



Department of Defense Legacy Resource Management Program

Recommended Best Management Practices
for the
Florida Pinesnake (*Pituophis melanoleucus mugitus*)
on
Department of Defense Installations
Department of Defense Partners in Amphibian and Reptile Conservation



February 2022

Introduction

The Florida Pinesnake (*Pituophis melanoleucus mugitus*), one of three subspecies of *P. melanoleucus*, is considered an at-risk species that has been petitioned for listing and is currently 'Under Review' by the U.S. Fish and Wildlife Service (USFWS). The Department of Defense (DoD), through its Partners in Amphibian and Reptile Conservation (PARC) network, and the USFWS, have developed these Best Management Practices (BMPs) for the Florida Pinesnake. The management practices described in this document were developed specifically for DoD installations, but are also suitable for implementation throughout the range of this species.

These BMPs are intended as guidelines for resource managers to plan, prioritize, and implement management actions for the conservation benefit to the Florida Pinesnake, while also providing information to comply with regulatory processes such as Environmental Protection Agency's National Environmental Policy Act (NEPA) and associated components (i.e., Environmental Assessments and Environmental Impact Statements). Implementation of these BMP guidelines should support military readiness activities, be documented in installation Integrated Natural Resource Management Plans (INRMPs), and should align with existing efforts among the DoD, federal/state agencies, and non-governmental organizations to prevent this species' decline and preclude further ESA listing.

Species Profile

Description: The dorsal pattern is brown to reddish blotches on a gray to sandy-colored background (Figure 1, 2, and 3). Pigmentation varies, and specimens from Florida are often lighter in color than those in the northern part of the range. Scales on the upper part of the body are keeled (ridge down the middle). Hatchlings range in total length from 15 to 24 inches (380 to 610 mm) and adults are typically 48 to 66 inches (122 to 168 cm) (Conant and Collins 1998, Hipes et al. 2000).



Figure 1. Adult Florida Pinesnake, south Alabama



Figure 2. Adult Florida Pinesnake, south Florida



Figure 3. Hatchling Florida Pinesnake, north Florida

Unlike the Gopher Tortoise (*Gopherus polyphemus*), Southeastern Pocket Gopher (*Geomys pinetis*), and Red-cockaded Woodpecker (*Picoides borealis*), with which it often shares habitat, the Florida Pinesnake is a cryptic species, meaning it can be difficult to detect even when using standardized survey techniques in occupied habitat. Burrows of Florida Pinesnake are often overlooked, and their pattern makes them difficult to spot except when in the open.

Range: The Florida Pinesnake occurs in the Gulf and Atlantic coastal plains in portions of four states: southeastern Alabama, southern Georgia, all but portions of southern Florida, and southern South Carolina (Figure 4).

