should be developed for this species.

CONSERVATION GOALS AND OBJECTIVES

IV. Encourage public understanding of the species and support for conservation actions.

Rationale

The Florida pine snake is a secretive, fossorial species that is rarely encountered in the wild. Habitat fragmentation and increased urbanization are leading to more human interactions with this and other snake species. Education and outreach on the natural history and ecological importance of the Florida pine snake and other snakes can increase public awareness and support for the conservation of this species.

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

The Florida pine snake is a wide-ranging species that requires large, intact tracts of xeric upland habitat. This species has experienced severe habitat loss in Florida since European settlement and much of its remaining habitat is not protected (FWC 2011). Habitat protection and appropriate habitat management, including managing existing high-quality habitat and restoring degraded areas, are critical to ensuring that healthy populations persist in Florida. Florida pine snakes inhabit a wide range of fire-dependent communities. While the habitat requirements of the species are only roughly understood, they appear to have habitat preferences similar to gopher tortoises. Florida pine snakes are a fossorial species that are dependent on the presence of a variety of underground refuges including pocket gopher burrows, gopher tortoise burrows, and stump holes. Management practices that reduce the availability of underground refuges (such as stump removal) should be avoided when managing for this species.

Action 1 Increase the amount of Florida pine snake habitat that is protected.

According to a geographic information system (GIS) analysis of potential habitat, only 24% of the potential habitat for this species within the state is on public conservation lands (FWC 2011). Florida's population is projected to increase significantly over the next 25 years (Zwick and Carr 2006). In addition, displacement of some of Florida's coastal residents is predicted to occur in the future due to sea level rise (Misra et al. 2011), which may drive patterns of increased development in xeric areas as displaced coastal residents move inland. Due to the sensitivity of this species to residential development and habitat fragmentation, it may experience future declines if additional habitat is not protected and managed. However, the direct purchase of additional public lands for this species may be quite difficult as state funding for land acquisition has been cut significantly in recent years. Given the current funding constraints, this plan encourages the use of less-than-fee simple acquisitions (conservation easements) and other habitat protection measures, such as land use agreements and partnerships between governmental agencies and private landowners, to protect additional lands for this species. Coordination will continue to be necessary with federal agencies, the state Acquisition and Restoration Council, non-governmental organizations, local governments, and internally with FWC programs (Gopher Tortoise Management) to help prioritize land acquisition projects and promote other habitat protection measures (conservation easements, land use agreements) to protect upland communities important to the Florida pine snake.

Home range size estimates averaged 59.2 ha (146 ac) in southern Georgia (Miller 2008) and were similar to home range size estimates from Franz (1992). These studies are based on small sample sizes but represent the best available information for determining the size of areas for acquisition and protection. Public and private lands for consideration should be large tracts of xeric uplands of sufficient size to support at least 50 individuals (>3,000 ha [7,413 ac]) and be

connected to other potential habitat (Miller 2008). Habitat type and quality should also be a factor for consideration in the acquisition and protection process. Lands that include sandhill habitat should be given priority, while other potential habitat types (i.e., scrub, xeric hammock, scrubby flatwoods, mesic pine flatwoods and dry prairie with dry soils, old fields, and pastures) should also receive consideration.

Action 2 Increase the amount of Florida pine snake habitat on public and private lands that is appropriately managed with fire.

Although Florida pine snakes will use xeric hammocks, they are less common in upland habitats degraded through fire suppression or unnatural fire regimes. We define appropriate fire management as fire management that is at the right interval, season, and intensity to mimic natural processes within a natural community. In general, appropriate fire management can be found at [FNAI's Guide to the Natural Communities of Florida 2010 Edition](#) for each natural community the species utilizes (FNAI 2010).

Potential strategies for implementing this action include supporting existing and forming new prescribed fire strike teams to assist public and private land managers, coordinating with other land managing agencies to provide any needed equipment and assistance for prescribed fire or restoration activities to return fire function, and providing training and other forms of support for private landowners who wish to manage their lands with prescribed fire.

Action 3 Increase restoration efforts on degraded upland habitats on public and private lands such that natural plant communities and functions are restored.

