Technical Report SERDP-98-4
March 1998

US Army Corps of Engineers
Waterways Experiment Station

Strategic Environmental Research and Development Program

Species Profile: Southern Hognose Snake (*Heterodon simus*) on Military Installations in the Southeastern United States

by Robert A. Jordan, The Nature Conservancy

Prepared for Headquarters, U.S. Army Corps of Engineers

Strategic Environmental Research and Development Program

Technical Report SERDP-98-4
March 1998

Species Profile: Southern Hognose Snake (*Heterodon simus*) on Military Installations in the Southeastern United States

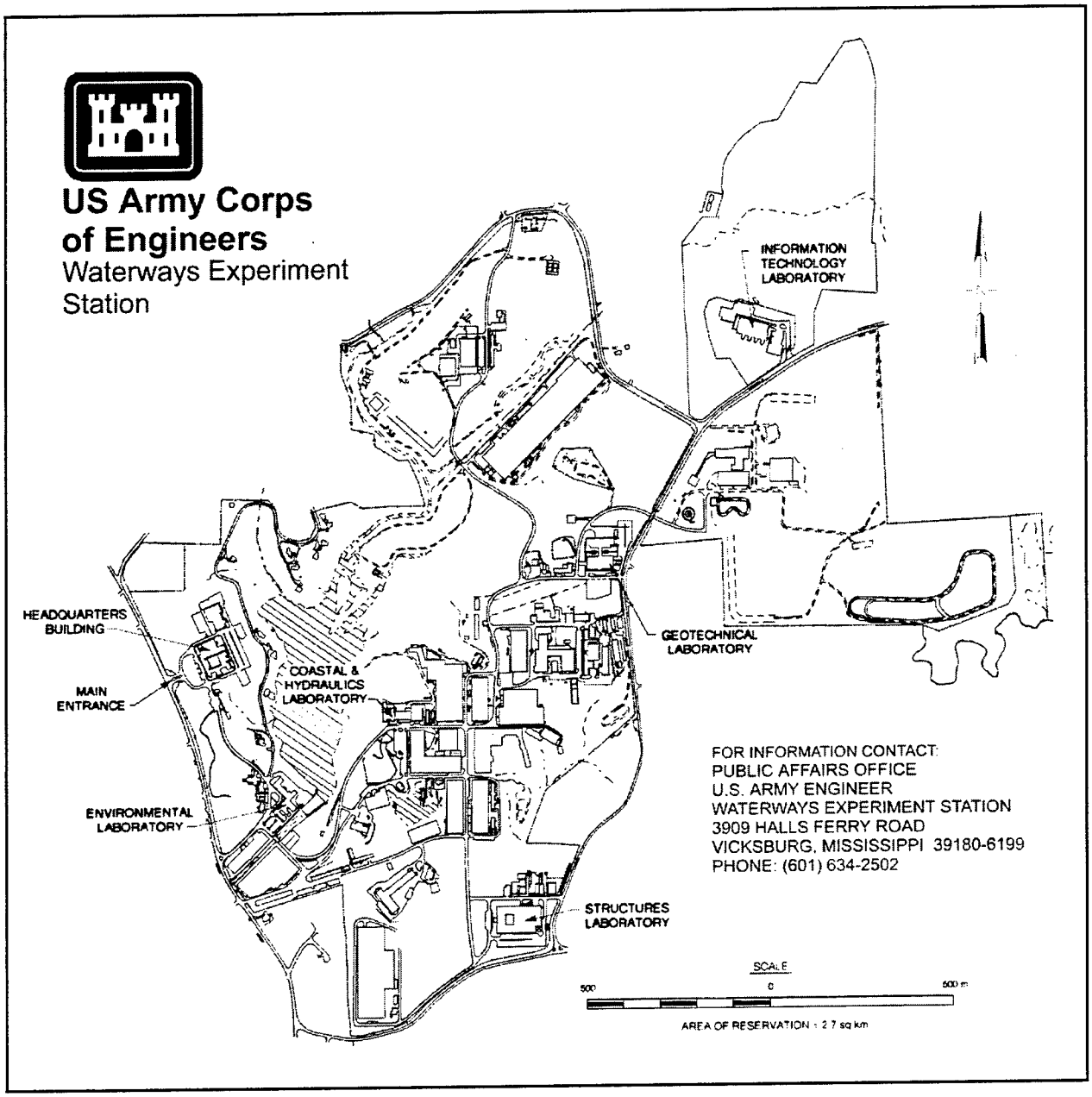
by Robert A. Jordan

The Nature Conservancy
Southeastern Regional Office
P.O. Box 2267
Chapel Hill, NC 27515-2267

Final report

Approved for public release; distribution is unlimited

Prepared for U.S. Army Corps of Engineers
Washington, DC 20314-1000



Waterways Experiment Station Cataloging-in-Publication Data

Jordan, Robert A.

