

SOUTHERN HOGNOSE SNAKE
CONSERVATION PLAN for NORTH CAROLINA

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NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

Table of Contents

EXECUTIVE SUMMARY 3
BIOLOGICAL INFORMATION 4
Description and Taxonomic Classification 4
Life History and Habitat 5
Distribution and Population Status 7
THREAT ASSESSMENT 9
Reason for Listing 9
Present and Anticipated Threats 9
Summary of Threats 9
Historic and Ongoing Conservation Efforts 10
CONSERVATION GOAL AND OBJECTIVES 11
Conservation Goal 11
Conservation Objectives 11
Summary of Actions Needed 11
GLOSSARY 15
LITERATURE CITED 16

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EXECUTIVE SUMMARY

The Southern Hognose Snake is state-listed as Threatened in North Carolina. The species inhabits deep, sandy soils primarily associated with Longleaf Pine ecosystems in the Sandhills and Coastal Plain, but its range has been reduced dramatically over the last century. The species has been reported historically from 20 counties in North Carolina, but it has only been reported in 13 counties in the past 20 years (Bladen, Brunswick, Cumberland, Duplin, Hoke, Moore, New Hanover, Onslow, Pender, Richmond, Robeson, Sampson, Scotland). The current population strongholds include large, well-managed areas, especially in the Sandhills region. Reasons for the species' decline include loss of habitat, changes in land use, lack of compatible forest management, frequent road mortality, impacts of Red Imported Fire Ants (*Solenopsis invicta*), and collection of animals from the wild for the pet trade. Increasing and restoring populations of the Southern Hognose Snake are ultimate goals of this conservation plan. These goals can be reached by working with partners to purchase and protect large tracts of land, focusing on connecting populations, and restoring habitat that is conducive to supporting this species. Sound habitat management, especially including prescribed fire, and habitat restoration is imperative to the future viability of the Southern Hognose Snake. Other conservation measures include education about laws regarding take, reduction of road mortality, efforts to control or reduce the spread of fire ants, and scientific research addressing the effects of land use on the species. Finally, staff should continue efforts to monitor the status of the Southern Hognose Snake and provide information to target land acquisition opportunities and direct management of acquired lands.

BIOLOGICAL INFORMATION

Description and Taxonomic Classification

The Southern Hognose Snake (*Heterodon simus*) is a small, stout-bodied snake with a prominently upturned snout, ranging in color from gray, tan, brown, to orange. They have 20 to 28 dark middorsal blotches with smaller dorsolateral blotches and a banded tail pattern (Palmer and Braswell 1995). Unlike the similar looking Eastern Hognose Snake (*Heterodon platirhinos*), the underside of the tail of the Southern Hognose Snake is similar in color to the posterior end of the belly. A prominent dark stripe is present running posterior from the eye to the rear of the mouth, and a prominent dark blotch is present on either side of the neck. The species grows to 61 centimeters (approximately two feet) in total length (Conant and Collins 1998). Females are larger than males, and males have proportionally longer tails than females (Palmer and Braswell 1995). Like other species of hognose snakes, *H. simus* may exhibit elaborate behavior when threatened, including hissing, spreading their necks, and eventually feigning death to deter predators. However, Southern Hognose Snakes exhibit this behavior much less frequently than Eastern Hognose Snakes.

Feigning death to deter predators

This species was first described by Linnaeus in 1766 and, through various scientific protocols, was named *Heterodon simus* by Holbrook in 1842. There are currently five members of the genus *Heterodon*, all endemic to North America, though the Southern (*H. simus*) and Eastern (*H. platirhinos*) Hognose Snakes are the only ones found in the Southeastern United States, and they are often found in the same habitat. Southern Hognose Snakes are referred to by other colloquial names including hissing adder, blow viper, puff adder, spreading adder, and hissing sand snake (Conant and Collins 1998; Gibbons and Dorcas 2005). The recommended standard name for *H. simus* is Southern Hog-nosed Snake, but most herpetologists refer to the species as Southern Hognose Snake.