Florida pine snakes are relatively large snakes that require large territories. Active restoration of degraded habitat on public and private lands will increase the amount of available habitat for Florida pine snakes in the state. Although specific habitat requirements of the Florida pine snake are poorly understood, these snakes are strongly associated with gopher tortoises whose habitat requirements are a useful substitute for setting restoration targets. Potential strategies for implementing this action include supporting the restoration of native vegetation on degraded lands, hardwood reduction in overgrown habitats using chemical and mechanical methods, pine thinning, invasive species removal, and decreasing habitat fragmentation by eliminating or reducing roads within Florida pine snake habitat.

Population Management

No population management actions are recommended at this time for the Florida pine snake. Important data gaps still exist in our understanding of Florida pine snake populations, life history, and potential threats. These data gaps will be addressed by the monitoring and research actions in the following section. Should these research and monitoring actions uncover threats to the species that require specific management actions, those actions will be included in future revisions of this plan.

Monitoring and Research

The Florida pine snake has not been intensively studied, and some of the information needed to ensure the conservation of the species is lacking. In addition, the potential impacts of some

threats to the species are unknown and require further investigation. The following actions are critical to understanding the requirements of the species and for implementing science-based species management. Results from research will help guide and refine conservation strategies for the species and future versions of this plan.

Action 4 Fill data gaps in Florida pine snake life history.

Although some aspects of the life history of the Florida pine snake are known, considerable gaps in our knowledge still exist, including:

- Information on species reproduction, including nesting behavior and location
- Habitat requirements in different natural communities
- Diet and refuge use in areas without pocket gophers
- Relationships between species densities and gopher tortoise and pocket gopher abundance
- Impact of habitat fragmentation and patch size on population
- Population demographic parameters (i.e., productivity, survivorship and mortality rates)

Much of this information will be challenging to study given current survey techniques (e.g., drift fence array sampling) and the secretive nature of this animal, but gathering additional information on life history and population dynamics will lead to a better understanding of the species and enable the development of more refined conservation strategies.

Action 5 Determine the status of the Florida pine snake on public and private lands.

Currently, our understanding of the status of this species is based on anecdotal evidence, as there have been no quantitative studies to determine the status and trend of the species statewide. Florida pine snakes are secretive animals that spend most of their time underground, which makes it difficult to determine their abundance or even presence in any given area. This makes it challenging to design studies that can evaluate the status of pine snake populations. Species experts and other partners should collaborate to design and implement studies to determine the status of this species statewide. Potential strategies include soliciting recent sightings from public land managers and others knowledgeable about this species, intensive trapping on specific areas of interest, conducting road surveys and the collection and identification of road-killed snakes, timed searches of areas with appropriate habitat, and requiring information on species encounters from FWC-issued scientific collecting and gopher tortoise relocation permits (Action 10).

Action 6 Complete a statewide genetic study of the Florida pine snake.

The analysis of genetic material can provide information on the health and long-term viability of wild populations by measuring the amount of genetic diversity in populations and the connectivity and gene flow between populations (identifying any potentially isolated populations). Genetic studies can also provide guidance for species management by determining the genetic relationships of populations across a landscape and determining the presence of genetically distinct populations that may require special management in order to preserve species diversity. Unfortunately, the secretive nature of the Florida pine snake makes it challenging to collect the number of genetic samples required to do an informative genetic study. Genetic

samples from the species should be collected from across the state. If enough genetic samples are gathered, a genetic analysis should be conducted to determine the number of genetically distinct populations within the state and the degree of gene flow among them. If possible, genetic indicators of population health (genetic diversity, degree of inbreeding) should also be examined.

Action 7 Reevaluate the habitat suitability model for the Florida pine snake and revise it, if necessary.

Cox and Kautz (2000) created a GIS-based model to determine the amount and location of suitable habitat for the Florida pine snake in the state. This habitat model combined data on the statewide coverage of natural communities used by Florida pine snakes with soil data. Although the authors used information on Florida pine snake home ranges and potential densities to interpret their results, they did not incorporate criteria on patch size into the model to determine the total amount of habitat statewide that could support viable populations. Because an accurate habitat model is necessary to inform conservation actions, this model should be reevaluated and revised if necessary.

Action 8 Determine the status of the Southeastern pocket gopher in Florida.