Species profile : Southern Hognose snake (*Heterodon simus*) on military installations in the Southeastern United States / by Robert A. Jordan ; prepared for U.S. Army Corps of Engineers.

17 p. : ill. ; 28 cm. — (Technical report ; SERDP-98-4)

Includes bibliographic references.

1. Hognose snakes — Speciation — United States. 2. Reptiles — Speciation — United States. 3. Endangered species. I. United States. Army. Corps of Engineers. II. U.S. Army Engineer Waterways Experiment Station. III. Strategic Environmental Research and Development Program (U.S.) IV. Title. VII. Series: Technical report (U.S. Army Engineer Waterways Experiment Station) ; SERDP-98-4.

TA7 W34 no.SERDP-98-4

Preface

The work described herein was authorized by the Strategic Environmental Research and Development Program (SERDP), Washington, DC. The work was performed under the SERDP study entitled "Regional Guidelines for Managing Threatened and Endangered Species Habitats." Mr. Brad Smith was Executive Director, SERDP.

This report was prepared by Mr. Robert A. Jordan, The Nature Conservancy (TNC). Mr. Jordan is currently employed by Ducks Unlimited, Lyndhurst, NJ. Portions of this report were taken from TNC's Element Stewardship Abstract (ESA) titled "Species Stewardship Summary; *Heterodon simus*" prepared by Mr. Jordan. The original ESA was prepared under contract with the Natural Resources Division, U.S. Army Construction Engineering Research Laboratories (CERL), Champaign, IL, for a document titled "Integrated Endangered Species Management Recommendations for Army Installations in the Southeastern United States: Assessment of Army-Wide Guidelines for the Red-Cockaded Woodpecker on Associated Endangered, Threatened, and Candidate Species."

Mr. Chester O. Martin, Environmental Laboratory (EL), U.S. Army Engineer Waterways Experiment Station (WES), and Ms. Ann-Marie Trame, Land Management Laboratory, CERL, were Principal Investigators for the regional guidelines work unit. Dr. Richard A. Fischer, EL, managed and coordinated preparation of species profiles for this study. WES internal review was provided by Mr. Martin, Ms. Dena Dickerson, and Dr. Fischer, WES.

This report was prepared under the general supervision of Dr. Michael F. Passmore, Chief, Stewardship Branch, Natural Resources Divison (NRD), EL; Dr. Dave Tazik, Chief, NRD; and Dr. John Harrison, Director, EL.

At the time of publication of this report, Dr. Robert W. Whalin was Director of WES. COL Robin R. Cababa, EN, was Commander.

This report should be cited as follows:

> Jordan, R. A. (1998). "Species profile: Southern hognose snake (*Heterodon simus*) on military installations in the southeastern United States," Technical Report SERDP-98-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Species Profile: Southern Hognose Snake
(Heterodon simus)