Of the five members of the genus Heterodon*, only the Southern Hognose Snake (left) and the Eastern Hognose Snake (right), are found in the Southeastern United States, often in the same habitat.*

Life History and Habitat

The most comprehensive overview of Southern Hognose Snake life history is outlined in the publication, "Natural History of the Southern Hognose Snake (*Heterodon simus*) in North Carolina, USA" (Beane, et al. 2014). Much of the information about life history and habitat presented here is summarized from that publication. The Southern Hognose Snake inhabits xeric Sandhills and other deep sand habitats throughout the Coastal Plain but is now mainly restricted to the Sandhills ecoregion and the southeastern portion of the Coastal Plain in North Carolina (see distribution section for greater detail). The species is usually tied to well-managed longleaf pine-wiregrass-turkey oak ecological communities, but they can also be found crossing roads between altered or disturbed habitats such as old fields, mixed forests, agricultural plots, clearcuts, and rural yards (Beane, et al. 2014).

The Southern Hognose Snake is now mainly found in the Sandhills ecoregion and southeastern portion of the Coastal Plain in North Carolina.

The Southern Hognose Snake is strictly diurnal and often fossorial (Palmer and Braswell 1995). Although this snake spends much of its time underground, surface activity peaks in September and October on warm, sunny days, and encounter frequency of the species is highest from mid-morning to early afternoon during those months. There is also a smaller peak in activity during April and May, possibly correlating with mating. Courtship and mating in North Carolina have been observed in May and September (Beane, et al. 2014) and hatchlings can be found moving on the surface by September and October. They are oviparous, producing clutches of 6 to 14 eggs measuring from 2.4 – 3.4 centimeters in length. Hatchling snakes range from 13.5 – 17.0 centimeters (Palmer and Braswell 1995). The Southern Hognose Snake uses its upturned snout to

burrow into sand 20 to 30 centimeters deep (Palmer and Braswell 1995), and two adults have been found as deep as 46 centimeters in apparently self-excavated hibernacula beneath the sand (Beane, et al. 2007; Beane, et al. 2014). They do not seem to use tree stumps for overwintering like many other snakes in the same habitat. They have been reported to live from 12 – 18 years in captivity (Beane 2015) but nothing is reported about their longevity in the wild. Documented predators include Eastern Kingsnake (*Lampropeltis getula*), Black Racer (*Coluber constrictor*), Red-tailed Hawk (*Buteo jamaicensis*), Red-shouldered Hawk (*B. lineatus*), and Great Horned Owl (*Bubo virginianus*) (Palmer and Braswell 1995; Beane 2012), though likely many other species consume hognose snakes as prey.

Based on examinations of stomach contents from dead individuals, the diet of *H. simus* consists of Eastern Spadefoots (*Scaphiopus holbrookii*), other toads (Genus *Anaxyrus*), Six-lined Racerunners (*Aspidoscelis sexlineatus*), Ground Skinks (*Scincilla lateralis*), and invertebrates such as an Ox Beetle (*Strategus antaeus*) larva and a Tree Stink Bug (*Brochymena arborea*) (Palmer and Braswell 1995; Beane, et al. 1998; Beane, et al. 2011; Beane, et al. 2014). Southern Hognose Snakes likely use their highly upturned snouts to dig up prey from sandy soils (Goin 1947). They also have large, ungrooved “rear fangs” whose hypothesized use is to deflate toads as they are being swallowed. It may be more likely that these specialized teeth are used to inject a mild venom into prey items.

Southern Hognose Snakes likely use their highly upturned snouts to dig up prey, such as Eastern Spadefoots (inset) and other toads, from sandy soils.

Distribution and Population Status

The Southern Hognose Snake once occurred from eastern North Carolina, south to Florida, and west to Mississippi; however, populations in Mississippi and Alabama are likely extirpated. In North Carolina, the species ranged from near Raleigh, east to near Morehead City, throughout the southeastern portion of the state and throughout the Sandhills (Fig. 1). The most robust populations of the species currently occur on and around the Sandhills Game Land and nearby areas in the Sandhills, though the species once occurred much farther north and east of its current known distribution.