Where they occur together, Southeastern pocket gophers (*Geomys pinetus*) are a major source of food and provide underground burrows for the Florida pine snake (Figure 8), although Florida pine snakes do occur in areas of Florida without pocket gophers. Pocket gopher population declines may be negatively impacting Florida pine snake populations through loss of prey and underground refuges. A study should be conducted to determine the status of pocket gophers statewide. Where possible, pocket gopher studies should be conducted in conjunction with Florida pine snake surveys (Action 5) in order to determine the relationship between pocket gopher abundance and Florida pine snake presence or densities (Action 4).



Figure 8. Pocket gopher (*Geomys pinetus*) mounds and tunnels in a Florida sandhill habitat. Photograph by Terry J. Doonan, FWC.

Action 9 Evaluate the impacts of translocation on Florida pine snake movement and behavior.

In 2012, the Gopher Tortoise Management Plan interim policy for commensal species relocation limited relocations to on-site only (FWC 2012) (see Appendix 1). This is a temporary policy until the effects of translocations between commensal species are studied. In order to inform FWC policy, radio-telemetry studies are needed to determine the effects of translocation on the survival, movement, and behavior of Florida pine snakes.

Rule and Permitting Intent

Protections and Regulations

Florida pine snakes are protected under 68A-25.002(10), F.A.C., which prohibits their commercial sale and limits the possession to 1 individual except for albino and amelanistic specimens. The Florida pine snake is also protected under 68A-27.007(a), F.A.C., which prohibits the take, possession, or sale of any Endangered or Threatened species, their parts, their eggs, and their nests. These protections are necessary and should be continued to prevent over-collection and unsustainable take of this species.

Although this species is secretive and fossorial in nature, Florida pine snakes can be regularly encountered on roads and in natural habitats where they occur in high densities. Over-collecting by snake enthusiasts has been suspected in past Florida declines (Franz 1992, Hipes et al. 2000). In addition, Florida pine snakes are large, slow-moving snakes that are susceptible to high road mortality and are regularly killed in residential areas due to a general public fear of snakes.

The provision for the possession of albino and amelanistic specimens (68A-25.002[10], F.A.C.) should be continued because albino and amelanistic animals are primarily produced through captive breeding and are rare in natural populations.

Permitting Structure

All permitted activities should be carefully considered to prevent further population declines. In recognition of the poor understanding of the taxonomy of this species, we recommend that tissue samples be taken when researchers encounter the species and that those tissue samples be provided to the FWC ([Action 6](#)).

Intentional Take for Conservation or Research Purposes

Having a scientifically informed listing process requires that researchers be able to take species when necessary. Even the gentlest methods might be considered harassment when the animals are handled or their movements impeded. Rule 68A-27.007, F.A.C., Permits and Authorizations for the Take of Florida Endangered or Threatened Species, provides factors for consideration of permit issuance for scientific or conservation purposes. These criteria are sufficient for permit issuance to further conservation while mitigating potentially threatening activities.

In order to compile additional data regarding Florida pine snake abundance and distribution, a condition should be added to scientific collecting and gopher tortoise relocation permits issued within the species' range that requires the notification of the FWC when the snakes are encountered. Existing permit conditions should be clarified to require the permittee to report specific information including date, location (including global positioning system [GPS] coordinates if possible), and habitat type information to the FWC. Permit conditions also should require that, if incidental mortality occurs, specimens be provided for genetic studies. This would allow the FWC to gather additional data on Florida pine snake populations and further achievement of the conservation goal, objective, and actions outlined in this plan.

Action 10 Revise scientific collection permit conditions to provide relevant data on Florida pine snake captures and mortality.

Law Enforcement

Action 11 Develop and implement a training program for FWC law enforcement officers about identification, rules and regulations pertaining to Florida’s protected snake species.

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. The FWC law enforcement officers are vital to the success of achieving the goals and objectives of this plan because they both ensure the enforcement of conservation laws and educate the public on how to identify and report violations. The FWC will provide adequate training to FWC law enforcement officers to ensure that they are able to accurately identify Florida’s protected snake species, are aware of all applicable rules and regulations pertaining to these species, and are able to explain to the public the ecological importance of Florida’s snakes.

Incentives and Influencing

Action 12 Encourage other agencies and private landowners to incorporate Florida pine snakes into management strategies.