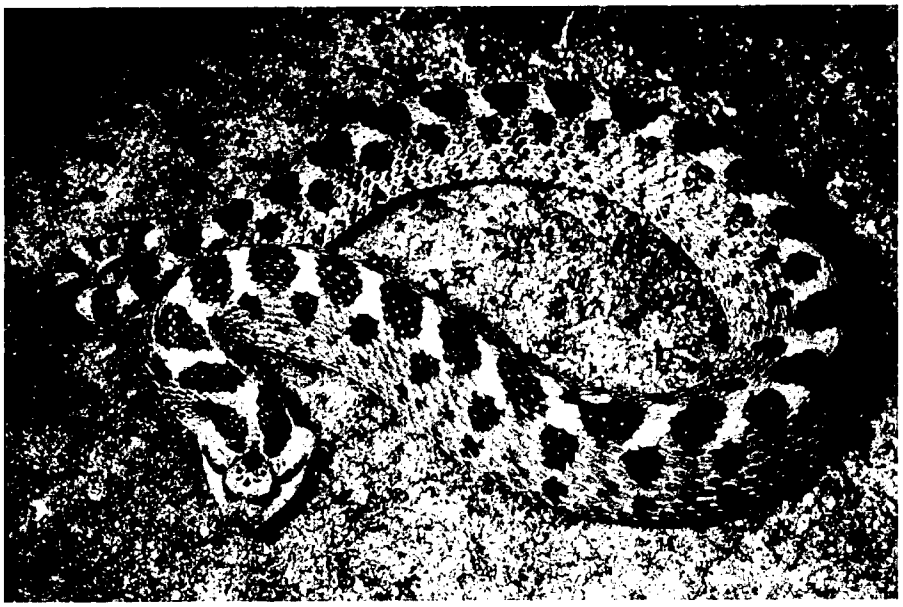


Photo by John G. Palis

Taxonomy

Class	Reptilia
Order	Squamata
Family	Colubridae
Genus/species	*Heterodon simus*

Description

The southern hognose snake is the smallest of the hognose snakes. Adult specimens typically range from 36 to 51 cm (14.2 to 22.1 in.; record 61 cm (24 in.)). The snout is sharply upturned and dorsally keeled (Figure 1). The dorsum is gray-brown to tan with three longitudinal rows of dark brown blotches outlined anteriorly and posteriorly with black. The larger middorsal blotches usually alternate with smaller lateral blotches. There is a dark brown or black stripe on either side of the neck and a short dark stripe may occur from the rear of the eye to the corner of the mouth. A dark transverse bar often occurs on the snout in front of the eyes. The venter is white, cream, or pinkish-brown with faint brownish pigment posteriorly.

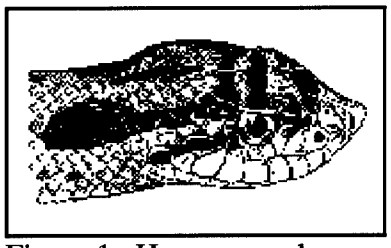


Figure 1. Hognose snakes have distinctive upturned snouts (illustration by Nancy Haver)

Dorsal scales are keeled; the scales are in 25 rows anteriorly and at midbody and 21 rows posteriorly. The anal plate is divided. There are three or more azygous (unpaired) scales separating the two internasals on the dorsal side of the head behind the rostral scale (on the nose). Diagnostic head scalation includes a loreal, a complete ring of oculars, 3 to 4 + 4 to 5 temporals, 6 to 8 supralabials, and 9 to 12 infralabials. The 6 to 11 anterior maxillary teeth are separated from the two enlarged, ungrooved, posterior teeth by a diastema (large space between teeth) (Ernst and Barbour 1989).

Males have shorter bodies with 122 or fewer ventral scales (scales beginning with the first scute that makes full contact with the first row of dorsals and ending with the one that contacts the anal plate) and longer tails with up to 44 subcaudal scales (those on the ventral surface of the tail); females have 134 or fewer ventral scales and 35 or less subcaudal scales (Ernst and Barbour 1989). Coloration is not as variable as the eastern hognose snake (*H. platyrhinos*), in which the underside of the tail is lighter than the belly; *H. platyrhinos* also has a relatively straight rostral scale. The pygmy rattlesnake (*Sistrurus miliarius*) has a tail rattle, a pit between the nostril and the eye, and a vertical pupil (Conant 1975, Ernst and Barbour 1989).

Status

Legal designation

Federal. The southern hognose snake was a candidate species (C2) for listing as either threatened or endangered by the U.S. Fish and Wildlife Service (USFWS). However, the USFWS discontinued the designation of C2 species as candidates for listing (50 CFR 17; 28 February 1996). The southern hognose snake is considered to be a species of concern, but more biological research and field study are needed to resolve its conservation status.

State. State endangered in Mississippi; State protected in Alabama.

Distribution and numbers

The southern hognose snake occurs from southeastern North Carolina to south-central Florida (Pinellas, Polk, and Brevard counties) and west to southern Mississippi and southeastern Louisiana (Meylan 1985) (Figure 2). The snake favors mature pine and sandhill habitats, which continue to decline in abundance in the Southeast. Habitat loss and fragmentation are the primary threats to the species survival.

Military installations

Table 1 represents the known status of the southern hognose snake on military installations in the southeastern United States.