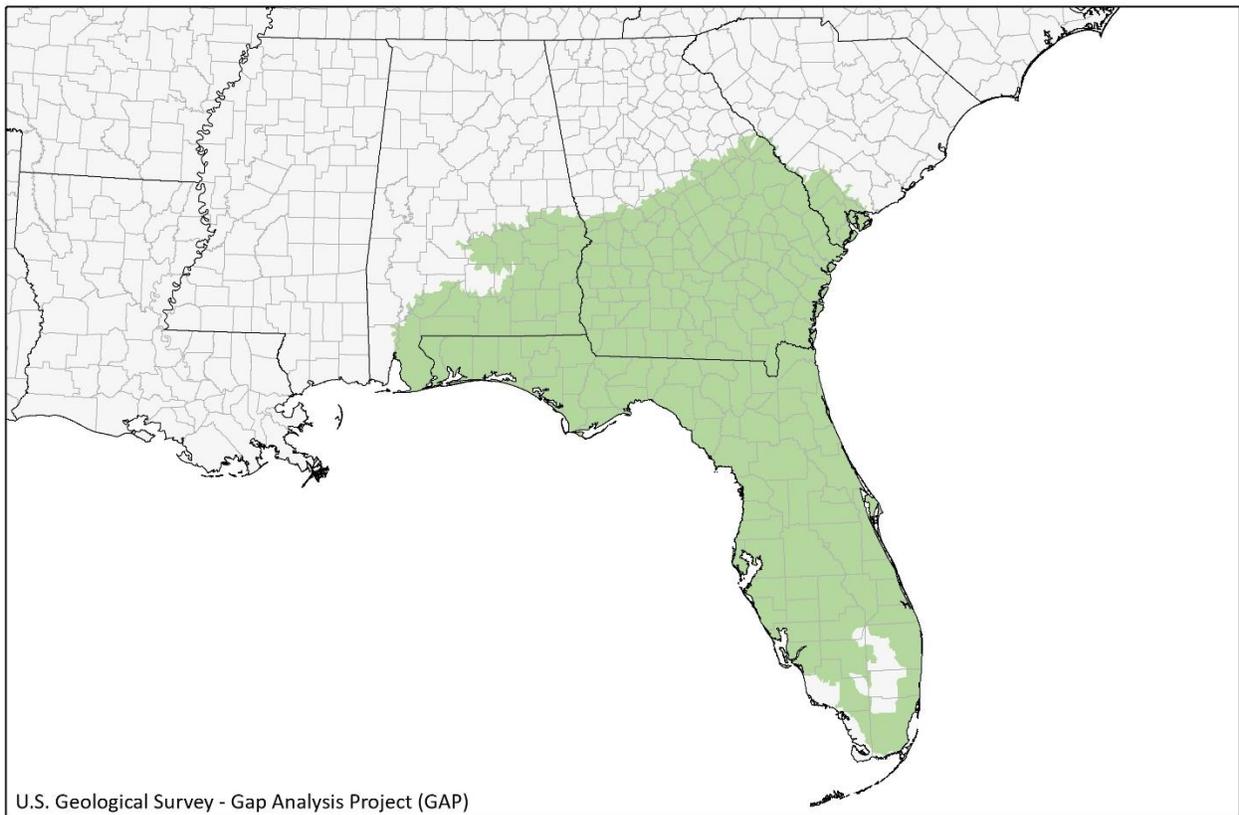


Figure 4. Approximate range of the Florida Pinesnake. U.S. Geological Survey (USGS) - Gap Analysis Project (GAP), 2018, Florida Pinesnake (*Gopherus polyphemus*) rGOTOx_CONUS_2001v1 Range Map: <https://doi.org/10.5066/F7XS5TCP>.

Distribution on Military Sites: The Florida Pinesnake is confirmed present on the following 8 military sites:

- Air Force: Avon Park Air Force Range (FL); Cape Canaveral Air Force Station (FL); Eglin Air Force Base (FL)
- Army/Army National Guard: Fort Benning (AL/GA); Fort Gordon (GA); Fort Rucker (AL); Fort Stewart (GA); Camp Blanding Joint Training Center (FL)

The Florida Pinesnake is considered unconfirmed, but potentially present on the following military sites. For these particular sites, specimens have been found in the same county, but not within the boundaries of the installation:

- Air Force: Hurlburt Field (FL); Joint Base Charleston - Weapons Station (SC)
- Marine Corps: MCAS Beaufort (SC); Townsend Bombing Range (GA); MCLB Albany (GA)

Navy: Naval Support Activity Orlando - Bugg Spring Facility (FL); NAVSUBASE Kings Bay (GA)

Habitat: Florida Pinesnakes occur primarily in natural habitats with well-drained sandy soils, including upland pine (*Pinus* sp.) forests and sandhills, but they are also found in scrubby flatwoods, oak (*Quercus* sp.) scrub, dry oak forests, old fields, and agricultural borders (Franz 1992). Vegetation characteristics considered suitable are 35 to 43% canopy cover; 13 to 21% bare sand; 50 to 60% leaf litter; 8 to 12% woody debris; 4 to 6% ground cover, and approximately 25% herbaceous and grass cover (Miller 2008, Morin 2005). Although Florida Pinesnakes may occur in habitats lacking Gopher Tortoises and Southeastern Pocket Gophers, presence of either is a good indicator of potential presence of the snakes.