Florida pine snake habitat occurs on multiple public and private lands. The Florida pine snake should be incorporated into habitat management on these lands as it will be critical to the long-term survival of the species in Florida. Technical, and in some cases, financial assistance should be provided to land managers who conduct wildlife management practices on their lands ([Action 13](#), [Action 14](#), and [Action 15](#)). Lands in need of restoration for these snakes and land managers who are willing to conduct restoration activities need to be identified.

As discussed in the Habitat Conservation and Management section, private lands will play an important role in achieving the goals and objectives for Florida pine snake conservation in Florida. Conservation-based incentives provide a way to engage more private landowners in conservation activities that benefit the Florida pine snake and other wildlife. These incentives typically consist of financial payments, regulatory assurance, or both, which help further the goals and objectives of species conservation plans. Landowners can also take advantage of incentives from the FWC’s [Gopher Tortoise Management Plan](#), as the Florida pine snake is a commensal species identified in that plan.

Action 13 Provide private landowners with incentives to conduct beneficial land management activities for Florida pine snakes.

Because a substantial amount of Florida pine snake habitat occurs on private lands, supporting and encouraging appropriate habitat management on these lands will be critical to the long-term survival of the species in Florida ([Action 12](#)). The FWC’s Landowner Assistance Program and Gopher Tortoise Program can provide technical and financial assistance to private landowners who conduct wildlife management practices on their lands. Private lands in need of restoration for Florida pine snakes and private landowners who are willing to conduct these restoration activities need to be identified.

County growth management plans and land development regulations provide an opportunity for the FWC to inform and influence land and water uses relevant to the conservation of Florida's fish and wildlife, including state-listed species. The BSR and this plan identify threats to the Florida pine snake that warrant state-listing, as well as specific permitting recommendations that specify means to avoid, minimize, or mitigate activities associated with the threats to the species. To that end, the FWC offers conservation planning services to local governments during growth management plan amendments and associated development proposals are being considered.

To promote incentives and technical assistance opportunities available to landowners, the FWC typically provides information to local governments regarding species management plans, permitting options and incentive programs that are available to landowners, applicants, developers, and the public. However, a county may not require as a condition of processing a development permit that an applicant obtain a permit or approval from any other state or federal agency unless the agency has issued a notice of intent to deny the federal or state permit before the county action on the local development permit.

The [Florida Wildlife Conservation Guide](#) (FWCG) is an online resource that facilitates effective land use planning, project design, and the management of natural communities, with a focus on wildlife conservation. Developed by the FWC in partnership with the U.S. Fish and Wildlife Service and the Florida Natural Areas Inventory, its purpose is to provide an easily accessible repository of wildlife life history, habitat management, and conservation options. The FWCG aims to provide a common platform of ecologically based wildlife information based on best available scientific information. As a dynamic resource, it is maintained with current guidelines and recommendations for wildlife management and protection, and includes numerous links to relevant external sources of information. The FWCG will have the specific information related to the Florida pine snake and necessary conservation measures that are developed.

Action 14 Coordinate and implement Habitat Conservation Plans (HCPs) and Candidate Conservation Agreements with Assurances (CCAAs) as appropriate to benefit the conservation of the Florida pine snake and provide incentives to interested landowners.

Because the U.S. Fish and Wildlife Service was recently petitioned to list the Florida pine snake as a federally Threatened species, HCPs and CCAAs may provide incentives for private landowners to conduct activities that benefit the species on private lands. Habitat Conservation Plans are planning documents that are developed during the application process for an incidental take permit for a federally listed species. These plans outline the effects of anticipated future impact and proposed actions to be undertaken to minimize and mitigate such impacts. Habitat Conservation Plans can apply to both listed and non-listed species, including those that are candidates or have been proposed for listing. Candidate Conservation Agreement with Assurances are proactive, voluntary agreements between the USFWS and a private party that allows a property owner to voluntarily implement conservation measures on lands that benefit the species in the agreement, while providing regulatory assurances to the landowner should the species become federally listed under the ESA. The FWC should work cooperatively with landowners and the USFWS to determine if HCPs and CCAAs are useful tools for furthering the conservation of Florida pine snakes in Florida.