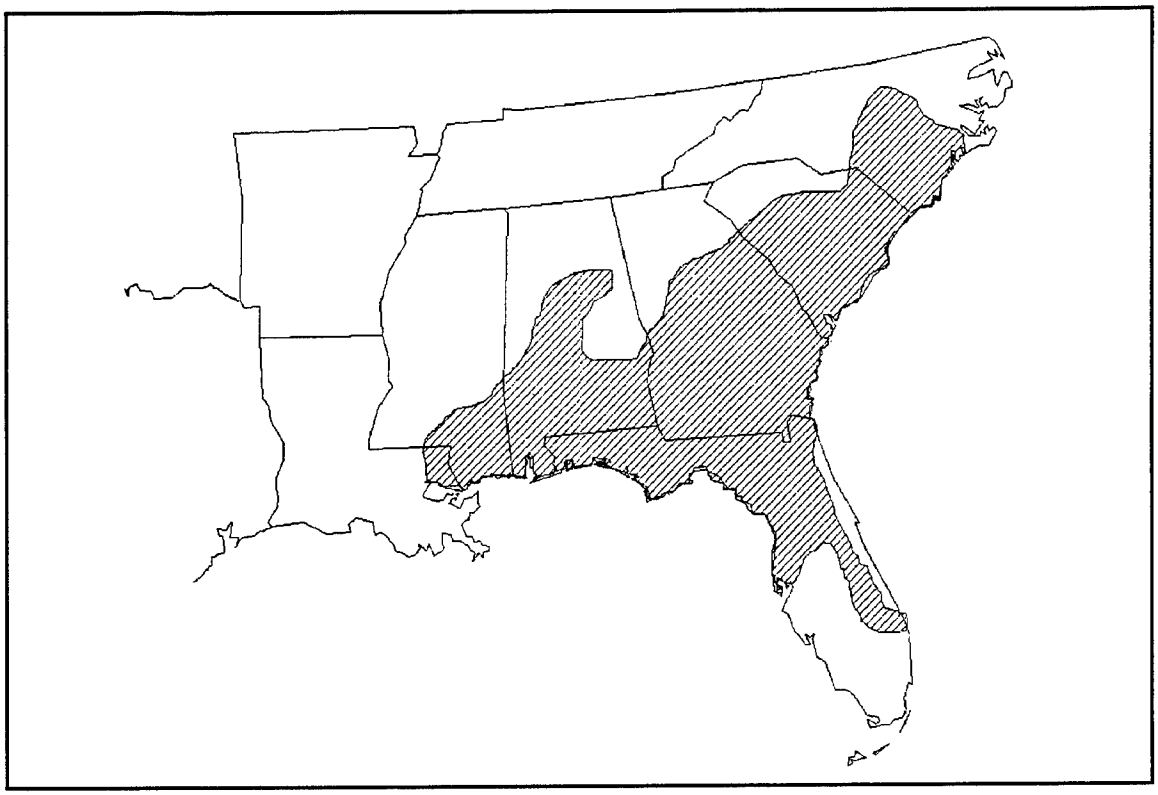


Figure 2. Approximate distribution of the southern hognose snake in the southeastern United States (after Meylan 1985)

Life History and Ecology

The ecology of southern hognose snakes across their range remains poorly known. Published information tends to be incomplete or anecdotal, and few recent studies have been published.

Behavior

The southern hognose snake is diurnal or crepuscular (Conant 1975, Ernst and Barbour 1989). When disturbed, hognose snakes will flatten their neck, spreading an almost cobralike hood, and emit a loud hissing sound. If this display fails to intimidate, the snake will roll over on its back, writhe about with its mouth held open and its tongue hanging out, and finally lie still. If righted, the snake will immediately roll back over.

Little data have been published on hibernation in the southern hognose snake. Edgren (1955) stated that eastern hognose snakes in Ohio go into hibernation in September - October and emerge in April. The same species in Georgia hibernated beneath rocks, stumps, or brush piles, burrows in "hard red clay soil," and beneath sheets of tin on open soil.

Table 1
Known Status of Southern Hognose Snake on Military Installations in the Southeastern United States

Status	Installation	Status on Installation
AL	Anniston Army Depot	Potential.
	Fort McClellan; Pelham Range	Potential; "Southern hognose snakes have been collected from Calhoun County, and although not detected during this study, may occur on Pelham Range" (Alabama Natural Heritage Program 1994).
FL	Eglin Air Force Base (AFB)	Documented onsite; Jensen (1996) collected five freshly road-killed hatchlings on Range Road 234 during late October 1994.
	Avon Park Air Force Range	Documented onsite.
	Tyndall AFB	Documented onsite (Stephen Shea, Personal Communication, 1996).
	Camp Blanding	Potential.
GA	Fort Stewart	Documented onsite: Scattered individuals have been observed by natural resources personnel on the installation (Tim Beaty, Personal Communication, 1996).
	Fort Gordon	Documented onsite.
	Townsend Bombing Range (Marine Corps Air Station, Beaufort, SC)	Potential.
	Marine Corps Logistics Base, Albany	Potential.
	Fort Benning	Documented onsite (John J. Brent, Personal Communication, 1997).
MS	Camp Shelby	Potential; probably outside known range.
NC	Marine Corps Base, Camp Lejeune	Documented onsite; one specimen found dead in road during 1990-91 survey. Habitat for the hognose snake appeared to be abundant, occurring in most of the dry upland natural communities on the installation. However, occurrence of the species during the survey did not substantiate this (Leblond et al. 1994).
	Fort Bragg	Documented onsite.
SC	Fort Jackson	Documented onsite (Kevin B. Wall, Personal Communication, 1996).
	Marine Corps Air Station, Beaufort, SC	Potential.

Reproduction and development

Copulation takes place in mid-May to late May (Ernst and Barbour 1989). Clutch sizes of 10 have been reported from Georgia (Edgren 1955) and 9 in mid-July from Florida (Ashton and Ashton 1981).