Based on NC Natural Heritage Program data, there are 1,317 individual records of Southern Hognose Snakes in North Carolina, dating back to 1907. There have been 874 records reported between 2000 - 2020, though most of those occurred in the Sandhills ecoregion. Over the past 20 years, the Southern Hognose Snake has only been documented in 13 of the 20 counties where it historically existed. Little is known about

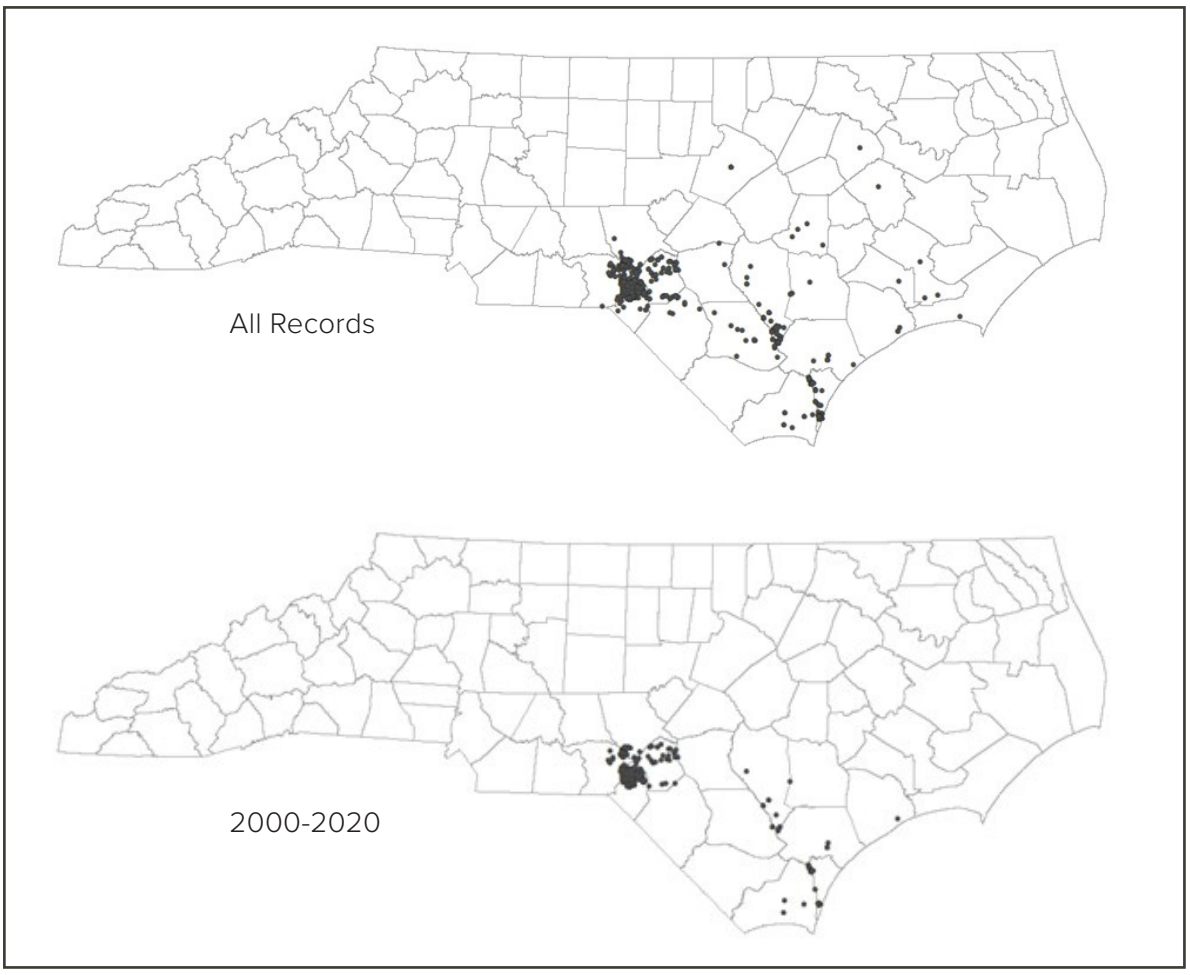

*Figure 1. Distribution of the Southern Hognose Snake (*Heterodon Simus*) in North Carolina based on all known records since the early 1900s (top) compared to recent records from 2000-2020 (bottom). Records are from the NC Natural Heritage Program and the NC Museum of Natural Sciences.*

the abundance of this species, but road-driving surveys conducted from 1985-2012, including 743 observations of the species, did not find a discernible trend in encounter rates where intensive surveys took place (Beane, et al. 2014). However, 643 (84%) of the snakes encountered during those surveys were found dead on roads. Despite not finding a downward trend in snake encounters (dead or alive) during that study, the range of the Southern Hognose Snake has clearly diminished significantly in North Carolina over the past century. The stronghold for the species is now in the Sandhills ecoregion, but scattered populations still occur in parts of the Cape Fear Arch / Bladen Lakes region to the Wilmington area. A notable decline in observations of the Southern Hognose Snake over the past several decades has occurred in Bladen and Sampson counties. More surveys are needed in counties where recent drastic declines appear to have occurred. Determining population sizes of Southern Hognose Snakes is extremely difficult, likely because the species is highly fossorial, infrequently encountered except on roads, and road mortality is high. For instance, from 2014 – 2020, mark-recapture studies focused on this species on Sandhills Game Land resulted in 42 individuals marked, with only 4 individuals recaptured (NCWRC data). A study by Willson, et al. (2018) attempted to estimate abundance based on road encounters. Models were constructed using number of snake encounters and the time it takes a snake to cross a road. The study