Education and Outreach

Education and outreach are necessary to increase the public’s knowledge and concern for this secretive species. Citizens who are well-informed regarding the merits of an imperiled species and the habitat that supports such species can make better decisions and can support sound conservation measures to secure those species’ continued survival. Both formal and informal settings can serve as opportunities to inform Floridians about native species in their state. Education and outreach will also help address the threats of road mortality and human persecution, which are important threats to the Florida pine snake and other snake species in Florida ([Action 15](#)).

Action 15 Create and distribute outreach materials that provide information on the identification, distribution, biology, and threats to the species, including road mortality and human persecution.

Since it is a fossorial species, the Florida pine snake is seldom seen and not well understood by the public. Education and outreach will inform the public about this snake and engage them in efforts to conserve it. A species profile, including photos and distribution maps, is currently located on the [FWC Imperiled Species](#) webpage, and the FWC managed species website for gopher tortoises has similar information with [printable fact sheets](#). Because road mortality and human persecution are major threats to this and other upland snake species, FWC staff should prepare additional outreach materials that provide information about the ecological importance of snakes and the negative impacts of road mortality and human persecution on Florida’s snake species. Potential outreach materials include bumper stickers, fact sheets or pamphlets, postings on social media and on the FWC website, and press releases.

Coordination with Other Entities

Florida pine snakes inhabit lands that are managed by multiple public agencies, non-profit organizations, and private individuals and organizations. Coordination and partnership with both public and private land managers will be necessary when developing land management strategies ([Action 12](#)), in implementing habitat conservation measures ([Action 16](#)) and research and monitoring activities ([Actions 4 through 9](#)) described in the previous sections of this plan. In addition, Florida has numerous academic institutions and researchers capable of assisting with the research and monitoring activities described in this plan ([Action 17](#)).

Action 16 Coordinate with partner agencies when developing land management strategies and implementing habitat conservation measures for Florida pine snakes.

Because Florida pine snake habitat occurs on various private and public lands, supporting and encouraging appropriate habitat management on these lands will be critical to the long-term survival of the species ([Action 12](#), [Action 13](#)). It is necessary to coordinate and identify partner agencies that conduct wildlife management practices on their lands in need of restoration for Florida pine snakes and assist them in conducting restoration activities. The FWC’s Landowner Assistance Program administers internal cost-share programs or assists other agencies with the application of several landowner incentive programs that may be useful in achieving the goals and objectives outlined in this plan. Among these are the Forest Stewardship Program, Wildlife Habitat Incentives Program, Environmental Quality Incentives Program, and Partners for Fish and Wildlife Program.

Action 17 Coordinate and partner with academic institutions and researchers to assist with research and monitoring activities.

Actions involving research and monitoring ([Actions 4 through 9](#)) will require coordination and partnership with academic institutions and researchers at various institutions.

Table 1. Florida Pine Snake (*Pituophis melanoleucus mugitus*) 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	Increase the amount of Florida pine snake habitat that is protected.	Habitat Conservation & Mgmt	EXPANDED	NO	YES	\$100k+	Legislature, Existing budget	HSC (SCP, LAP)	ARC, TNC, Local governments, Private landowners	High. Only 24% of the suitable habitat for this species within the state is on public conservation lands, and the habitat of this species is in demand for development. This action will help insure that the necessary habitat is available for this species.	Low/Medium. The feasibility of this action will depend on the funding/incentives available for the long-term protection of identified lands. Funds for state land protection have been scarce in recent years.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
1	1	2	Increase the amount of Florida pine snake habitat on public and private lands that is appropriately managed with fire.	Habitat Conservation & Mgmt	EXPANDED	NO	YES	\$100k+	Legislature, Existing budget, Grant, Unknown	HSC (WHM, SCP, LAP, Legacy)	USFWS, DOD, USFS, DEP, FFS, USACE, TNC, Local governments, Private landowners	High. Increasing the amount of uplands that are appropriately burned will increase the amount of habitat suitable for this species.	Feasible. FWC and other partners have programs in place to complete this action, but substantial funding will be needed.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
1	2	3	Increase restoration efforts on degraded upland habitats on public and private lands such that natural plant communities and functions are restored.	Habitat Conservation & Mgmt	EXPANDED	NO	YES	\$100k+	Legislature, Existing budget, Grant, Unknown	HSC (WHM, SCP, LAP, Legacy)	USFWS, DOD, USFS, DEP, FFS, USACE, TNC, Local governments, Private landowners	High. Restoring uplands will increase the amount of habitat suitable for this species.	Feasible. FWC and other partners have programs in place to complete this action, but substantial funding will be needed.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
2	2	4	Fill data gaps in Florida pine snake life history.	Monitoring & Research	NEW	YES	NO	TBD	Existing budget, Grant, Unknown	FWRI	Universities	Medium/High. Gathering additional information on life history and population dynamics will lead to a better understanding of the species and enable the development of more refined conservation strategies.	Feasible. FWC has existing relationships and programs in place to complete this action, but substantial funding will be required.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
3	1	5	Determine the status of the Florida pine snake on public and private lands.	Monitoring & Research	ONGOING	YES	NO	TBD	Existing budget, Grant, Unknown	FWRI	FWRI began an effort to determine the status of this species in Fall 2013. External partners include various public and private landowners.	High. Surveys will enable FWC staff to determine the status of the species and evaluate whether additional management actions are needed.	Difficult. Pine snakes are secretive animals that spend the majority of their time underground, which makes it difficult to determine their abundance or even presence in any given area.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
2,3	3	6	Complete a statewide genetic study of the Florida pine snake.	Monitoring & Research	NEW	YES	YES	\$25-50k	Grant, Unknown	FWRI	Universities	High. This action can provide a wealth of information on the health and long-term viability of wild populations.	Feasible. FWC and other partners have the expertise to carry out this action, but it may be difficult to collect the number of samples needed in a reasonable time frame. Additional funding will also be needed.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
2	2	7	Reevaluate the habitat suitability model for the Florida pine snake and revise it, if necessary.	Monitoring & Research	NEW	YES	YES	\$0-25k	Existing budget, Grant, Unknown	FWRI, HSC	NA	High. An accurate habitat model will provide information on the location and amount of suitable habitat in the state.	Highly Feasible. FWC has the resources to accomplish this action, although some additional funding may be needed.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.

Table 1. Florida Pine Snake (*Pituophis melanoleucus mugitus*) 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?
2	3	8	Determine the status of the Southeastern pocket gopher in Florida.	Monitoring & Research	NEW	YES	NO	TBD	Grant, Unknown	FWRI	Universities	Medium. This action will provide important information about an important prey species of the pine snake, but pine snakes are not completely dependent on pocket gophers or their burrows.	Feasible. FWC and other partners have the expertise to carry out this action, but additional funding will be needed.	NO; Immediate survival is not under threat, however this action will provide information about a potential threat to the species.
2	2	9	Evaluate the impacts of translocation on Florida pine snake movement and behavior.	Monitoring & Research	NEW	YES	YES	TBD	Legislature, Existing budget, Grant, Unknown	FWRI, HSC	Universities	Medium/High. Effectiveness will depend on the number of individuals that can be collected when translocation is allowed to continue.	Difficult. Pine snakes are secretive animals that spend the majority of their time underground, which will make it difficult to collect significant numbers needed in a reasonable time frame. Additional funding will also be needed.	NO; Immediate survival is not under threat, however this action will provide information about a potential threat to the species.
2	3	10	Revise scientific collection permit conditions to provide relevant data on Florida pine snake captures and mortality.	Protections & Permitting	EXPANDED	YES	YES	\$0-25k	Existing budget	SCP	NA	Low/Medium. Effectiveness depends on the willingness of permittees to comply. Compliance will need to be enforced by permitting staff.	Feasible. FWC can modify the permit process to complete this action.	No; this action will not directly affect the survival of the species but will increase our understanding of the species.
4	1	11	Develop and implement a training program for FWC law enforcement officers about identification, rules and regulations pertaining to Florida's protected snake species.	Law Enforcement	EXPANDED	YES	YES	\$0-25k	Existing budget, Unknown	SCP, LE	NA	Medium/High. Since Florida has a large number of snake species, effectiveness will depend on the quality of the training and instruction materials provided.	Feasible. FWC staff have the knowledge to provide training for FWC law enforcement officers.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
1	2	12	Encourage other agencies and private landowners to incorporate Florida pine snakes into management strategies.	Incentives & Influencing	NEW	NO	YES	TBD	Legislature, Existing budget, Grant, Unknown	HSC, LAP	USFWS, DOD, USFS, DEP, FFS, USACE, TNC, Local governments, Private landowners	Low/Medium. Effectiveness will depend on the willingness of other agencies and private landowners to implement management strategies.	Feasible. FWC has existing relationships and programs in place to complete this action.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
1	2	13	Provide private landowners with incentives to conduct beneficial land management activities for Florida pine snakes.	Incentives & Influencing	EXPANDED	NO	YES	TBD	Legislature, Existing budget, Grant, Unknown	HSC, LAP	USFWS, USDA, Private landowners	Low/Medium. Effectiveness will depend on funding availability and the willingness of private landowners to participate.	Feasible. FWC has existing relationships and programs in place to complete this action, but additional funding will be needed.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
1	3	14	Coordinate and implement Habitat Conservation Plans (HCPs) and Candidate Conservation Agreements with Assurances (CCAAs) as appropriate to benefit the conservation of the Florida pine snake and provide incentives to interested landowners.	Incentives & Influencing	EXPANDED	NO	YES	TBD	Legislature, Existing budget, Grant, Unknown	HSC	USFWS, private landowners	Low/Medium. Effectiveness will depend on the willingness of private landowners to participate.	Feasible. FWC has existing relationships and programs in place to complete this action.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
4	4	15	Create and distribute outreach materials that provide information on the identification, distribution, biology, and threats to the species, including road mortality and human persecution.	Education & Outreach	EXPANDED	YES	YES	TBD	Existing budget, Unknown	SCP, OCR	IFAS	Low. The pine snake is a secretive, uncharismatic species that is unlikely to garner significant public support.	Highly feasible. FWC already has programs in place to conduct this action. Additional funding may be required to create printed outreach materials.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.

Table 1. Florida Pine Snake (*Pituophis melanoleucus mugitus*) 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?
1	4	16	Coordinate with partner agencies when developing land management strategies and implementing habitat conservation measures for Florida pine snakes.	Coordination with Other Entities	EXPANDED	NO	YES	TBD	Legislature, Existing budget, Grant, Unknown	HSC	USFWS, DOD, USFS, DEP, FFS, USACE, TNC, Local governments, Private landowners	Low/Medium. Effectiveness will depend on the willingness of other agencies to implement management strategies.	Feasible. FWC has existing relationships and programs in place to complete this action.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.
2, 3	4	17	Coordinate and partner with academic institutions and researchers to assist with research and monitoring activities.	Coordination with Other Entities	EXPANDED	NO	YES	TBD	Legislature, Existing budget, Grant, Unknown	HSC	Universities	Medium. Working with others outside the agency will increase the amount of information that can be collected on this species.	Feasible. FWC has existing relationships and programs in place to complete this action.	NO; Immediate survival is not under threat, however this action will be beneficial to the long-term survival of this species.

Acronyms used in this table:

- ARC: Amphibian and Reptile Conservation
- CCCA: Candidate Conservation Agreement with Assurances
- DEP: Florida Department of Environmental Protection
- DOACS: Florida Department of Agricultural and Consumer Services
- DOD: Department of Defense
- FFS: Florida Forest Service
- FWC: Florida Fish and Wildlife Conservation Commission
- FWRI: Fish and Wildlife Research Institute, the research branch of the Florida Fish and Wildlife Conservation Commission
- HCP: Habitat Conservation Plan
- HCSS: Habitat Conservation Scientific Services, part of the Landowner Assistance Program Special Initiative of the Florida Fish and Wildlife Conservation Commission
- HSC: Habitat and Species Conservation, a Division of the Florida Fish and Wildlife Conservation Commission
- IFAS: Institute of Food and Agricultural Sciences, a program administered by the University of Florida
- LAP: Landowner Assistance Program
- LE: Law enforcement
- NRCS: National Resource Conservation Service
- OCR: Office of Community Relations, administered by the Florida Fish and Wildlife Conservation Commission
- SCP: Species Conservation Planning, a Section of the Florida Fish and Wildlife Conservation Commission's Division of Habitat and Species Conservation
- TNC: The Nature Conservancy
- USACE: United States Army Corps of Engineers
- USDA: United States Department of Agriculture
- USFS: United States Forest Service
- USFWS: United States Fish and Wildlife Service
- 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. Excerpts pertinent to the Florida pine snake from the [Gopher Tortoise Management Plan](#).*Commensal Ecology*