There is little information available on natural nests. Edgren (1955) reviewed the literature and reported nests 15 cm (5.9 in.) below the surface in a gravel deposit, under a rock, and at depths of 10 to 15 cm (3.9 to 5.9 in.) in sandy fields. The eastern hognose

snake in captivity digs a U-shaped burrow to deposit eggs. There are also little data on hatching success or hatchling survival, although data on the eastern hognose snake suggested high hatching rates (Edgren 1955).

Food habits and foraging

The upturned snout of hognose snakes is used to burrow and dig for toads (*Bufo* spp., *Scaphiopus* spp.) (Goin 1947, Ashton and Ashton 1981), but the snake also feeds on frogs, salamanders, lizards, and small mammals (Martof et al. 1980, Ernst and Barbour 1989). Goin (1947) described a 25-cm (9.8-in.)-long snake burrowing in "hard packed sand" to excavate a "half-grown *Scaphiopus h. holbrookii* (eastern spadefoot toad)" from a depth of 11.5 cm (4.5 in.). Edgren (1955) suggested that, because snakes are diurnal while toads are chiefly nocturnal, the foraging snakes may follow chemical trails left by toads to their burrows.

Other

Edgren (1955) lists potential predators of southern hognose snakes as kingsnakes (*Lampropeltis* spp.), red-tailed hawks (*Buteo jamaicensis*), and various mammals.

Habitat Requirements

Southern hognose snakes are prevalent in xeric, upland habitats. Good quality habitat appears to be characterized by pine (*Pinus* spp.)-dominated or pine-oak (*Quercus* spp.) (50- to 80-percent pine) woodland having a low, open understory established on sandy soils. Specifically, the snake favors pine and wiregrass (*Aristida stricta*) flatwoods or longleaf pine (*P. palustris*)-turkey oak (*Q. laevis*) sandhill habitats (Edgren 1955). It is also known from oldfields, dry river floodplains, and hardwood hammocks. Longleaf pine sandhills may represent the most important habitat over much of the Southeast. For nesting and hibernation, the hognose snake appears to require forest openings, with level, well-drained sandy soils and little shrub cover. The species is notably fossorial and may thus make little use of aboveground shelter (Edgren 1955).

Habitat Assessment Techniques

Insufficient information was available in the literature to adequately describe habitat assessment techniques.

Impacts and Cause of Decline

Habitat loss

Because hognose snakes in the Southeast appear to be primarily restricted to xeric pine forests and sandhills, commercial logging of these limited habitats leads to the disappearance of the snake. As with many sandhill-dependent organisms, outright loss of habitat occurs when land is converted to agriculture, housing, or pine plantations. Remaining areas are degraded so that their suitability for the snakes is greatly diminished. Fire exclusion leads to the oak component becoming too dominant, and densely stocked stands may not provide adequate openings for nesting or hibernacula.

Military training (adapted from Trame and Harper 1997)

Mechanized training. Mechanized military training can alter natural plant communities through impacts to soils and subsequently cause soil erosion. Intense use of tactical land vehicles (both tracked and wheeled) can cause extensive soil disturbance, which may destroy burrows in which hognose snakes may nest or seek refuge.

Bivouacs. Military bivouacs, which involve a combination of vehicle and non-mechanized trampling, represent a serious source of soil compaction and related impacts to sandhill habitat. Sustained high levels of trampling can ultimately eliminate vegetation.

Fire. Military training can impact native communities and associated species by fragmenting the fuel sources needed to carry fire over large areas. Native ground cover, especially grasses, is an essential fuel source that allows large areas to burn. Bunchgrasses are often eliminated in bivouac sites, assembly areas, and tank-maneuver areas through direct destruction or soil compaction. Areas that do not burn undergo a change in species composition and become increasingly shaded through time, resulting in the loss of the natural community.

The reintroduction of fire resulting from activities such as live arms firing and use of incendiary devices may be potentially beneficial to sandhill organisms. The frequency of ignition on military installations, especially in high hazard impact areas, often produces a fire regime over large areas at a frequency that resembles presettlement natural fire return intervals. This encourages a mosaic burn pattern and enhances conditions for the fire-adapted species in southern pine woodlands (Gulf Engineers and Consultants, Inc., and Geo-Marine, Inc. 1994; LeBlond et al. 1994).

Inventory and Monitoring

Censuses should be conducted on installations to locate and delineate populations of hognose snakes. Population monitoring may assist in determining whether the often reported low densities is a reflection of rarity or of its secretive nature. Systematic searches

and long-term monitoring of populations should occur in all potentially suitable habitats to determine actual status of the snake across its range.

Research is needed to develop appropriate, cost-effective monitoring methods for population trends and habitat requirements in managed landscapes. Census methods should include systematic searches of available habitats that avoid biases toward those habitats where the snakes are easier to spot during random searches and against habitats that are more difficult to search. The status of the snake on Forest Service lands and military reservations should be determined to take advantage of proposed management prescriptions for the endangered red-cockaded woodpecker (RCW) (*Picoides borealis*).