also modeled movements based on radiotelemetry. They estimated densities of Southern Hognose Snakes in the North Carolina Sandhills to be 0.17 snakes (adults and juveniles) per hectare of upland habitat. The Sandhills Game Land encompasses approximately 65,000 acres (26,300 hectares), with approximately 55,000 acres (22,260 hectares) of upland habitat. Extrapolated densities of Southern Hognose Snakes based on that study suggest a population size of 3,800 individuals on Sandhills Game Land. That estimate is likely an overestimate, as much of the upland habitat on the Game Land may not be suitable for this species. It is difficult to describe conservation goals in terms of population size because of the uncertainty in estimating abundance.

A highly fossorial species, the Southern Hognose Snake is infrequently encountered except on roads, and road mortality is high.

THREAT ASSESSMENT

Reason for Listing

The Southern Hognose Snake's disappearance from much of its former range in North Carolina, its decline in other states, and the loss of the longleaf pine ecosystem have been well documented (Noss, et al. 1995; Tuberville, et al. 2000). The species faces habitat loss and fragmentation, mortality on roads, and predation by the Red Imported Fire Ant (Tuberville, et al. 2000; Gibbons and Dorcas 2005; Tuberville and Jensen 2008). The large reduction in this species' range over time, combined with ongoing threats to its extant populations, warranted a listing of State Threatened. Southern Hognose Snakes have disappeared at the periphery of the range, including the northeastern portion of their range in North Carolina. This is consistent with range reduction in their southwestern range in the Gulf states. The Southern Hognose Snake was petitioned for Federal listing by the U.S. Fish and Wildlife Service in 2012; however, Federal listing of the species was found not to be warranted (USFWS 2019). Analyses done by USFWS indicated that "redundancy and representation will likely decline from current conditions; however, the Southern Hognose Snake is expected to remain viable into the foreseeable future."

Along with habitat loss and fragmentation and road mortality, the Red Imported Fire Ant is one of many threats facing the Southern Hognose Snake.

Present and Anticipated Threats

The loss of well-managed habitat in the Sandhills and Coastal Plain is the biggest reason for recent and present declines of the Southern Hognose Snake in North Carolina. Increased development and the associated loss of habitat and increased vehicle traffic continue to threaten this species. The inability to manage large contiguous blocks of forest with prescribed fire is an ongoing and future threat also associated with increased development. The loss or degradation of wetlands may impact populations of this species by reducing the amphibian prey base. Red Imported Fire Ants are likely detrimental to Southern Hognose Snake populations and fire ants are likely to continue to increase across the region. Finally, collection of this species from the wild for the pet trade or personal collections is certainly known, but the impact of collection on populations is not documented.

Summary of Threats

- Loss of habitat through development and land conversion.
- Road mortality due to increased vehicle traffic associated with development.
- Reduction in application of compatible land-management practices (e.g., prescribed fire, maintaining open forests with ground cover, maintenance of productive wetlands that produce a plentiful prey source).
- Possible mortality of eggs and juvenile snakes caused by Red Imported Fire Ants (*Solenopsis invicta*).
- Poaching of individuals for the pet trade.

Historic and Ongoing Conservation Efforts

Protection of land and compatible management techniques (e.g., prescribed fire, upland pine thinning) on land managed by NCWRC and other entities has likely had the greatest conservation impact on the Southern Hognose Snake. The fact that the best remaining populations of this species now occur on and around Sandhills Game Land is evidence of the importance of land conservation and habitat management. Partnerships between NCWRC, The Nature Conservancy, Department of Defense, and other entities are actively protecting land in the Sandhills (where the core populations remain) for the benefit of many species including the Southern Hognose Snake.

> The single-most important conservation effort is the continued conservation and management of land within the current and historic range of Southern Hognose Snakes, especially focused on connecting large tracts of land together.

Research on the natural history of the Southern Hognose Snake has helped the conservation of the species by providing information about how the species uses the landscape, information about nesting, and diet. Work by Jeff Beane (NC Museum of Natural Sciences) and Project Simus continue to provide information about the life history, movement patterns, and habitat use of this species. Biologists with NCWRC have also been surveying for and marking Southern Hognose Snakes, along with other snake species, on Sandhills Game Land for over 6 years. This research is gathering further natural history information and is identifying areas with the most robust remaining populations.

Southern Hognose Snake hatchling

CONSERVATION GOAL AND OBJECTIVES

Conservation Goal

Biologists with the NC Wildlife Resources Commission and partner organizations aim to stabilize then increase Southern Hognose Snake populations in North Carolina. This plan's proximate goals are to prevent the loss of populations of the Southern Hognose in their stronghold in the Sandhills and to prevent the extirpation of, and increase outlying populations. Long-term overall goals are to prevent extirpation and to increase population viability of this species in North Carolina over at least the next 100 years.

Conservation Objectives

1. Increase habitat and connect Southern Hognose Snake populations through the purchase of land and/or conservation easements in the Sandhills ecoregion specifically.
2. Increase populations of the Southern Hognose Snake through compatible management practices such as prescribed burning, thinning as needed, and connecting tracts of high-quality habitat.
3. Restore and increase populations of the Southern Hognose Snake in historically occupied areas where declines have occurred but where small populations persist (e.g., Southern Coastal Plain) through land acquisition, conservation easements, and management aimed at improving the integrity of longleaf pine ecosystems.
4. Reduce pressure on local populations by educating people about laws specific to collection for the pet trade and private collections.
5. Mitigate road mortality of individuals using management actions such as wildlife crossings, road closures, and halting new road construction in areas of prime habitat.
6. Reduce the numbers and spread of Red Imported Fire Ants on landscapes where the Southern Hognose Snake occurs. This can be done by limiting soil disturbance and direct treatments of fire ant colonies.
7. Conduct research exploring the effects of land use on Southern Hognose Snake populations.
8. Education and outreach should be conducted to promote awareness of, and conservation actions needed to conserve this species.

Summary of Actions Needed

Actions needed to increase populations of the Southern Hognose Snake are presented in Table 1 (page 14). The most important action needed is to increase the number of large tracts of Longleaf Pine ecosystems and to connect tracts to increase the viability of Southern Hognose populations. In the Sandhills specifically, it is estimated that acquiring an additional 6,000 – 8,000 acres of land at minimum is needed to increase connection between Sandhills Game Land and Fort Bragg military installation and to link key outlying blocks on Sandhills Game Land (Jeff Marcus, The Nature Conservancy, pers. comm.). Conservation easements where quality habitat still occurs is also a viable option for maintaining populations of the species.

Sandhills Game Land

Purchasing, restoring, and increasing management to connect and maintain healthy longleaf pine forests in areas where the species seems to have declined significantly (e.g., Bladen Lakes region) are important to restore relict or declining populations in the state. For example, the purchase of 5,000 – 6,000 acres of land in the northern Bladen Lakes region and near 18,000 acres in the southern Bladen Lakes region would create large blocks of connected land that would benefit many species, including the Southern Hognose Snake (Jeff Marcus, The Nature Conservancy, pers. comm.).

Continued and increased sound habitat management is needed to promote healthy, open Longleaf Pine habitat where populations appear to be relatively stable. These management actions include prescribed burning, thinning of dense forests as needed, and restoration of wetlands for production of a healthy prey base. Where populations have declined, forest management and land use need to be altered to align with the habitat needs of the Southern Hognose Snake and other species associated with healthy longleaf pine ecosystems. For example, large areas of the Bladen Lakes region are managed as working forests where much of the landscape is harvested on a rotation or used for pine straw raking for revenue. For the Southern Hognose Snake and other wildlife species dependent on the Longleaf Pine ecosystem, these landscapes need to be managed differently, avoiding short-rotation forestry, and increasing the use of prescribed fire to restore ground cover and reduce soil disturbance. Management actions directed toward improving and maintaining habitat for the Southern Hognose Snake will also benefit habitat for the Northern Pinesnake, Eastern Coachwhip, Pigmy Rattlesnake, Eastern Diamondback Rattlesnake, Chicken Turtle, Gopher Frog, Ornate Chorus Frog, Southern Chorus Frog, Pine Barrens Treefrog, Northern Bobwhite, Red-cockaded Woodpeckers, and Bachman's Sparrow, as well as many rare plant species.

The most important conservation action needed to increase populations of Southern Hognose Snakes is to increase the number of large tracts of Longleaf Pine ecosystems.

The North Carolina Sandhills are a well-known and frequently visited area for people interested in finding rare reptiles and amphibians, including Southern Hognose Snakes. While most people may seek this species just for the experience of seeing or photographing them, some collection of animals likely takes place. Law Enforcement should continue to monitor highly visited areas during peak activity times (September and October) to educate the public and enforce laws regarding the take of Southern Hognose Snakes. Law Enforcement presence alone helps deter take of the species, especially on Game Lands.

As noted, Southern Hognose Snakes experience extremely high rates of mortality on roads. Installing wildlife crossings on current roads as well as during new road construction, where high quality Southern Hognose Snake habitat exists, can help reduce fragmentation of populations.. The closure of certain roads, especially in areas where large numbers of animals migrate during fall activity periods should be considered where possible. NCWRC should reinforce our policy of not building new roads on Sandhills Game Land and other properties where the Southern Hognose exists. We should also discourage paving sand and dirt roads because paved roads lead to increased traffic, higher traffic speeds, and higher snake mortality.

Reducing the abundance and spread of Red Imported Fire Ants on the landscape would benefit Southern Hognose Snake populations and other ground-nesting and fossorial species. Some non-chemical methods are available (Tschenkel and King 2007), but these methods are only effective on small scales. Soil disturbance, which often facilitates the colonization of fire ants, can be reduced by avoiding the installation of new wildlife food plots on the landscape, as well as trying to avoid creating new fire lines, especially when they are not necessary.

Research is needed to determine the effects of various types of land use on Southern Hognose Snake populations. This species is highly fossorial, and therefore may be heavily impacted by management that results in heavy soil disturbance and compaction. Exploring the impacts of management and land use could help to inform why the species has declined in certain areas and inform restoration goals.

Finally, education and outreach should continue to promote awareness of this species, threats facing it, and land management strategies to improve habitat for the Southern Hognose and other species that share its habitat. Educational materials should be made available to the public through brochures, information on the NCWRC website, and through presentations at venues such as North Carolina Partners in Amphibian and Reptile Conservation (NCPARC), the North Carolina Herpetological Society (NCHS), the Sandhills Conservation Partnership, and through outreach at events taking place within the range of this species.

Table 1. A summary of conservation actions needed to address the goals, the partners involved, and the desired outcomes of each action. These actions are listed generally in order of priority, though all actions are considered important and necessary.

#	ACTIONS	OBJECTIVES	PARTNERS	DESIRED OUTCOMES
1	Land acquisition	Increase and connect populations	The Nature Conservancy (TNC), Department of Defense (DOD), NC Forest Service, NC State Parks	Increase populations and the future viability of the Southern Hognose Snake in North Carolina
2	Compatible land management	Maintain and restore high-quality habitat	TNC, DOD, NC Forest Service, NC State Parks, Private Landowners	Increase populations of Southern Hognose Snakes where they occur
3	Restore populations	Establish or increase populations where diminished or extirpated	DOD, NC Forest Service, NC State Parks, U.S. Forest Service	Increase relict populations to a point where they are viable for the foreseeable future
4	Law enforcement	Increased education, monitoring, and enforcement of laws prohibiting the collection of animals	NCWRC Law Enforcement Division	Reduce the loss of animals to collectors
5	Mitigate direct mortality by vehicle traffic	Reduce road mortality using multiple methods	NCDOT, Landowners	Increase populations by reducing road mortality
6	Control or reduce Red Imported Fire Ants	Decrease the extent or numbers of Red Imported Fire Ants where possible	North Carolina Zoo, TNC, and others	Reduce mortality of eggs or juveniles of Southern Hognose Snakes caused by fire ants
7	Conduct research	Determine the effects of land use and management on populations	NCWRC staff, Universities, other research institutions	Provide tangible information to guide land management that benefits the Southern Hognose Snake
8	Education and outreach	Promote awareness of and conservation of the species.	NCPARC, NCHS, Sandhills Conservation Partnership, NC State Parks, NC Zoo	Educate the public about the Southern Hognose and promote conservation actions that benefit the species and its habitat.

GLOSSARY

Sandhills ecoregion:
A portion of south-central North Carolina on the Fall-line Sandhills. Uplands consist of deep, mostly well-drained, sandy terrain dominated by Longleaf Pine – Wiregrass communities, interspersed with drainages consisting of seepages, creeks and rivers, bottomland hardwood forests and impoundments. Upland habitat is maintained by a 3 – 5 -year natural fire cycle, mostly now maintained by prescribed burning.

Threatened species:
In North Carolina, "Any native or once-native species of wild animal that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range or one that is designated as a threatened species pursuant to the Endangered Species Act."

Population:
The number of individuals of a particular species in a given area. For this plan, populations are defined as the number of individuals that are connected throughout a given area and can interact with each other biologically (breeding). "Population size" could also be defined as the number of individuals that occur across the entirety of the species' range in the state.

Fossorial:
An animal that is adapted to burrowing and spends much of its time underground.

Oviparous:
Producing eggs that develop and hatch outside of the maternal body. An egg-layer.

Hibernaculum / Hibernacula:
A place(s) where an animal seeks refuge to overwinter.

Extant:
Still in existence; surviving.

Relict:
A remnant population of a formerly widespread species that currently persists in an isolated area.

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