Although Florida pine snakes are not known to prey on gopher tortoises, they will use tortoise burrows. Studies have shown that Florida pine snakes can spend up to 70% to 80% of their time underground (Franz 1992, Miller 2008) where they forage, nest, and escape adverse weather conditions or fire. In Florida, Georgia, and South Carolina, Florida pine snakes primarily use pocket gopher burrows as underground refuge, but also use stump holes, and gopher tortoise and other animal burrows (Franz 1992, Hipes et al. 2000).

Considerations for Limited Relocation of Florida pine snake

Limited relocation may be authorized by the FWC in concert with permitted gopher tortoise relocation activities and specified on the gopher tortoise relocation permit. This is because Florida pine snakes may be encountered during site surveys, excavation of gopher tortoise burrows, or capture of tortoises. Snakes should be enclosed in a cloth bag (1 snake per container) such as a pillow case or similar “snake bag” constructed for that purpose. Alternatively, snakes may be picked up with a rake or stick and dropped into a plastic garbage can with a secure lid. Snakes in bags can be placed in the same type container used for a gopher tortoise (without the gopher tortoise) and maintained under the same conditions as the tortoises until release. Snakes should be released with gopher tortoises and will make their own way to suitable cover.

Florida pine snakes have relatively large home ranges and use a variety of upland habitats, so they will require large, diverse recipient sites. Males have an average home range of 70.1 ha (173 ac) and females of 37.5 ha (93 ac) (Miller 2008). Because of negative impacts from fragmentation (reduction in large, continuous natural areas by roads, cities, rivers, or other barriers), Florida pine snakes should be moved to sites with as little fragmentation as possible. Florida pine snakes should not be relocated to reclaimed sites unless a sufficient onsite prey base can be verified.

Conservation and Research Actions*Determine and implement effective methods for surveying Florida pine snake populations on areas where gopher tortoises are found.*

Due to the Florida pine snake’s fossorial nature, actual numbers of the current population and the degree of genetic flow among subpopulations remain poorly known. Florida pine snakes occupy large home ranges; but as a result of habitat loss and fragmentation, populations or subpopulations in poor habitat could be in decline. Before relocation or population augmentation is used as a possible management tool, a better understanding of population numbers and genetics is needed.

Identify habitat characteristics that influence Florida pine snakes densities.

If relocation becomes a viable conservation strategy, identification of important habitat characteristics could be used to determine potential relocation sites able to support Florida pine snake populations.

Develop effective relocation strategies and guidelines for Florida pine snakes.

At this time, relocation guidance has not been developed for the Florida pine snake. Research is necessary to determine if relocation is appropriate. If experimental relocations indicate that relocation is a viable strategy for this species, further research should be conducted to determine the most effective relocation method for pine snakes.

Monitor relocated Florida pine snakes to assess their survivorship and behavior and also impacts on recipient populations.

Currently, there are no guidelines for relocating Florida pine snakes. Additionally, if Florida pine snakes are relocated, monitoring will be needed to assess the survivorship and behavior of relocated individuals to determine the success of the relocations. Information about impacts on recipient populations is also lacking.

Evaluate disease susceptibility, transmission risk factors, and disease mitigation strategies for relocating Florida pine snakes.

Assess the disease status of Florida pine snake populations in Florida to determine if relocation poses a disease transmission risk and, if necessary, develop a protocol for accommodating diseased snakes.

Interim guidance for limited relocation of Florida pine snakes based on post-development site characteristics.

If a gopher tortoise burrow will be impacted from development activities and *some habitat will remain on-site or adjacent habitat is available* then any incidentally captured pine snake should be released on site or allowed to escape unharmed if some habitat will remain post-development activities.

If a gopher tortoise burrow will be impacted or destroyed from development activities and no habitat will remain then any incidentally captured pine snake should be allowed to escape unharmed or donated to a facility for educational or research purposes (permit required for receiving facility).