The primary method for censusing hognose snakes has been by walking transects through suitable habitat. Radiotelemetry may be an effective technique for investigating hognose snake behavior and habitat use. For example, Burger and Zappalorti (1988) and Franz (1992) have effectively used implanted radiotelemetry to elucidate pine snake (*Pituophis melanoleucus*) movement and behavior patterns. Where information on specific habitat and range requirements is required, the cost of such a method, both in equipment and human resources, may be justified.

Management and Protection

Management of public lands, including the national forests and military installations, offers the best opportunities for protection of large, contiguous areas of mature pine and pine-oak forest habitats. Such protection efforts often are being driven by recovery of the RCW. Concern for the RCW has generated increased interest in the preservation and restoration of the longleaf pine forest ecosystem. In general, Army-wide management guidelines for RCW habitat (U.S. Army Construction Engineering Laboratories (CERL) 1994) would apply equally well to maintenance of the overall integrity of the sandhill habitats apparently used by hognose snakes. In particular, institution of a regime of regular prescribed fires on a 2- to 3-year rotation to control the hardwood midstory, maximize the regeneration and growth of ground cover, and prepare a suitable seedbed for longleaf pine is important to the maintenance of open pine stands suitable for snake habitat. Management plans for the RCW should be adapted to take into account the requirements of the hognose snake, particularly since the needs of the two species generally do not conflict.

Until additional research is conducted regarding the ecology and habitat preferences of the southern hognose snake, any assessment of the potential impacts of RCW management must be based on the snake's apparent prevalence in xeric sandhill habitats. The following discussion is based on this assumption and on the habitat requirements of the better known northern pine snake (*P. m. melanoleucus*) and eastern indigo snake.

Prescribed burning

Regular prescribed fire is highly desirable for the maintenance and improvement of hognose snake habitat because it acts to reduce the shrub and midstory woody vegetation

and promotes a well-established herbaceous layer (which, in turn, favors the primary prey species utilized by hognose snakes). Growing season burns may have adverse short-term impacts on dispersing snakes. Further research is required to determine the most appropriate season for burning that avoids adverse impacts to hognose snake populations.

Rudolph et al. (In Press) demonstrated that radiomarked Louisiana pine snakes (*Pituophis melanoleucus ruthveni*) were able to easily escape approaching fire by retreating into underground burrows. Research is needed to determine if hognose snakes exhibit similar behavior; however, it is likely that growing-season fire can be prescribed to maintain or improve habitat since this species inhabits plant communities with a historical frequent fire-return interval.

Natural fire breaks (topographic features, wetland boundaries) should be favored over artificial means of controlling fire, since use of natural breaks would more closely mimic natural ecosystem processes. Use of heavy equipment to construct berms or fire lanes should be minimized to avoid negative impacts to ground layer vegetation, soil stability, and hognose snake burrow systems. Snake nests appear to be fairly shallow in sandy areas and may be easily disturbed. Where hognose snake burrow entrances are known, mechanical fire management should be prohibited within 7.6 m (25 ft).

Hardwood control and pine thinning

To avoid interference with the snake's fossorial habits, low-intensity site preparation methods (e.g., burning) should be used rather than more intensive methods (e.g., root raking, chopping). In general, the hardwood and pine thinning guidelines for the RCW (CERL 1994), to the extent that they restore or promote the maintenance of an open, parklike stand of mature pine-oak forest, should benefit the hognose snake. Chemical and mechanical methods of hardwood control should employ best management practices to avoid soil disturbance, destruction of ground-layer vegetation, and nontarget effects of herbicides.

Erosion control

Concerted efforts to reduce and prevent soil erosion within RCW Habitat Management Units (HMUs) (CERL 1994) would have a beneficial effect on hognose snake habitats by maintaining the integrity of herbaceous layers and hognose snake burrow systems. Use of native vegetation should be used wherever possible, and nonnative species should be avoided. Mechanical means of erosion control should maintain the natural contours of the surrounding topography and ensure the integrity of natural hydrologic processes.

Longleaf pine regeneration

In general, reestablishment of longleaf pine and the regeneration of existing longleaf pine stands would increase the available habitats for the hognose snake. Natural regeneration methods should be used in order to avoid high-impact artificial means. Site preparation should employ fire where possible rather than mechanical methods such as discing or chopping. Site preparation should avoid a 7.6-m (25-ft) buffer around hognose snake

burrow entrances. Slash piles and fallen trees should be retained where possible to provide refugia.