Behavior: Florida Pinesnakes spend most of their time in underground refuges such as stump holes, Gopher Tortoise burrows, and mammal burrows, especially—where they occur—those of Southeastern Pocket Gophers. They are most active in spring and early summer, and again in early autumn (Franz 1986). Florida Pinesnakes are seldom on the surface in the heat of mid-late summer or the cold of winter. They are most active during the day as they forage for food, seek mates, and bask in the sun. Florida Pinesnakes are adapted for burrowing and use their enlarged rostral scales (the scale at the tip of the snout) and spade-like heads to burrow into existing underground retreats or to construct their own.

When approached or handled, Florida Pinesnakes exhibit impressive defensive displays, including hissing loudly and noisily vibrating the tail in leaf litter. This behavior, combined with their color pattern and size, sometimes results in them being confused with the venomous Eastern Diamondback Rattlesnake (*Crotalus adamanteus*), which may occur in the same habitats.

Florida Pinesnakes forage both above and below ground. They constrict their prey, which

includes rodents, rabbits, ground-nesting birds, and their eggs.

Breeding takes place in spring and early summer. Male Florida Pinesnakes have home ranges as large as 400 acres (Miller 2008; Miller et al. 2016) that may overlap the home ranges of multiple females. Females lay from four to eight eggs in a stump hole, burrow, or specially excavated egg chamber, and hatching occurs approximately two months later.

Threats: Threats to Florida Pinesnakes include 1) direct persecution (deliberate killing), 2) fragmentation of habitat by roads, which results in road mortality as well as reproductive isolation; 3) habitat destruction or degradation, including conversion of open longleaf pine (*Pinus palustris*) woodlands to other silvicultural or agricultural use, stump removal, and shrub and midstory encroachment from insufficient fire, 4) establishment and spread of invasive species, 5) snake fungal disease caused by the pathogen *Ophidiomyces ophiodiicola* (Allender et al. 2020), and 6) unsustainable collection as pets.

Conservation Status

The Florida Pinesnake is a species of conservation concern because of significant declines across its range, and thus it is currently considered to be of conservation need by the USFWS in each of the states in which it occurs. It is designated as a Species of Greatest Conservation Need (SGCN) in each of the states in which it occurs. It was petitioned for federal listing in 2012 and placed on the USFWS National Workplan for Federal Fiscal Year 2022. Currently, the USFWS is conducting a Species Status Assessment for the species, which will provide the science used in making a final decision regarding its federal status.

Recommended Conservation Implementation Strategies and Best Management Practices for Florida Pinesnakes on Military Sites

In general, light mechanical vegetation cutting/removal, troop movements, and weapons firing are compatible with Florida Pinesnake conservation. Activities involving vehicular traffic or heavy equipment (especially spring and fall) and/or digging (year-round) have potential to be harmful. Implementation of some habitat management practices can be performed when the snakes are not active to reduce negative impacts. Document performance of any of the following BMPs, whether current or future, in your installation's INRMP. The USFWS may consider these proactive conservation actions prior to making a listing determination for this species.

1. **Identify potential habitat and document any individual occurrences.** Develop a Geographic Information System (GIS) layer of potential habitat (open forested areas on sandy soils, especially those with Southeastern Pocket Gopher mounds and Gopher Tortoise burrows). Also document any known occurrences of Florida Pinesnakes on the installation. State Natural Heritage data can be accessed for historic records, as well as more recent crowdsourced and validated data, such as iNaturalist and HerpMapper, that may exist. As targeted surveys of this highly cryptic species are labor-intensive and often not effective unless deployed for months (Stevenson et al. 2016), it may suffice to rely on

opportunistic encounters (animals crossing roads or found in the field) by encouraging field personnel (including contractors) to submit observations and photographs of any animals encountered, and the Global Positioning System (GPS) coordinates (latitude/longitude) at which they were encountered. Such images can be confirmed by experts should there be any doubt regarding species identification. A few more targeted methods of documenting Florida Pinesnakes include the installation of motion-controlled cameras at suitable sites such as the entrances to Gopher Tortoise burrows or stump holes, and the insertion of a video camera down these structures to attempt to determine whether a pinesnake is inside.

2. **Maintain large blocks of properly managed habitat.** Florida Pinesnakes require large intact tracts of properly managed uplands, thus actions that result in the loss, degradation or fragmentation of those lands may impair or disrupt essential behavioral patterns (Hipes et al. 2000). Activities that may degrade or fragment habitat include exclusion of fire, land clearing, development, and road widening or improvement.
3. **Manage for underground refugia.** Because Gopher Tortoise and mammal burrows, stump holes, and other underground refugia are essential for Florida Pinesnake nesting and sheltering, activities such as stump removal, tortoise burrow excavation, subsurface root raking, and soil compaction from heavy equipment have the potential to harm pinesnakes (Diemer and Moler 1982, Means 2005, Smith et al. 2015, Andelt and Case 2016). Avoid or minimize soil compaction, especially in areas where Southeastern Pocket Gophers or Gopher Tortoises are present. DoD PARC has developed a companion set of more detailed BMPs for the Gopher Tortoise that should be followed if that species is present.
4. **Use prescribed fire to maintain habitat.** Land management for Florida Pinesnakes should maintain diverse herbaceous ground cover and open, sunlit areas. Habitat in good condition usually can be maintained using prescribed fire on a regular basis (i.e., every one to three years). Growing season (April-June) burns are recommended, but if conditions are not suitable during the growing season for a scheduled burn, maintain the frequency of the fire return interval by applying a dormant season burn rather than waiting for the following growing season. Current silvicultural standards for Gopher Tortoise and Red-cockaded Woodpecker management on installations are consistent with requirements for Florida Pinesnake habitat maintenance. Use existing roads and trails as fire breaks whenever possible, but if disking/plowing fire lanes is required, avoid disturbing soil below three inches.
5. **Where needed, use thinning and/or herbicide to improve and maintain habitat.** In cases where excessive tree and shrub canopy cannot be reduced by prescribed fire alone, mechanical thinning or other mechanical and/or herbicidal treatments may be required. Thinning opens the canopy and creates conditions more suitable to the safe application of prescribed fire. Other mechanical techniques that may be appropriate for certain sites include chopping, mulching, and mowing. Herbicides can also be used to reduce shrub and hardwood densities. Individual stems can be selectively killed by basal bark spraying or stem injection (“hack-n-squirt”). If herbicides are used, it is important to select a

chemical that has the desired effect on shrubs and hardwoods, but does not significantly harm native, herbaceous ground cover.

6. **Control and/or eradicate invasive non-native species.** Cogongrass (*Imperata cylindrica*) is probably the single most invasive non-native plant species that changes the physical habitat structure and adversely impacts Florida Pinesnakes. Other invasive plants that may impact pinesnake habitat include, but are not restricted to, Mimosa or Chinese Silktree (*Albizia julibrissin*), Shrub Lespedeza (*Lepedeza bicolor*), Centipede Grass (*Eremochloa ophiuroides*), and Natal Grass (*Melinis repens*). Problematic invasive non-native animal species include red imported fire ants (*Solenopsis invicta*) and feral hogs (*Sus scrofa*). The best procedures for controlling invasive species are those that both effectively limit their proliferation and minimize potentially harmful impacts to native wildlife, will vary according to the species in need of control and numerous criteria specific to each installation. Therefore, consult your natural resources staff for invasive species control guidelines for your installation.
7. **Manage predator populations.** Subsidized predators are species whose populations have increased in part due to enhancement of food and habitat provided directly or indirectly by humans. Raccoon (*Procyon lotor*), fox (*Vulpes* sp.), and coyote (*Canis latrans*) are natural predators of Florida Pinesnakes and their nests. Household garbage—a source of food—should not be accessible to these animals in or near areas that potentially support Florida Pinesnakes.
8. **Develop signage and outreach tools.** Areas known or suspected to support Florida Pinesnakes can be posted as necessary with signage along roads and other human travel corridors to inform personnel about the actual or potential presence of Florida Pinesnakes and their vulnerability to military operations and other human activities. Include a contact number on signage to report observations of illegal and/or unauthorized operations and activities. Soldiers and other personnel involved in “on the ground” activities frequently lack awareness of the presence and biology of Florida Pinesnakes, their high conservation priority as a Species at Risk, and/or their vulnerability to certain training and land management practices. Although no training activities are restricted by these guidelines, soldiers and other personnel (including contractors) involved in field activities should receive training or literature on how to minimize impacts whenever practical while still accomplishing mission goals. Outreach and education materials should include Florida Pinesnake identification, the relevance of Florida Pinesnake conservation to the DoD mission, and information on how certain activities (e.g., heavy wheeled and tracked vehicle operation and mechanical digging) may directly harm Florida Pinesnakes and have potential for significant habitat damage. Fact sheets and pamphlets, like the one at <https://edis.ifas.ufl.edu/pdf/UW/UW29600.pdf>, can be shared with military and civilian personnel to inform them about this at-risk species.
9. **Prohibit the killing and poaching of Florida Pinesnakes.** The killing of Florida Pinesnakes has obvious negative impacts to populations and is an illegal activity in all states where the species occurs. Treat reports seriously and remain observant for signs of intentional killing and poaching. Wildlife enforcement officials should be contacted

immediately, and evidence provided whenever possible, of individuals poaching, observed killing, or attempting to kill or otherwise harm, a Florida Pinesnake.

Benefits of Florida Pinesnake Best Management Practices to Military Training Operations

1. Identification of occupied habitat enables military planners to consider these sensitive areas when developing and/or scheduling training and maneuvering activities.
2. Stable or expanding Florida Pinesnake populations on DoD lands may be considered by the USFWS when making decisions regarding species listing, and thus contribute towards the potential precluding of an elevated listing thereof.
3. Management of invasive species lessens the damage they may cause to training and maneuver area conditions and provide natural, realistic training environments.
4. Implementation of Florida Pinesnake BMPs benefit a wide group of at-risk species, such as the Gopher Tortoise, and support other natural resource management projects and conservation goals.

DoD PARC Points of Contact

Chris Petersen, National Representative, DoD Partners in Amphibian and Reptile Conservation
christopher.e.petersen4.civ@us.navy.mil

Robert E. Lovich, National Technical Representative, DoD Partners in Amphibian and Reptile Conservation, robert.lovich@navy.mil

Military Service Points of Contact

Contact your Military Service headquarters natural resources personnel with questions regarding Blanding's Turtle and conservation actions:

Navy: Jeff Gardner (jeffrey.a.gardner2@navy.mil; 202 685-9330)

Marine Corps: Jacque Rice (jacqueline.rice@usmc.mil; 571-256-2796)

Army: Steve Sekscienski (steven.sekscienski@us.army.mil; 571-256-9725)

Air Force: Paul Jurena (paul.jurena.1@us.af.mil; 210-925-4448)

High Priority Research Questions

Confirmation of Florida Pinesnakes at Unconfirmed Military Sites

Several DoD installations (see Distribution on Military Site above) throughout the range of the Florida Pinesnake have the potential to have populations of this species, however their presence is unconfirmed. It is recommended that surveys be conducted to confirm the presence or likely

absence of the species on those military lands. For this, the most effective survey methodology is multiple drift fence arrays coupled with funnels leading into wire mesh traps, conducted over a period of months (Stevenson et al. 2016). Brief surveys using this technique may not be effective. All trapping operations will require a scientific collecting permit, and traps should be checked daily. Burgdorf et al. (2005) contains a methodology for appropriate trap design. However, if long-term trapping is logistically prohibitive, the determination of presence/absence of Florida Pinesnakes can be attempted with far less time and effort through employment of the camera methodologies outlined at the end of the first BMP above.

Population Size and Trends

The stability of the Florida Pinesnake population on a military installation is influenced by population size (number of snakes present), demography (sex and age ratios), and population trajectory (rate of increase or decrease). Surveys that focus on population size and trends are needed on DoD sites.

Additional Sources of Information on Florida Pinesnakes

- [Florida Museum of Natural History](https://www.floridamuseum.ufl.edu/) (https://www.floridamuseum.ufl.edu/)
- [NatureServe Explorer](https://explorer.natureserve.org/) (https://explorer.natureserve.org/)
- [IUCN](https://www.iucnredlist.org/) (https://www.iucnredlist.org/)

Acknowledgements

DoD PARC thanks Mark Bailey (Conservation Southeast, Inc.) for taking the lead on writing this document. We also thank John A. Tupy and Jo Anna Emanuel of the USFWS for reviewing and providing comments on this document.

Literature Cited

- Allender, M.C., M.J. Ravesi, E. Haynes, E. Ospina., C. Petersen., C.A. Phillips (2020) Ophidiomycosis, an emerging fungal disease of snakes: Targeted surveillance on military lands and detection in the western US and Puerto Rico. PLoS ONE 15(10): e0240415. <https://doi.org/10.1371/journal.pone.0240415>
- Andelt, W. F. and R. M. Case. 2016. Managing pocket gophers. Colorado State University Fact Sheet no. 6.515.
- S.J. Burgdorf, D.C. Burgdorf, R.N. Conner, D. Saenz, and R.R. Schaefer. 2005. A successful trap design for capturing large terrestrial snakes. Herpetological Review. 36(4): 421-424.
- Conant, R. and J.T. Collins. 1998. Peterson Field Guide: A Field Guide to Reptiles and Amphibians of Eastern and Central North America, 3rd expanded ed. Boston, MA:

- Houghton Mifflin.
- Diemer, J.E. and P.E. Moler. 1982. Gopher tortoise response to site preparation in Northern Florida. Proceedings from the Annual Conference of the Southeast Association of Fish and Wildlife Agencies 36:634-637.
- Franz, R. 1986. The Florida gopher frog and the Florida pine snake as burrow associates of the gopher tortoise in northern Florida. Pages 16-20 in Jackson, D.R. and R.J. Bryant (eds.). The gopher tortoise and its community: Proceedings of the 5th Annual Meeting of the Gopher Tortoise Council, Florida State Museum, Gainesville, Florida.
- Franz, R. 1992. Florida Pine Snake, *Pituophis melanoleucus mugitus* Barbour. Pages 254-258 in Rare and Endangered Biota of Florida, Vol. III: Amphibians and reptiles, ed. P. E. Moler. Gainesville, FL: University Press of Florida.
- Hipes, D., D.R., Jackson, K. NeSmith, D. Printess, and K. Brandt. 2000. Florida pine snake *Pituophis melanoleucus mugitus*. Florida Natural Areas Inventory: Field guide to the rare animals of Florida. Walsworth Publishing Company, Brookfield, Missouri.
- Means, D.B. 2005. The value of dead tree bases and stumpholes as habitat for wildlife. Pages 74-78 in Meshaka W. E. Jr. and K. J. Babbitt, editors. Amphibians and reptiles: status and conservation in Florida. Krieger, Malabar, Florida.
- Miller, G. J. 2008. Home range size, habitat associations and refuge use of the Florida pine snake, *Pituophis melanoleucus mugitus*, in Southwest Georgia, U.S.A. Thesis, University of Florida, Gainesville.
- Miller, G. J., L. L. Smith, S. A. Johnson, and R. Franz. 2012. Home range size and habitat selection in the Florida pine snake (*Pituophis melonoleucus mugitus*). Copeia 4:706-713.
- Miller, G.J., S.A. Johnson, and L.L. Smith. 2016. The Florida Pinesnake: *Pituophis melanoleucus mugitus*. University of Florida/IFAS Extension Publication WEC 251 pp.
- Morin, K.C. 2005. Herpetofaunal responses to prescribed fire in upland pine communities of northeast Florida. Master's Thesis. University of Florida, Gainesville, Florida. 77 pp.
- Smith, L. L., M. Hinderliter, R. S. Taylor, and J.M. Howze. 2015. Recommendation for gopher tortoise burrow buffer to avoid collapse from heavy equipment. Journal of Fish and Wildlife Management 6:456-436.
- Stevenson, D.J., E.M. Schlimm, K.E. Stohlgren, and J. Heppinstall-Cymerman. 2016. 2013-2014 Georgia status surveys for the Florida pine snake (*Pituophis melanoleucus mugitus*) and the southern hognose snake (*Heterodon simus*). Unpublished report to Georgia Department of Natural Resources. 13 pp.
- Tuberville, T. D. and P. A. Mason. 2008. Pine Snake, *Pituophis melanoleucus*. Pages 388-90 in Amphibians and Reptiles of Georgia, eds. J. B. Jensen, C. D. Camp, J. W. Gibbons, and M. J. Elliott. Athens, GA: University of Georgia Press. pp. 388-90.