Extractive land uses

Pine straw raking has been shown to destroy ground-layer vegetation and longleaf pine seedlings and to cause or exacerbate erosion problems. In the long term, removal of pine straw may also alter fire regimes by reducing fuel loading. All of these potential effects would have negative impacts on hognose snakes. Timber harvest that shifts forest stands toward longer rotations and replaces offsite pines and hardwoods with longleaf pine should restore natural fire, hydrologic, and nutrient dynamics in plant communities. Forest management should minimize adverse impacts to wiregrass and other herbaceous ground-layer species. Forestry practices should be avoided within a 7.6-m (25-ft) buffer around known hognose snake burrow entrances.

Training restrictions

Restrictions on training activities within HMUs, to the extent that they minimize disturbance to vegetation and soils, should benefit hognose snakes. Vehicular traffic on roadways should be monitored to reduce soil erosion; off-road traffic should be prohibited, as it is highly deleterious to ground cover, soil structure, and hydrologic patterns. Where off-road traffic is unavoidable, it should be prohibited from within 7.6 m (25 ft) of known hognose snake burrows as well as from within 15 m (50 ft) of RCW cavity trees.

Education

Education programs directed toward altering public opinion concerning snakes in general, and the common tendency to kill snakes on sight, are appropriate. Installation education programs should be directed to both soldiers and their dependents. Public education regarding the preservation and restoration of the longleaf pine ecosystem should include information about the habitat requirements of the hognose snake and its status in the Southeast.

Research needs

The ecology and population status of hognose snakes remains poorly understood throughout its range. Information is needed concerning the spatial ecology of the snakes, particularly in response to an increasingly fragmented habitat (Durner and Gates 1993). Home range sizes, movement patterns across different habitat types, and viable population densities must be reliably investigated to provide information necessary for management of existing populations. For example, Moler (1992) suggested that habitat protection for the indigo snake, a larger snake with similar habitat affinity, should focus on large tracts of at least 1,000 ha (2,470 acres).

Habitat Protection and Species Recovery

Species recovery

Population levels of hognose snakes are poorly known across the species range. Apparently low numbers in the Southeast may be related to the status of mature, xeric pine and sandhill habitats upon which it depends. Recovery/persistence of snake populations depends on the preservation of large tracts of remaining forest, restoration of disturbed forest, and provision of habitat linkages to obviate fragmentation of existing populations.

Habitat preservation

Of primary importance to the preservation of the hognose snake is the maintenance of suitable habitats. Many of the last remaining large areas of longleaf pine-turkey oak sandhills and forests are found on U.S. Forest Service and military lands. Management prescriptions for the RCW on these lands may be beneficial for the southern hognose snake. Those national forests and military installations that manage for the woodpecker have instituted programs of growing season controlled burns (2- to 3-year intervals), hardwood midstory control, and restoration of longleaf pine on suitable sites. Until the habitat requirements of the snake are better known, it is probably prudent to address the integrity of sandhill habitats in general.

Land protection through acquisition, easement, and registry programs is the best means of ensuring that large tracts of suitable habitats are preserved. Habitat preservation must include the avoidance of habitat fragmentation that may put populations of the snakes at greater risk from roadway mortality. Reducing physical impediments to burning, including roads and habitat fragmentation, would help reduce the isolation of subpopulations.

Preservation of the mature pine-oak forest must also include protection for adjacent lowland habitats. Mature pine forest is not the only habitat type used or required by the snakes, and it need not occur in single large units. A mosaic of habitats, with a substantial mature pine-oak component and access to bottomland forest, should be managed to approximate natural conditions.

Literature Cited

Alabama Natural Heritage Program. 1994. Natural heritage inventory of Fort McClellan, Pelham Range: Federal endangered, threatened, candidate species and state-listed species. Alabama Natural Heritage Program, Alabama Department of Conservation and Natural Resources, State Lands Division, Montgomery.

Ashton, R. E., Jr., and P. S. Ashton. 1981. Handbook of reptiles and amphibians of Florida. Part 1. The snakes. Windward Publishing, Incorporated, Miami, FL.

Burger, J., and R. T. Zappalorti. 1988. Habitat use in free-ranging pine snakes, *Pituophis melanoleucus*, in New Jersey Pine Barrens. Herpetologica 44:48-55.

Conant, R. 1975. A field guide to reptiles and amphibians of eastern and central North America. Houghton Mifflin Company, Boston, MA.

Durner, G. M., and J. E. Gates. 1993. Spatial ecology of black rat snakes on Remington Farms, Maryland. Journal of Wildlife Management 57:812-826.

Edgren, R. A. 1955. The natural history of the hog-nosed snakes, genus *Heterodon*: A review. Herpetologica 11:105-117.

Ernst, C. H., and R. W. Barbour. 1989. Snakes of eastern North America. George Mason University Press, Fairfax, VA.

Franz, R. 1992. Florida pine snake. Pages 254-258 *In* P. E. Moler (ed.). Rare and endangered biota of Florida. Vol. 3. Amphibians and reptiles. University Press of Florida, Gainesville.

Goin, C. J. 1947. A note on the food of *Heterodon simus*. Copeia 1947:275.

Gulf Engineers and Consultants, Inc., and Geo-Marine, Inc. 1994. Final report, rare, threatened and endangered species survey and their habitat at Fort Benning, Georgia. Contract No. DACW21-89-0016. Baton Rouge, LA.

Jensen, J. B. 1996. *Heterodon simus* (southern hognose snake) hatchling size. Herpetological Review 27:25.

Leblond, R. J., J. O. Fussell, and A. L. Braswell. 1994. Inventory of the rare species, natural communities, and critical areas of the Camp Lejeune Marine Corps Base, North Carolina. North Carolina Natural Heritage Program, Dept. Of Environment, Health, and Natural Resources, Raleigh, NC.

Martof, B. S., W. M. Palmer, J. R. Bailey, J. R. Harrison III, and J. Dermid. 1980. Amphibians and reptiles of the Carolinas and Virginia. University of North Carolina Press, Chapel Hill.

Meylan, P. A. 1985. *Heterodon simus* (Linnaeus): Southern hognose snake. Catalogue of American amphibians and reptiles. Society for the Study of Amphibians and Reptiles.

Moler, P. E. 1992. Eastern indigo snake. Pages 181-186 *In* P. E. Moler (ed.). Rare and endangered biota of Florida. Vol. 3. Amphibians and reptiles. University Press of Florida, Gainesville.

Rudolph, D. C., S. J. Burgdorf, J. C. Tull, M. Ealy, R. N. Conner, R. R. Schaefer, and R. R. Fleet. Avoidance of fire by Louisiana pine snakes, *Pituophis melanoleucus ruthveni*. Herpetological Review, In Press.

Trame, A. M., and M. G. Harper. 1997. Potential military impacts to selected plant communities in the southeastern United States. Natural Resources Division, U.S. Army Construction Engineering Laboratories, Champaign, IL.

U.S. Army Construction Engineering Laboratories. 1994. Management guidelines for the red-cockaded woodpecker. *In* Biological assessment of Army-wide guidelines for the red-cockaded woodpecker. U.S. Army Construction Engineering Laboratories, Natural Resources Division, Special Report EN-94/03.

Personal Communications

Beaty, Tim. 1996. Biologist, Environmental/Natural Resources Branch, DPW, ENRD, Fish and Wildlife Branch, ATTN: AFZP-DEV-W, Fort Stewart, GA 31314-5000. 912-767-7261/2584.

Brent, John J. 1997. Chief, Environmental Management Division, Fort Benning, GA.

Shea, Stephen. 1996. Wildlife Biologist, Tyndall AFB. 325 CES/CEV, 119 Alabama Avenue, Tyndall AFB, FL 32403-5014. 904-283-2641.

Wall, Kevin B. 1996. Director of Public Works, Fort Jackson, SC.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
March 1998

3. REPORT TYPE AND DATES COVERED
Final report

4. TITLE AND SUBTITLE
Species Profile: Southern Hognose Snake (*Heterodon simus*) on Military Installations in the Southeastern United States

5. FUNDING NUMBERS

6. AUTHOR(S)
Robert A. Jordan

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
The Nature Conservancy
Southeastern Regional Office
P.O. Box 2267
Chapel Hill, NC 27515-2267

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Corps of Engineers
Washington, DC 20314-1000;
U.S. Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, MS 39180-6199

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
Technical Report SERDP-98-4

11. SUPPLEMENTARY NOTES
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT ***(Maximum 200 words)***

The southern hognose snake (*Heterodon simus*) is the smallest of the hognose snakes, occurring in the southeastern United States, from southeastern North Carolina to south-central Florida and west to southern Mississippi and southeastern Louisiana. The species is a former candidate species for listing as threatened or endangered by the U.S. Fish and Wildlife Service. The snake favors mature pine and sandhill habitats, which continue to decline in abundance in the Southeast. Habitat loss and fragmentation are the primary threats to the survival of the species. Southern hognose snakes have been documented on several military installations in the Southeast. This report is one of a series of Species Profiles being developed for threatened, endangered, and sensitive species inhabiting southeastern United States plant communities. The work is being conducted as part of the Department of Defense (DoD) Strategic Environmental Research and Development Program (SERDP). The report is designed to supplement information provided in plant community management reports for major United States plant communities found on military installations. Information provided on the southern hognose snake includes status, life history and ecology, habitat requirements, impacts and cause of decline, management and protection, and inventory and monitoring.

14. SUBJECT TERMS
DoD installations
Plant communities
Sandhill habitat
SERDP
Southern hognose snake
Species profile
Threatened and Endangered species

15. NUMBER OF PAGES
17

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED		