

APPENDIX H

**Candidate Conservation Agreement for the
Louisiana Pine Snake**



USFWS - 13 April 2011

CANDIDATE CONSERVATION AGREEMENT

for the

**Louisiana Pine Snake
(*Pituophis ruthveni*)**

BETWEEN

**U. S. Fish and Wildlife Service
U.S. Forest Service
Natural Resources Conservation Service
U. S. Department of Defense, Fort Polk and the Joint Readiness Training
Center
Texas Parks and Wildlife Department
Louisiana Department of Wildlife and Fisheries
Association of Zoos and Aquariums**

Amended and Revised: August 2013

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1. SUMMARY (ABSTRACT)

The Louisiana pine snake (*Pituophis ruthveni*) is recognized as one of the rarest snakes in North America (Young and Vandeverter 1988, p. 203; Himes *et al.* 2006, p. 114). This amended and revised Candidate Conservation Agreement (CCA) for the Louisiana Pine Snake, a candidate species for Federal listing as threatened or endangered[†], has been developed as a cooperative effort among private, state, and federal agencies in order to collectively implement proactive conservation measures and habitat management guidelines throughout a significant portion of the snake's known range. Furthermore, this CCA updates, supersedes, and improves upon the CCA for the Louisiana pine snake finalized in 2003 and is based upon current habitat threats, implemented management actions, and significant new information derived from research, threats assessments, and habitat modeling that were not available in 2003. Implementation of this CCA addresses conservation needs of the Louisiana pine snake, and will allow the parties to this CCA (Cooperators) to leverage knowledge and funding within a common conservation framework to reduce threats to the species. The Cooperators believe that establishment, implementation, and refinement of the conservation measures herein defined will benefit the Louisiana pine snake. The effect of those conservation measures will be considered when determining the need for listing the Louisiana pine snake as threatened or endangered under the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. §§ 1531-1544). This CCA is conceptually based upon adaptive management principles, is voluntary, and flexible in nature.

Specifically, this CCA intends to guide conservation measures on public lands managed by the U.S. Forest Service (USFS) and Department of Defense (DOD) by establishing a framework of management actions through collaboration with all of the Cooperators. Indirectly, this CCA will increase management protection for the Louisiana pine snake on private lands through the inclusion of U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) programs and their staff interactions with private landowners. Management of the Louisiana pine snake captive-bred assurance population and reintroduction program through the Association of Zoos and Aquariums' (AZA) Species Survival Plan (SSP) and other Cooperators will enhance the long-term viability of the species in captivity and the wild.

[†] A petition to list the Louisiana pine snake was received on July 19, 2000. The species was designated a candidate for listing by the USFWS in 1999.

2. INTRODUCTION AND PURPOSE

A significant factor influencing the current status of the Louisiana pine snake is the loss or modification of longleaf (*Pinus palustris*) and shortleaf pine (*Pinus echinata*) communities throughout its historic (i.e., pre-settlement) range (USFWS 2012, p. 17). Those communities have been dramatically reduced by changes in land use and timber management. The historic range of longleaf pine dominated the Coastal Plain areas of the United States from Virginia to Texas through central Florida, and has been estimated at 37 million hectares (ha) (91 million acres (ac)), of which 23 million ha (57 million ac) were dominated by longleaf, and 14 million ha (34 million ac) occurred in mixed stands (Frost 2006, p. 9-42). Less than 1 million highly fragmented ha (2.5 million ac) remain today (Outcalt and Sheffield 1996, p. 17; Jose *et al.* 2006, p. 3) which provide habitat for many vertebrate, invertebrate, and plant species, some of which are endemic (or longleaf pine specialists), and a number of which are federally designated as candidate, threatened or endangered species. Much of the remaining longleaf pine habitat has been degraded by fire suppression, the predominant use of dormant season fire, and the implementation of intensive, short-rotation silviculture on non-federal lands (Outcalt and Sheffield 1996, p. 2; Rudolph and Burgdorf 1997, p. 118-119, Frost 2006, p. 37). For the Louisiana pine snake, secondary threats are mortality associated with road and off-road vehicle traffic, erosion control blankets placed in road and pipeline rights-of-way that cause entanglement and intentional killing by humans (Young and Vandeventer 1988, p.203; Himes *et al.* 2002, p. 8-9; Rudolph 2011 in litt.; USFWS 2012, pp. 20-21). Fragmentation and loss of genetic diversity are additional factors that reduce the viability of populations (USFWS 2012, p. 19-20). As a result, populations of the Louisiana pine snake appear to have declined alarmingly, both in numbers and in range.

The Louisiana pine snake was designated as a candidate species under the authority of the ESA on October 1, 1999. Candidate species are plants and animals for which the U.S. Fish and Wildlife Service (USFWS) has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a listing regulation is precluded by other higher priority listing activities. Candidate conservation can be facilitated through inter-agency agreements. A CCA is intended to direct specific conservation efforts, to outline management practices that will prevent further decline of their habitat, and to ensure regular, periodic review of their status with the goal of working to preclude the need to list the species.

This CCA is intended to establish a framework for Cooperator participation and specific actions for the Louisiana pine snake's protection, conservation, management, and improvement of the species' status. Initiation of this CCA will further conservation of the Louisiana pine snake on Federal lands by:

- protecting known populations and additional potential habitat by reducing threats to its survival,
- maintaining its ecosystem,
- restoring degraded habitat, and
- reintroducing captive-bred snakes to some of the restored habitat.

Indirectly, this CCA will conserve Louisiana pine snakes on private lands through habitat maintenance and restoration initiatives through programs of the NRCS.

This CCA is voluntary and flexible in nature, and has been developed so that different conservation and management actions that reduce threats to the species can be agreed to and implemented by each Cooperator within their organization. Through such cooperation in establishment, refinement, and implementation of conservation measures and in conjunction with potential Candidate Conservation Agreements with Assurances (CCAAs) with private landowners, the Cooperators hope to significantly reduce the threats upon the Louisiana pine snake.

3. GOALS

The goals of this CCA fall into two main categories:

- A. **Conservation and Management:** By addressing Louisiana pine snake conservation throughout a substantial portion of the snake's range, the Cooperators hope to effectively conserve and increase Louisiana pine snake populations by:
- developing and implementing habitat management strategies that maintain or enhance the species' habitat,
 - monitoring the response of the species to conservation and management initiatives,
 - supporting research related to the life history, ecology, and distribution/status of Louisiana pine snake populations,
 - providing education and outreach information to government agencies, private landowners, and the public, and
 - managing a captive-bred population that can feasibly support a reintroduction program.
- B. **Cooperation and Collaboration:** By managing Louisiana pine snake conservation actions collaboratively, the Cooperators will:
- increase consensus and scientific vigor,
 - maximize resource (i.e., expertise, funds and authority, public outreach) availability,
 - improve the chances for the species' long-term conservation and survival,
 - enable integration of monitoring and research efforts with habitat management activities (Adaptive Management), and
 - provide an organized conservation approach that encourages uniform actions and reporting.

By defining, reviewing and refining the steps necessary to accomplish and ultimately achieve these goals, many Cooperators believe that current and potential threats to the Louisiana pine snake will be significantly reduced and that the Louisiana pine snake and a significant portion of its habitat can be conserved. The effect of those conservation measures in this CCA, and any potential CCAAs with key private landowners, will be considered when determining the need for listing the Louisiana pine snake as threatened or endangered under the ESA. The Cooperators generally believe that the conservation measures implemented by this CCA will contribute to improving the

species' conservation status and hopefully make listing the species as threatened or endangered under the ESA unnecessary within the foreseeable future.

4. BENEFITS TO ADDITIONAL SPECIES

Management actions established through this CCA are anticipated to result in the restoration and protection of significant portions of the longleaf pine ecosystem of east Texas and west-central Louisiana, a habitat that has experienced substantial decline.

Commitments made through this CCA should benefit the Louisiana pine snake, and species that occur in the longleaf pine ecosystem of east Texas and west-central Louisiana outlined below (Gregory 2013 in litt.):

Federally listed species:

Navasota ladies'-tresses (*Spiranthes parksii*),
Texas trailing phlox (*Phlox nivalis* ssp. *texensis*),
red-cockaded woodpecker (RCW, *Picoides borealis*).

Plant and animal species of concern:

white firewheel (*Gaillardia aestivalis* var. *winklert*),
slender gay-feather (*Liatrus tenuis*),
scarlet catchfly (*Silene subciliata*),
Texas trillium (*Trillium pusillum* var. *texarum*),
Soxman's milkvetch (*Astragalus soxmaniorum*)
Illinois flatsedge (*Cyperus grayoides*),
Texas Brown Tarantula (*Aphonopelma hentzi*),
Bachman's sparrow (*Peucaea aestivalis*),
Henslow's sparrow (*Ammodramus henslowii*),
Le Conte's sparrow (*Ammodramus leconteii*),
greater roadrunner (*Geococcyx californianus*),
southeastern American kestrel (*Falco sparverius paulus*),
northern scarlet snake (*Cemophora coccinea*),
western slender glass lizard (*Ophisaurus attenuatus attenuates*),
western chicken turtle (*Deirochelys reticularia miaria*),
coal skink (*Plestiodon anthracinus*),
eastern hog-nosed snake (*Heterodon platyrhinos*),
hispid pocket mouse (*Chaetodipus hispidus*),
Baird's pocket gopher (*Geomys breviceps sagittatus*).

Additionally, other important species such as the eastern wild turkey (*Meleagris gallopavo sylvestris*), and northern bobwhite (*Colinus virginianus*) will benefit.

5. COOPERATORS AND POINTS OF CONTACT

5.1. FEDERAL AGENCIES

5.1.1. U.S. Department of Agriculture, Forest Service

National Forests and Grasslands in Texas
2221 N. Raquet Street
Lufkin, TX 75904
Forest Biologist, Jason Engle
(936-639-8501, jaengle@fs.fed.us)

Kisatchie National Forest
2500 Shreveport Highway
Pineville, LA 71360-2009
Forest Biologist, Jason Nolde
(318-473-7160, jnolde@fs.fed.us)

U.S. Forest Service, Southern Research Station
P.O. Box 7600, SFA Station
Nacogdoches, TX 75962
Research Scientist, Craig Rudolph
(936-569-7981, crudolph01@fs.fed.us)

5.1.2. U.S. Department of Agriculture, Natural Resources Conservation Service

Louisiana NRCS
3737 Government Street
Alexandria, LA 71302
Wildlife Biologist, John Pitre
(318-473-7809, john.pitre@la.usda.gov)

5.1.3. U.S. Department of Defense, Fort Polk and the Joint Readiness Training Center

Fort Polk and the Joint Readiness Training Center
DPW-ENRMD
1697 23rd Street, Building 2543
Fort Polk, LA 71459-5509
Ecologist, Elizabeth Hoyt
(337-531-1363, elizabeth.a.hoyt6.civ@mail.mil)

5.1.4. U.S. Department of the Interior, Fish and Wildlife Service

East Texas Sub-office of the Arlington Ecological Services Office
506 Hayter Street
Nacogdoches, TX 75965
Wildlife Biologist, Robert Allen
(936-569-7981 ext. 4017, robert_allen@fws.gov)

Louisiana Ecological Services Office
646 Cajundome Blvd., Suite 400
Lafayette, LA 70506
Fish and Wildlife Biologist, Michael Sealy
(337-291-3123, michael_sealy@fws.gov)

5.2. STATE AGENCIES

5.2.1. State of Louisiana

Louisiana Department of Wildlife and Fisheries
Natural Heritage Program
P.O. Box 98000
Baton Rouge, LA 70898-9000
Biologist Program Manager, Amity Bass
(225-765-2975, abass@wlf.la.gov)

5.2.2. State of Texas

Texas Parks and Wildlife Department
4200 Smith School Road
Austin, TX 78744
Wildlife Diversity Biologist, Andy Gluesenkamp
(512-389-8722, andy.gluesenkamp@tpwd.state.tx.us)

5.3. NON-GOVERNMENTAL ORGANIZATIONS

5.3.1. Association of Zoos and Aquariums

Association of Zoos and Aquariums
Louisiana Pine Snake Species Survival Plan (SSP)
Memphis Zoo
2000 Prentiss Place
Memphis, TN 38112
Curator of Reptiles, Steve Reichling
(901-333-6711, sreichling@memphiszoo.org)

6. AUTHORITY

The signatory Cooperators enter into this CCA under federal and state law. All Parties recognize that they each have specific statutory responsibilities which cannot be delegated, particularly with respect to the management and conservation of wildlife and habitat. Nothing in this CCA is intended to reduce or nullify any of the Cooperators' respective responsibilities.

6.1. FEDERAL AGENCIES

6.1.1. U.S. Department of Agriculture, Forest Service (USFS)

The USFS is a natural resource management agency responsible for 78 million ha (193 million ac) of national forests and grasslands in 44 states, Puerto Rico, and the Virgin Islands. The national forests and grasslands comprise 8.5 percent of the total land area in the United States, and roughly 20 percent of the land holdings of the federal government. The National Forests and Grasslands harbor the most imperiled species, and the second most federally listed species of any federal agency (Grooves *et al.* 2000, p. 275). The Forest Service Manual (FSM) provides specific direction and guidance for managing rare species on national forests, and allows the Regional Forester to designate species as Sensitive (FSM 2670.22, 2670.32). The Louisiana pine snake is designated Sensitive on the Regional Forester's list. General objectives for Sensitive Species include: (1) developing and implementing management practices to ensure that species do not become threatened or endangered, (2) maintaining viable populations of all native and desired non-native wildlife, fish, and plant species and their habitats on national forests and grasslands, and (3) developing and implementing management objectives for Sensitive Species and their habitats. The authority to develop the concept of partnerships and enter into specific agreements is outlined in The Forest Service Manual (FSM 1580, 1580.1). Regional Foresters, Station Directors, and the Area Director are designated as signatory officials for cooperative agreements, and other FSM 1580 agreements for programs under their jurisdiction (FSM 1580.41d)

6.1.2. U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)

The mission of the NRCS is to improve the health of America's natural resources while sustaining and enhancing the productivity of American agriculture. NRCS achieves this by providing voluntary assistance through strong partnerships with private landowners, managers, and communities to protect, restore, and enhance the lands and waters upon which people and the environment depend under the provisions of the Soil Conservation and Domestic Allotment Act, as amended 16 U.S.C. 590f, and other applicable legislation. This legislation authorizes NRCS to cooperate with various Federal agencies, State and local governments, nongovernmental organizations, and individuals in order to carry out its responsibilities and further the

conservation mission of NRCS on private lands in a voluntary, scientifically-based manner.

6.1.3. U.S. Department of Defense, Army (DOD)

The mission of the DOD is to provide the military forces needed to deter war and to protect the security of the U.S. DOD lands contain the most federally listed species of any federal agency. However, these lands represent only 3 percent of the land holdings of the federal government (Grooves *et al.* 2000, p.276). The Sikes Act (16 U.S.C. §§ 670a-670c) authorizes the Secretary of Defense to prepare and implement an Integrated Natural Resource Management Plan (INRMP), in cooperation with the Secretary of the Interior, and the head of each appropriate state fish and wildlife agency.

An INRMP is a planning document that allows DOD installations to implement landscape level management of their natural resources while coordinating with various stakeholders. INRMPs provide for the management of natural resources, including fish, wildlife, and plants; allow multipurpose use of resources (including public access where appropriate); integrates conservation measures with military operations; and are consistent with stewardship and legal requirements. Under the Sikes Act (16 U.S.C. § 670c-1), the Secretary of a military department may enter into cooperative agreements with states, local governments, non-governmental organizations, and individuals to provide for the maintenance and improvement of natural resources on, or to benefit natural and historic research on DOD installations. Section 2684a of Title 10 of the United States Code, authorizes the Secretary of Defense or Secretary of the Military Department to enter into partnerships with private conservation organizations, local, or state governments to prevent development or use of property that would be incompatible with the mission of the installation, or preserve habitat that is compatible with environmental requirements and eliminates or relieves current or anticipated environmental restrictions that may impede upon current or future operations.

6.1.4. U.S. Department of the Interior, Fish and Wildlife Service (USFWS)

The mission of the USFWS is to work with others, in order to conserve, protect, and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people. The USFWS is responsible for the co-administration of the ESA and for monitoring candidate and species of concern. In 1973, the ESA was enacted for the purpose of conserving threatened and endangered species and preventing their extinction. All federal agencies were called upon to utilize their authorities in furtherance of the purposes of the ESA by carrying out conservation programs for these species. Sections 2, 6, and 7 of the ESA, as well as the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-754), and the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e) authorize the USFWS, in coordination with other Federal and State agencies, to facilitate conservation programs through inter-agency agreements.

6.2. STATE AGENCIES

6.2.1. Louisiana Department of Wildlife and Fisheries (LDWF)

The mission of the LDWF is to manage, conserve, and promote wise utilization of Louisiana's renewable fish and wildlife resources and their supporting habitats through replenishment, protection, enhancement, research, development, and education for the social and economic benefit of current and future generations; to provide opportunities for knowledge of and use and enjoyment of these resources; and to promote a safe and healthy environment for the users of the resources (LDWF 2010, p. 9). The control and supervision of programs relating to the management, protection, conservation, and replenishment of these resources are assigned to LDWF in the Constitution of the State of Louisiana of 1974, Article IX, Section 7 and in revised statutes under Title 36 and Title 56. The Louisiana Natural Heritage Program administers the provisions of law and rules and regulations regarding the Threatened and Endangered Species conservation program (Louisiana Acts 1974, No. 473, § 1. Amended by Louisiana Acts 1981, No. 736, § 1). The Louisiana pine snake is considered a Species of Conservation Concern (Lester et al. 2005, p. 36) and is classified as imperiled (S2) by the LDWF.

Under Louisiana Title 36:605, the Secretary of the LDWF may act as the sole agent of the State of Louisiana or designate one of the offices within LDWF or its Assistant Secretary to cooperate with the federal government and with other state and local agencies in matters of mutual concern.

6.2.2. Texas Parks and Wildlife Department (TPWD)

The mission of the TPWD is to manage and conserve the natural and cultural resources of Texas and to provide hunting, fishing and outdoor recreation opportunities for the use and enjoyment of present and future generations. TPWD's primary responsibility is to monitor, conserve, protect, and enhance the state's fish and wildlife resources, much of which is, by statute, coordinated with other state and federal agencies (TPWD 2012, p. 5-6). Additionally, the director of TPWD is responsible for filing with the secretary of state a list of fish or wildlife threatened with statewide extinction (Parks and Wildlife Code, Title 5, Subtitle B, Chapter 68, Section 68.003). The Louisiana pine snake is considered a Species of Greatest Conservation Need (SGCN), and State-listed as threatened in Texas (TPWD 2005, p.749). The Texas Natural Diversity Database is currently reviewing the status of the Louisiana pine snake throughout its range.

Under Title 5, Subtitle E, Chapter 83, Subchapter A, Section 83.005, any conservation agreement for the protection of species (an agreement between the state or a political subdivision of the state and the United States Department of the Interior under the federal ESA that does not relate to a federal permit) must be developed in consultation

with the Parks and Wildlife Department.

7. CCA MANAGEMENT AND ADMINISTRATION

7.1. LOUISIANA PINE SNAKE CCA WORKGROUP FORMATION, ORGANIZATION AND LEADERSHIP

In order to meet the objectives of this CCA, the Louisiana Pine Snake CCA Workgroup (LPSCW) will manage, administer, and periodically review this CCA. The LPSCW will consist of one or more designated representatives from each Cooperator participating in this CCA and may include technical and legal advisors and other members as deemed necessary. Cooperators may have multiple sub-organizations involved; e.g., individual Ranger Districts of the Kisatchie National Forest. The responsibility of this workgroup is to coordinate the implementation and administration of the CCA without superseding the jurisdictional responsibility of any Cooperator. The LPSCW will make recommendations for the conservation, management, and research needs of the Louisiana pine snake, particularly regarding their specific authority. Louisiana pine snake trapping (including locations, effort, and success) and other occurrence data collected by LPSCW representatives will be maintained and managed within a geodatabase by the USFS Southern Research Station or USFWS. A database of captive breeding data (including the individual snakes' origins, breeding pairings and location, egg production, hatching success, neonate survival, and disposition of individuals (release into wild or held for breeding)) will be maintained, managed, and distributed within the LPSCW.

Individual workgroup representatives of the LPSCW and the Cooperator that they represent can be found in Appendix E.

7.2. CCA ASSESSMENT AND MANAGEMENT

The LPSCW will be responsible for the coordination of the conservation activities and monitoring of the conservation actions and commitments of the Cooperators to determine whether all actions are in accordance with the CCA. One designated Cooperator of the LPSCW will develop an annual assessment report of the Cooperators' progress towards implementing the conservation actions described in this CCA. LPSCW members will meet annually to review the progress that the Cooperators have made, and discuss recommendations for CCA revisions. Following the annual review, the LPSCW will publish an announcement to the repositories designated below detailing the progress made to date on the implementation of the conservation actions described in the CCA.

8. SPECIES INVOLVED

8.1. DESCRIPTION

Pine snakes (genus *Pituophis*) are large, short-tailed, non-venomous, powerful constricting

snakes with keeled scales, a single anal plate (the scale covering the cloaca) and disproportionately small heads (Conant and Collins 1991, pp. 201-202). Their snouts are pointed and they are proficient burrowers. The Louisiana pine snake (*P. ruthveni*) has a buff to yellowish background color with dark brown to russet dorsal blotches covering its total length (Vandeventer and Young 1989, p. 35; Conant and Collins 1991, p. 203). The belly of the Louisiana pine snake is unmarked or boldly patterned with black markings. The Louisiana pine snake is variable in both coloration and pattern, but a characteristic feature is that its body markings are always conspicuously different at opposite ends of its body. Blotches run together near the head, often obscuring the background color, and then become more separate and well-defined towards the tail. Typically, there are no noticeable head markings, although rarely a light bar or stripe may occur behind the eye. The typical length of adult Louisiana pine snakes ranges from 122 to 142 centimeters (cm) (48 to 56 inches (in)) (Conant and Collins 1991, p. 203). The largest reported specimen was 178 cm (5.8 feet (ft)) long (Conant and Collins 1991, p. 203; Davis 1971, p. 145).

The Louisiana pine snake is a member of the Class Reptilia, Order Squamata, Suborder Serpentes, and Family Colubridae. Stull (1929, pp. 2-3) formally described the Louisiana pine snake as a pine snake subspecies (*P. melanoleucus ruthveni*) based on two specimens taken in Rapides Parish, Louisiana. Reichling (1995, p. 192) reassessed this snake's taxonomic status and concluded that the Louisiana pine snake was geographically isolated and phenotypically distinct, and thus a valid evolutionary species. The Louisiana pine snake has subsequently been accepted as a full species, *P. ruthveni* (Crother 2000, p. 69; Rodriguez-Robles and Jesus-Escobar 2000, p. 46; Collins and Taggart 2002, p. 33).

8.2. LIFE HISTORY

Sexual maturity is attained at an approximate length of 120 cm (4 ft) and an age of approximately three years (Himes *et al.* 2002, p. 686). The Louisiana pine snake is oviparous, with a gestation period of about 21 days (Reichling 1988, p. 77), followed by 60 days of incubation. Having the smallest clutch size (3 to 5) of any North American colubrid snake, the Louisiana pine snake is limited by a remarkably low reproductive rate (Reichling 1990, p. 221). However, the Louisiana pine snake produces the largest eggs (generally 12 cm (5 in) long and 5 cm (2 in) wide) of any U.S. snake (Reichling 1990, p. 221). It also produces the largest hatchlings reported for any North American snake, ranging 45 to 55 cm (18 to 22 in) in length, and up to 107 grams (g) (4 ounces (oz)) in weight (Reichling 1990, p. 221). Captive Louisiana pine snakes can live over 30 years, but females have not been observed to have reproduced beyond the age of 18 years (Reichling 2008a, p. 4, Appendix A).

Telemetry data indicate that Louisiana pine snakes are most often (80.9 percent) found within or near Baird's pocket gopher (*Geomys breviceps*) burrow systems (Ealy *et al.* 2004, p. 389; Himes *et al.* 2006, p. 107), and that they use these burrow systems as nocturnal refugia, as hibernacula, and to escape from fire (Rudolph and Burgdorf 1997, p. 117; Rudolph *et al.* 1998, p. 147; Ealy *et al.* 2004, p. 386). Himes *et al.* (2006, p. 107) found that

Louisiana pine snakes had an average home range size of 33.2 ha (82 ac) (range 6.5 to 108 ha (16 to 267 ac)). Himes (1998, p. 18) found that adult males had larger home ranges (58.7 ha (145 ac)) than females (14 ha (25 ac)) and juveniles (5.5 ha (13 ac)). Due to its rarity, secretive nature, and preference for occupying pocket gopher burrow systems, Louisiana pine snakes are difficult to locate and capture, even in areas where they are known to occur (Ealy *et al.* 2004, p. 384). No nests of this species have been located in the wild.

Louisiana pine snakes appeared to be most active March-May and September-November (especially November) and least active December-February and summer (especially August) (Himes 1998, p. 12). Louisiana pine snakes were observed by Ealy *et al.* (2004, p. 391) to be semi-fossorial and essentially diurnal. Ealy *et al.* (2004, p. 390) documented that the species spent 59 percent of daylight hours (sunrise to sunset) below ground and moved an average of 163 meters (m) (541 ft) per day. Furthermore, Louisiana pine snakes in east Texas were relatively immobile (i.e., moved less than 10 m (33 ft)) on 54.5 percent of days monitored and all recorded movements occurred during daytime (Ealy *et al.* 2004, p. 391). Adult males in Louisiana moved an average of 150 m (495 ft) daily, adult females 106 m (348 ft), and juveniles 34 m (112 ft) (Himes 1998, p. 18).

Baird's pocket gophers are the primary prey of the Louisiana pine snake (Himes 2000, p. 97; Rudolph *et al.* 2002, p. 58; Rudolph *et al.* 2012, p. 243), although the species has also been known to eat eastern moles (*Scalopus aquaticus*), mice (*Peromyscus* sp. and *Reithrodontomys* sp.), cotton rats (*Sigmodon hispidus*), and turtle (probably *Trachemys scripta*) eggs (Rudolph *et al.* 2002, p. 59; Rudolph *et al.* 2012, p. 244).

8.3. HABITAT

Louisiana pine snakes are endemic to the westerly extent of the longleaf pine ecosystem that historically existed in Louisiana and Texas. Louisiana pine snake habitat consists of sandy, well-drained soils in open pine forest (especially longleaf-pine savanna), a sparse midstory, and well-developed herbaceous ground cover dominated by grasses and forbs (Rudolph and Burgdorf 1997, p. 117). Abundant ground layer herbaceous vegetation is important for Louisiana pine snakes and their primary prey, the Baird's pocket gopher. These fire-climax park-like conditions are created and maintained by recurrent low-intensity ground fires that occur on a 3 to 5 year return interval. In the absence of recurrent fire, suitable Louisiana pine snake habitat conditions are lost due to vegetative succession. Using radio-telemetry in Bienville Parish, Louisiana, Himes (1998, p. 17) recorded native Louisiana pine snakes (nine adults and one juvenile) most frequently in pine forests (56 percent), followed by pine plantation (23 percent) and clear-cuts (9 percent). Louisiana pine snakes have also been found in grasslands and pine plantations that contain sufficient herbaceous ground cover, and sandy soils (Reichling *et al.* 2008, p. 9).

Additionally, Baird's pocket gophers create the burrow systems in which Louisiana pine snakes are most frequently found (Rudolph and Conner 1996, p. 2; Rudolph and Burgdorf 1997, p. 117; Himes 1998, p. 42; Rudolph *et al.* 1998, p. 146; Rudolph *et al.* 2002, p. 62).

Up to 90 percent of radio-tagged snake relocations have been underground in pocket gopher burrow systems, and movement patterns are typically from one pocket gopher burrow system to another. In Louisiana, habitat selection by Louisiana pine snakes seemed to be determined by the abundance and distribution of pocket gophers and their burrow systems (Himes 1998, p. 41). Although active snakes did utilize debris and logs as temporary shelters, they were most often found adjacent to pocket gopher burrows. Snakes disturbed on the surface retreated to nearby burrows, and hibernation sites were always within burrows (Rudolph and Burgdorf 1997, p. 117).

Pocket gopher abundance is dependent upon an abundance of herbaceous groundcover and loose, sandy soils. The amount of herbaceous vegetation is related to canopy cover. Generally, a rich, herbaceous ground layer requires a high degree of solar penetration onto the forest floor. Himes (1998, p. 43) found that pocket gopher abundance was associated with a low density of trees and an open canopy, which allowed greater sunlight, more herbaceous understory growth, and better forage for pocket gophers.

8.4. DISTRIBUTION AND STATUS

The Louisiana pine snake is recognized as one of the rarest snakes in North America (Young and Vandevanter 1988, p. 203; Himes *et al.* 2006, p. 114). The Louisiana pine snake historically occurred in portions of northwest and west-central Louisiana and extreme east-central Texas (Conant 1956, p. 19). This area coincides with an isolated, and the most westerly, occurrence of the longleaf pine ecosystem and is situated west of the Mississippi River. Most of the sandy longleaf pine-dominated savannas believed to be the preferred habitat of the Louisiana pine snake had been lost by the mid-1930's (Bridges and Orzell 1989, p. 246; Frost 1993, p. 30). Therefore, it is extremely likely that undocumented populations of this species historically occurred but were lost before the 1930s, since virtually all virgin timber in the south was cut during intensive logging from 1870 to 1920 (Frost 1993, p. 38).

The USFS Southern Research Station, Wildlife Habitat and Silviculture Laboratory in Nacogdoches, Texas, has compiled a 'historical records' database of all known Louisiana pine snake locations (excluding telemetry data). According to that database, 236 occurrence records of 218 individual Louisiana pine snakes at 162 unique locations have been verified from 1927 through March 27, 2013 (Pierce 2013 unpub. data). Based on this database, there are historical records for the Louisiana pine snake from seven parishes in Louisiana (Beauregard, Bienville, Jackson, Natchitoches, Rapides, Sabine, and Vernon) and 12 counties in Texas (Angelina, Hardin, Houston, Jasper, Nacogdoches, Newton, Polk, Sabine, San Augustine, Trinity, Tyler, and Wood). Currently, trapping is the only available method for surveying Louisiana pine snake populations. Since 1990, Louisiana pine snake trapping has been conducted by the USFS, the DOD (Fort Polk), the Memphis Zoo, and the LDWF. In total, trapping in selected areas throughout the entire (including historic) range of the Louisiana pine snake has resulted in 79 captures during 328,396 trap days (1992-2011). Supported by range-wide trapping results and the historical records database, Rudolph *et al.*

(2006, p. 467-469) concluded that the failure to document existing Louisiana pine snake populations at known historical localities, coupled with the extensive documented loss, degradation, and fragmentation of longleaf pine habitat, indicates that the Louisiana pine snake has been extirpated from significant portions of its historical range and that six occupied ranges were in existence at that time. Later, an additional Louisiana pine snake occupied range was observed on the Kisatchie District of the Kisatchie National Forest in Louisiana. Based on counties or parishes with multiple Louisiana pine snake sightings and trap-captures during 1990 to 2011, extant Louisiana pine snake populations occur in four parishes (Bienville, Natchitoches, Sabine, and Vernon) in Louisiana and four counties (Angelina, Jasper, Newton, and Sabine) in Texas (Appendix C.). A single observation of a Louisiana pine snake found dead along a road in 2001 suggests that the current Louisiana pine snake population in Natchitoches Parish may extend into extreme northwestern Rapides Parish, Louisiana. In 2013, an adult female Louisiana pine snake was obtained which was captured as a juvenile in 2008 in Nacogdoches County near Garrison, Texas. The absence of Louisiana pine snake sightings and trap-captures during 1990 to 2011 indicates that the Louisiana pine snake has likely been extirpated from three parishes (Beauregard, Jackson, and Rapides) in Louisiana and six counties (Hardin, Houston, Polk, San Augustine, Trinity, and Wood) in Texas (USDA Forest Service 2011, pers. comm.).

Those seven existing Louisiana pine snake populations (based upon 1990 - 2011 occurrence data) are primarily concentrated on public lands (DOD lands at Fort Polk and Peason Ridge, Louisiana and the Kisatchie, Angelina, and Sabine National Forests) and privately-owned industrial timberlands in Louisiana and Texas. However, due to the expense and time required for trapping and the only recently available predictive habitat model (LRSF Model) (Wagner *et al.* 2009), sufficient Louisiana pine snake surveys have not occurred in all areas of potential habitat to precisely delineate the boundaries of the occupied range of extant populations. Consequently, although trapping data and opportunistic sighting records were used to establish the boundaries of occupied ranges, the estimates derived from these data are approximations.

To estimate the size of the occupied ranges, Louisiana pine snake records ($n = 110$, from 1990 to 2007) containing location data were plotted in a Geographic Information System (GIS). Using ArcMap (Version 9.2), a minimum convex polygon (MCP) was drawn around clustered records, and a one kilometer (km) (0.6 mile (mi)) buffer was drawn around each MCP (Occupied Habitat MCP (OHMCP)) (Appendix C.). Because trapping results are functions of trap location selection, trap success, and true presence or absence, trapping data only approximates Louisiana pine snake use of an area, but is the best available estimate. A one km (0.6 mi) buffer was used because telemetry data indicate this is a reasonable approximation of the area that a Louisiana pine snake uses during one or more years (D.C. Rudolph 2008a in litt.).

Using the methodology described above to estimate the seven extant Louisiana pine snake occupied ranges, The following OHMCPs have been delineated (Appendix C.): (1) the Bienville, LA OHMCP located on privately owned industrial timberlands in Bienville

Parish, USFS lands (a small section of the Winn District of the Kisatchie National Forest in extreme northern Natchitoches Parish), and a small amount of State lands; (2) the Kisatchie, LA OHMCP located on USFS lands (the Kisatchie District of the Kisatchie National Forest in Natchitoches Parish); (3) the Peason Ridge, LA OHMCP located on DOD lands (Peason Ridge Military Reservation in Vernon and Sabine Parishes) and a small amount of private lands; (4) the Fort Polk/Vernon, LA OHMCP located on DOD lands (Fort Polk Military Reservation (Main Post)), USFS lands (the Vernon Unit/Calcasieu District of the Kisatchie National Forest in Vernon Parish), and a small amount of private lands; (5) the Sabine, TX OHMCP located on USFS lands (the southern section of the Sabine National Forest in Sabine County) and a small amount of private lands; (6) the Scrappin Valley, TX OHMCP located on privately owned industrial timberlands in Newton County; and (7) the Angelina, TX OHMCP located on USFS lands (the southern section of the Angelina National Forest in Angelina and Jasper Counties) and private lands.

Population densities cannot be reliably estimated from trapping data because mark-recapture analyses cannot be conducted without sufficient numbers of Louisiana pine snake recaptures. Consequently, no estimates of Louisiana pine snake population densities exist.

The best available indices of current Louisiana pine snake occurrence are trap success and the number of capture/sighting records per population. How these metrics relate to true population size is unknown. With the exception of the Fort Polk/Vernon and Peason Ridge populations, most populations have shown a decline in trap success through time. Despite continued effort, some populations have not experienced trap success or new individual occurrence records for many years. Occurrence records (all provided by Pierce 2013 unpub. data) are presented for each OHMCP (Appendix C.) below:

- The Bienville, LA OHMCP: Based on historic trap success and individual occurrence records (34 records from 2000 to 2012), the Bienville population is widely believed to be the largest extant Louisiana pine snake population (Rudolph *et al.* 2006, p. 465; Reichling *et al.* 2008, p. 10). Most records within this OHMCP ($n = 29$, (2000 to 2012)) have occurred on a 12,353 ha (30,525 ac) parcel of privately-owned industrial timberland (Reichling *et al.* 2008, p. 1) which is not covered by this CCA. On the Winn District, two individual records were obtained in 2000 and a recapture occurred in 2001, which was the last known observation on that District.
- The Kisatchie, LA OHMCP: Two individual records (one non-capture sighting (2003) and one hand-capture (2007)) exist for this population since 2000. No Louisiana pine snakes have been documented within this OHMCP since 2007.
- The Peason Ridge, LA OHMCP: Five individual records (from 2000 to 2012, all observed after 2005) exist for this population; one of which was a non-trap sighting. The trapping effort for the last three years (2010 to 2012) produced three captures.
- The Fort Polk/Vernon, LA OHMCP: Twenty-eight individual records from 2000 to 2012 including four separate non-trap sightings exist for this population. Relatively moderate trap success and records of occurrence, and a large amount of potentially suitable habitat under active management, occur within this population.

- The Sabine, TX OHMCP: Only four individual records (all from trapping data obtained during 1993 to 1995) exist for this population. No trap success or any other sighting has occurred within this population since 1995. This population may be extirpated or is currently vulnerable to decreased demographic viability or stochastic environmental factors.
- The Scrappin' Valley, TX OHMCP: Five individual records during 2000 to 2012 (all since 2005) exist for this population; however, two of those were road mortalities, two were removed from the wild for captive breeding, and one was sighted but not captured. The most recent trap capture at this site was in 2008. The OHMCP of this population occurs on privately-owned property in Newton County, TX, and is not addressed by this CCA.
- The Angelina, TX OHMCP: Six individual records (2000 to 2012) exist for this population. However, no unique occurrences, including trap success, have been documented since 2007. A previously captured snake was found dead on a road in 2009 and another previously captured snake was recaptured in 2012 and is being held to supplement the captive breeding program described below. This population may have become extirpated and/or is currently vulnerable to decreased demographic viability or stochastic environmental factors.

Additionally, as of April 2013, the captive-breeding Louisiana pine snake population consists of 83 individuals (39 males and 44 females) at 21 AZA institutions and 2 non-AZA institutions, which are divided into three groups separated by their different geographic origins – Bienville Parish, LA; Vernon Parish, LA; and eastern Texas. The Bienville portion of the population consists of 64 individuals (28 males and 36 females) distributed among 21 AZA institutions and 1 non-AZA institution. The Vernon portion consists of 13 individuals (7 male and 6 females) at 3 AZA institutions and 1 non-AZA institution. The Texas portion consists of 6 individuals (4 males and 2 female) at 2 AZA institutions (Reichling and Schad 2010, p. 1; Reichling 2012, p. 1, Reichling and Marti 2013, p. 4).

Because significant life history information is lacking for this species and current sampling methodology cannot determine population density, no estimates exist regarding the acreage or population size necessary to support a viable Louisiana pine snake population. Furthermore, the current and future status of the Louisiana pine snake must be viewed in light of the fact that most remnant Louisiana pine snake populations will remain demographically and genetically isolated into the future. Genetic studies are currently underway to define the genetic health of these populations and further inform the management of the captive breeding program.

Based on the low capture rates and limited habitat availability, Rudolph *et al.* (2006, p. 468) concluded that remnant Louisiana pine snake populations are not large. The Louisiana pine snake was classified in 2007 as endangered on the IUCN (World Conservation Union) Red List of Threatened Species (version 3.1; <http://www.iucnredlist.org/>). As a candidate, the Louisiana pine snake receives no formal Federal protection under the ESA. The State of Texas has designated the Louisiana pine snake as threatened and protected from direct harm

and unauthorized collection. In Louisiana, unpermitted killing or removal from the wild is prohibited and the Louisiana pine snake is classified as imperiled.

8.5. LAND OWNERSHIP

Using the methodology described above to estimate the seven extant Louisiana pine snake occupied ranges, those OHMCPs occur on 14,141 ha (34,943 ac) of DOD land, 21,630 ha (53,451 ac) of USFS land, 84 ha (206 ac) of State land, and 30,259 ha (74,770 ac) of private land (Table 1).

State	OHMCP	U. S. Forest Service	Department of Defense	State	Private	Total for Population		
Louisiana	Bienville	1,034 (2,555)		84 (206)	27,519 (68,002)	28,657 (70,763)		
	Kisatchie	1,553 (3,838)						
	Peason Ridge		1,927 (4,761)				22 (29)	1,939 (4,790)
	Fort Polk/Vernon	14,886 (36,785)	12,214 (30,182)				36 (88)	27,236 (67,055)
State Total		17,473 (43,178)	14,141 (34,943)	84 (206)	27,567 (68,119)	59,265 (146,446)		
Texas	Sabine	320 (791)			71 (176)	391 (967)		
	Scrappin' Valley				2,047 (5,057)	2,047 (5,057)		
	Angelina	3,837 (9,482)			574 (1,418)	4,411 (10,900)		
State Total		4,157 (10,273)			2,692 (6,691)	6,849 (16,964)		
Total Ownership		21,630 (53,451)	14,141 (34,943)	84 (206)	30,299 (74,770)	66,114 (163,370)		

Table 1. Land ownership (ha (ac)) of estimated Louisiana pine snake populations (OHMCP)

9. THREATS INFLUENCING THE SURVIVAL OF THE LOUISIANA PINE SNAKE

The success of any conservation program is dependent upon eliminating or significantly reducing the impact of threats to the species' existence. The following summarizes the five listing factors identified in section 4(a)(1) of the ESA which must be considered by the USFWS in evaluating current threats to the Louisiana pine snake. In addition, identification of the specific threats to the Louisiana pine snake and its habitat provides a framework for implementation of conservation measures to address those threats. Much of the information below comes directly from the most recent Species Assessment and Listing Priority Assignment Form completed for the species (USFWS, 2012).

9.1. THE PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF THE SPECIES' HABITAT OR RANGE

Both the quantity and quality of the longleaf pine ecosystem have declined in Louisiana and Texas since European settlement. The loss and degradation of most of the longleaf pine ecosystem, and hence of Louisiana pine snake habitat, was historically caused by logging, turpentine, fire suppression, alteration of fire seasonality and periodicity, conversion to off-site pine plantations, agriculture, and urbanization (Frost 1993, pp. 24-30). Between the 1930s and the 1980s, most of what still remained of the natural longleaf pine forest in Louisiana and Texas was converted to extensive pine plantation monocultures (Bridges and Orzell 1989, p. 246). Consequently, the longleaf pine forest that existed as of the late 1980s in Louisiana and Texas has been reduced to 15 and 8 percent, respectively, of the acreage that existed in 1935 (Bridges and Orzell 1989, p. 246). Importantly, the estimated 1935 acreages were a fraction of those that existed pre-European settlement, since virtually all virgin timber in the south was cut during intensive logging from 1870 to 1920 (Frost 1993, p. 30). Disruption of natural fire regimes, due to fire suppression and inadequate prescribed burning, is the leading factor responsible for the degradation of the small amount of remaining longleaf pine forest available within the Louisiana pine snake range (Rudolph and Burgdorf 1997, p. 118). Habitat surveys conducted by Rudolph (2000, p. 7) indicate that changes in fire regimes may represent the greatest threat to Louisiana pine snake habitat quality in recent years. In the absence of frequent and effective fires, upland pine savannah ecosystems rapidly develop a mid-story of hardwoods and off-site species which suppress or eliminate any herbaceous understory. Since the presence of pocket gophers is directly related to the extent of herbaceous vegetation available to them, their population numbers and distribution declines as such vegetation declines. The resulting reduction of pocket gophers and their distribution directly impacts the number and distribution of Louisiana pine snakes.

All extant Louisiana pine snake populations have been affected by habitat loss and fragmentation, and all require active management to maintain suitable habitat conditions. Potential Louisiana pine snake habitat has been maintained or increased in some populations, whereas in other populations existing habitat continues to be lost and degraded, albeit at a slower rate than that which occurred historically. On private land, open pine habitats containing dense herbaceous vegetation are being (or have been) converted to densely-stocked, closed canopy, off-site industrial pine plantations that are harvested on very short rotations (less than 40 years) and managed with herbicides. These forests have sparse and poorly structured understory plant communities, an early successional trait that is present throughout the rotation, rendering them generally unsuitable for pocket gophers. Furthermore, if herbicide use alters the composition and/or density of the ground cover vegetation and pocket gophers decline in response, the Louisiana pine snake population in that area will decline as well (Rudolph and Burgdorf 1997, p. 118). The use of fire is heavily reduced on private timberland because of the expense of fire liability insurance, legal liability, the planting of off-site pine species which have a reduced tolerance to fire, limited funds and personnel, and smoke management issues. In addition, the increasing

trend towards the divestiture of industrial forest lands in the southeast complicates establishing public-private partnerships and long-term forest management agreements.

The Bienville Parish, LA population of Louisiana pine snakes, presumably the largest extant population based on trapping results, primarily occurs on private industrial forest land. Much of this industrial forest has been converted to short-rotation loblolly pine plantations. Although the broadcast application of herbicides has been restricted in select plantations, these sites are managed with clear-cutting at 25-year harvest rotations and the use of targeted herbicides instead of prescribed burning (Smith 2008 pers. comm.). Two separate Louisiana pine snake Conservation Management Areas (CMAs), are being beneficially managed (via longleaf pine restoration, prescribed burning, and understory control) for the Louisiana pine snake by the private landowner. However, if the conversion of forests outside of the CMAs to short-rotation loblolly plantations results in a decrease in the suitability of these areas as Louisiana pine snake habitat (Rudolph *et al.* 2006, p. 470), the Louisiana pine snakes occupying the CMAs will become fragmented. If isolation occurs, the long-term persistence of Louisiana pine snakes in the CMAs has been questioned by some authorities (Reichling *et al.* 2008, p. 10) based on the belief that neither CMA is large enough to support a viable Louisiana pine snake population. Louisiana pine snakes have been found within loblolly pine plantations at these sites outside of the CMAs (Reichling *et al.* 2008, p. 6). However, based on trapping surveys and location records, Rudolph *et al.* (2006, p. 470) concluded that areas managed with these intensive silvicultural practices (e.g., clear-cutting, short rotations, planting of off-site pine species, and the use of herbicides instead of prescribed fire) do not support viable Louisiana pine snake populations. The buying and selling of the Bienville properties by Timber Investment Management Organizations (TIMOs) adds additional uncertainty regarding the future land use priorities on these sites. The recent conversion of a large portion of occupied habitat to short-rotation pine plantations highlights the potential conflicts between Louisiana pine snake conservation and economics on private land. Despite the beneficial management in the two CMAs, no formal conservation agreements currently exist for habitat occupied by this population. Furthermore, the Bienville properties are located near an area which is undergoing increasing natural gas exploration in association with a formation known as Haynesville shale. It is currently unknown if and at what level the Louisiana pine snake is being affected by those activities. However, well pad, pipeline, and road construction are anticipated to cause direct loss of existing habitat, and increased fragmentation, road mortality, and erosion control blanket exposure.

The quality of Louisiana pine snake habitat has been a concern on Federal lands in Louisiana and Texas in recent decades due to midstory encroachment and high stand density (Rudolph *et al.* 2006, p. 470). Forest fragmentation by roads and private inholdings and the concomitant smoke management and liability concerns, have hindered prescribed-burning and have caused natural fires to be suppressed. These factors have limited the development of healthy ground layer herbaceous vegetation in some areas. Since the 2003 signing of the CCA for the Louisiana Pine Snake between the USFWS, USFS, DOD, TPWD, and LDWF (USFWS 2003, pp. 30), extensive beneficial habitat management (prescribed burning and

thinning) within occupied and potential Louisiana pine snake habitat has occurred on Federal lands. The increases in the acreages of burning and thinning conducted have improved habitat conditions on many Federal lands that support Louisiana pine snake populations (Rudolph 2008b in litt.). Quantifying the extent to which these management activities have improved conditions for Louisiana pine snakes has remained difficult because vegetative responses to habitat management are not typically reported. In addition, not all areas of occupied Louisiana pine snake habitat or areas that have been identified by the LRSF Model as potentially preferable Louisiana pine snake habitat have received recent beneficial management.

9.2. OVERUTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC, OR EDUCATIONAL PURPOSES

According to the United Nations Environment Program-World Conservation Monitoring Centre (UNEP-WCMC 2009, p. 17), reportedly captive-bred Louisiana pine snakes were advertised for sale on four German websites in 2009 and two U.S. breeders were listed on another website. However, current levels of Louisiana pine snake collection to support the captive-bred snake market have not been quantified. Ongoing take of Louisiana pine snakes in Louisiana for commercial, recreational, scientific, or educational purposes is not currently considered a threat (Boundy 2008 in litt.) and there appears to be very little demand for this species by private collectors (Reichling 2008b in litt.). Given the restricted distribution, presumed low population sizes, and low reproductive potential of Louisiana pine snakes, even moderate collecting pressure would negatively affect extant populations of this species. Webb *et al.* (2002, p. 64) concluded that, in long-lived snake species exhibiting low capacity to produce young in large numbers, the sustained removal of adults from isolated populations would eventually lead to extirpation. Because extant Louisiana pine snake populations are isolated, dispersal does not occur between populations. However, the Louisiana pine snake is prohibited from non-permitted collection by State law in Texas and Louisiana, and most private land where extant Louisiana pine snake populations occur restrict public access. In addition, the secretive nature, preference for occupying pocket gopher burrows, and current rarity of the Louisiana pine snake make collection of this species difficult (Gregory 2008 in litt.).

9.3. DISEASE OR PREDATION

Disease and natural predation are not currently considered to be threats to this species survival.

9.4. THE INADEQUACY OF EXISTING REGULATORY MECHANISMS

In Texas, the Louisiana pine snake is listed as state threatened and prohibited from unauthorized collection. As of February 2013, unpermitted killing or removal from the wild is prohibited in Louisiana. Collection or harassment of Louisiana pine snakes is prohibited on USFS properties in Louisiana (USDA Forest Service 2002, p. 1). The capture, removal,

or killing of non-game wildlife from Fort Polk and Peason Ridge (DOD land) is prohibited without a special permit (U.S. Department of the Army 2008, p. 6; U.S. Department of the Army 2013, p. 51). However, those regulations do not protect the habitat of the species which has declined.

Malicious killing of snakes by humans is a significant issue in snake conservation because snakes arouse fear and resentment from the general public (Bonnet *et al.* 1999, p. 40). Intentional killing of black pine snakes by humans along the Gulf Coast has been documented (USFWS 2007, p. 8). The intentional killing of Louisiana pine snakes by humans is likely, but the extent of the impact of this stressor is unknown. The Service does not have information related to the implementation, compliance, or enforcement of the existing regulatory mechanisms by the states or federal land managers.

9.5. OTHER NATURAL OR MANMADE FACTORS AFFECTING ITS CONTINUED EXISTENCE

The historic and ongoing fragmentation of the longleaf pine ecosystem, and hence of Louisiana pine snake habitat, has resulted in extant Louisiana pine snake populations that are all isolated and small. Small, isolated populations experience decreased demographic viability, increased susceptibility of extirpation from stochastic environmental factors (e.g., weather events, disease), and increased threat of extirpation from genetic isolation and subsequent inbreeding depression and genetic drift.

Roads, and associated vehicular traffic, have been identified as important causes of snake mortality and population declines (Rudolph *et al.* 1999, p. 130; Himes *et al.* 2002, p. 686). Himes *et al.* (2002, p. 686) documented the death of 15 Louisiana pine snakes during their radio-telemetry study in Louisiana and Texas. Three of the 15 (20 percent) deaths were from vehicle mortality. Roads with moderate to high traffic levels reduce adjacent snake populations by 50 to 75 percent and measurable impacts extend up to 850 m (approximately one-half mile) from roads (Rudolph *et al.* 1999, p. 130). The threat of road mortality may be highest in the Longleaf Ridge Area of the south Angelina National Forest (Compartments 74 thru 77, 79 thru 92, and south portions of 73 and 78). In the Sabine National Forest, vehicle-induced mortality may be high in Compartment 139 (Foxhunter's Hill). Off-road vehicle use may also cause significant impacts to Louisiana pine snake populations. However, no significant data exists to quantify the impact of off-road vehicle use.

ECBs installed in pipeline, power line, and road rights-of-way can result in direct Louisiana pine snake mortality due to entanglement. Rudolph (2011 in litt.) demonstrated that synthetic erosion control blanket material caused immediate entanglement and snakes were unable to extract themselves after exposure.

The Louisiana pine snake has an extremely low reproductive rate, producing a very small clutch of 4 eggs on average (Reichling 1990, p. 221). The Louisiana pine snake's low fecundity (reproductive output) and low population growth rate magnifies the effect of all

other threats and increases the likelihood of local extirpations.

The extensive historic loss of habitat has reduced the Louisiana pine snake into seven (possibly less) isolated populations. The historic and ongoing loss of potential habitat on private land in the matrix between these extant populations has essentially eliminated the potential for successful dispersal among remnant populations, as well as the potential for natural re-colonization of vacant or extirpated habitat patches. In addition, the prospects are low for securing and restoring habitat corridors between most extant populations. Furthermore, snakes are vulnerable to increased intentional and unintentional mortality when they disperse outside of their home ranges and into developed areas (Bonnet *et al.* 1999, p. 47).

Because extant Louisiana pine snake populations are few in number, small in size, demographically isolated and produce a relatively small number of eggs, any factor (e.g., habitat change, a loss of demographic viability, etc.) that results in a further decline in Louisiana pine snake densities within a remnant population is problematic for the long-term recovery of this species.

10. CONSERVATION STRATEGY COMMITMENTS

The commitments and actions described in this CCA focus on targeting education, conservation, improvement and management of the Louisiana pine snake's status and its habitat to directly address identified threats. Specifically, the Cooperators are using the best scientific information available to focus specific actions that directly influence the impact of identified threats within habitat that is preferable to the Louisiana pine snake (Appendix B). Because each of the Cooperators are bound to certain guiding agency/entity requirements based on mission, goals and responsibilities, the landscape and local level conservation actions (subsection 10.2) are intended to be adaptable and implemented by all Cooperators in accordance with their individual missions. All Cooperators will seek funding for carrying out the conservation actions identified below, and will collaborate on cost-sharing opportunities when possible. All funding commitments made pursuant to this CCA are subject to budget authorizations and approval by the appropriate agency/entity. The LPSCW will meet on an annual basis to evaluate the activities identified below and determine their effectiveness in conserving the Louisiana pine snake. Cooperator-specific conservation actions can be found in subsection 10.3. Appendix B links specific land-owning Cooperator actions directly to currently identified threats and provides a mechanism for reporting the impact of those actions.

For all land-owning Cooperators, the land areas identified in the CCA will be treated as habitat management units (HMUs) for the Louisiana pine snake, and protected as such to the maximum extent possible. HMUs were established by utilizing the LRSF Model in conjunction with professional land-manager expertise to identify areas that have the best potential for providing preferential habitat to Louisiana pine snakes regardless of known occupancy, current ground, midstory, or canopy conditions, or pocket gopher density presently occurring. Adverse impacts to the species will be avoided, and beneficial management activities will be continued or

implemented. In consideration of the premises of this document, the respective responsibilities and provisions of each Cooperator are as follows:

10.1. EDUCATION AND OUTREACH

“The best hope to protect snakes’ habitats and prevent malicious killing lies in public education” (Gibbons and Dorcas, 2005). All Cooperators agree that education and outreach efforts will be integral tools for the conservation of the Louisiana pine snake. The LPSCW will assess the need to distribute and improve current or develop additional outreach materials, and Cooperators will engage in public awareness programs that promote Louisiana pine snake conservation and encourage land users to avoid harassing or harming snakes. Cooperators that develop new outreach materials related to the Louisiana pine snake and/or its habitat will share those materials with other LPSCW members. Outreach materials include, but are not limited to pamphlets, newsletter articles, public announcements, factsheets, expert interviews to the media, and other educational materials. Public awareness programs include, but are not limited to, wildlife crossing signs, identification and conservation training programs for agency/entity staff, general public, hunters, foresters, loggers, and other stakeholders of lands containing Louisiana pine snakes. In addition, the LPSCW will reach out to, and utilize partnering organizations such as the Partnership for Amphibian and Reptile Conservation (PARC), The Nature Conservancy (TNC), Louisiana and Texas Chapters of the Wildlife Society, The Longleaf Alliance, and local universities for overall support.

Awareness can promote higher levels of environmental stewardship and protection for the Louisiana pine snake. The USFWS and USFS/SRS will create and manage repositories for Louisiana pine snake conservation research and information (e.g., Louisiana pine snake Sharepoint website (TBD), the Gulf Coastal Plains and Ozarks LCC, Louisiana Pine Snake Working Group Forum (<http://gcpolcc.org/group/louisiana-pine-snake-working-group>) and the USFS/SRS Library of Publications (<http://www.srs.fs.usda.gov/4159/pubs/>)). These repositories will include items such as Louisiana pine snake research, habitat management strategies, and outreach/education materials. Each Cooperator will provide new information to the repository managers and will post Louisiana pine snake information (and/or links to other appropriate websites) to their own internal and external websites.

10.2. HABITAT CONSERVATION COMMITMENTS

10.2.1. Landscape Level Conservation

This section describes general conservation actions that all Cooperators agree to implement at the regional or landscape level in accordance with their individual missions. These common and broad actions include:

- Seek funding and staffing necessary to carry out the conservation actions through all available channels.

- Support the maintenance of the ‘historical records’ database by providing field data used to identify areas currently known to support, or historically supported Louisiana pine snakes.
- Identify suitable or potentially suitable Louisiana pine snake habitat.
- Avoid or minimize impacts to suitable habitat.
- Identify conflicts between agency mission and potential impacts to Louisiana pine snake habitat.
- Identify and reduce dispersal barriers between Louisiana pine snake populations when possible.
- Develop and implement best management practices for avoiding or minimizing impacts to preferable and occupied habitat.
- Provide support for research involving trapping and other techniques to better determine population numbers, range, distribution, habitat, behavior, and specific management requirements of the Louisiana pine snake.
- Participate in the annual Louisiana Pine Snake Stakeholders Meeting to discuss the results of implementing this CCA.
- Review and provide comment on any management plans, proposed strategies, reports, and other documents that may impact the Louisiana pine snake.
- Serve on the Captive-bred, Reintroduction Advisory Team which devises plans for the maximum achievable results of the Captive-bred, Reintroduction Program.
- Support reintroduction of Louisiana pine snakes into blocks of restored habitat where they may be extirpated.

10.2.2. Local Level Conservation

This section describes general conservation efforts that all Parties agree to implement at the local, installation or property level, in accordance with their individual missions. These site-specific efforts and actions include:

- For Federal projects, consider the effects of actions, including land management activities, on the Louisiana pine snake during the planning process, avoid or minimize impacts to habitat as well as potential corridors between populations where practical, and assess such impacts in NEPA documents.
- Provide for review to the Cooperators any management plans, proposed strategies, reports, or other documents under that Cooperator’s purview that may affect Louisiana pine snake recovery.
- Train personnel to properly identify Louisiana pine snakes, and encourage personnel to report sightings to their LPSCW representative.
- LPSCW representatives will compile and keep record of all Louisiana pine snake observations/occurrences for the area they oversee. These data will be shared with the LPSCW for inclusion into the geodatabase.

- Avoid actions, where practical, that could further isolate existing Louisiana pine snake populations.
- Conduct surveys, using traps, road cruising, other methods, or combination thereof, to document Louisiana pine snake presence and distribution on property or installation.

10.3. CONSERVATION ACTIONS SPECIFIC TO EACH COOPERATOR

10.3.1. U.S. Department of Agriculture, Forest Service

10.3.1.1. National Forests and Grasslands in Texas

- Specific compartments on the Angelina National Forest (67, 74, 75, 76, 77, 78, 79, 80, 81, 83 (northern portion), 85, 86, 87, 88, 89, 90, 91, 92, 93) and Sabine National Forest (127, 129, 132, 135, 136, 139, 140, 141, 142) are designated for inclusion into Louisiana pine snake habitat management units (LPS HMUs) (Appendix D). These compartments were selected because they have significant amounts of preferable soils based on the LRSF model. Other areas that are isolated from other Forest Service lands and/or have fragmented pockets of suitable soils were not included, because most likely these areas could not provide enough suitable habitat to support a viable population. Wilderness areas were excluded because of very limited management options, other than prescribed burning. Within the LPS HMUs, management actions such as prescribed burning, thinning, and longleaf pine restoration will be prioritized to maintain or establish herbaceous-dominated vegetative understory conditions on appropriate sites.
 - Conduct an aggressive prescribed burning program that is specifically designed to reduce or eliminate existing shrub encroachment, restore herbaceous dominated conditions, and prevent future woody shrub encroachment, within existing and potential longleaf pine woodlands.
 - Target burning in longleaf pine ecosystem areas that have the best potential to provide preferable habitat to the Louisiana pine snake and ensure that prescribed burns in the Longleaf Ridge area receive priority.
 - Ensure that burns are carried out during the most effective season and on a periodic and regular basis, preferably every 2 to 3 years in longleaf pine habitat, in order to maintain or expedite sufficient and timely restoration of herbaceous understory communities.
 - Initiate monitoring to measure the success of burns at reducing woody understory and restoring herbaceous understory conditions. Modify burn program, if needed, as new information on fire management is developed.

- Consistent with the Angelina and Sabine NF Forest Plans and within historical longleaf pine habitat, where practicable, continue aggressive thinning and early conversion of existing slash pine and loblolly pine stands to longleaf pine forest. Retain all residual longleaf pines within these stands.
- Inventory and evaluate off-road-vehicle (ORV) use and trails within potential Louisiana pine snake habitat to determine if and where ORV use is adversely affecting Louisiana pine snake populations. Consider roads for closure in HMUs that may have adverse effects on the Louisiana pine snake. Avoid establishing or designating ORV trails in LPS HMUs. Enforce the Motor Vehicle Use Map (MVUM) for road closures and ORV use. Prevent public vehicle use of closed roads to the extent reasonably possible, from February through September, unless the road is required for administrative purposes, access to private land, school bus route, or permitted special use.
- Support research, as funding and personnel are available, by establishing and maintaining herpetofaunal monitoring stations throughout longleaf pine woodland habitat to document the seasonal presence/absence of terrestrial reptiles and amphibians in the forest.
- As funding and personnel are available, support studies to determine pocket gopher dynamics within USFS boundaries, including population numbers, distribution, suitable habitat, and the effects of fire.
- Seek to acquire lands with preferable soils for Louisiana pine snakes, and that potentially connects populations and reduces habitat fragmentation.

10.3.1.2. Kisatchie National Forest

- Specific portions or entire compartments on the Kisatchie National Forest within the Catahoula Ranger District (RD), the Evangeline Unit and Vernon Unit of the Calcasieu RD, Kisatchie RD, and the Winn RD are designated for inclusion into Louisiana pine snake habitat management units (LPS HMUs) (Appendix D). These compartments were selected because they have significant amounts of preferable soils based on the LRSF model. Other areas that are isolated from other Forest Service lands and/or have fragmented pockets of suitable soils were not included, because most likely these areas could not provide enough habitat to support a viable population. Wilderness areas were excluded because of very limited management options, other than prescribed burning. Within the LPS HMUs, management actions such as prescribed burning, thinning, and longleaf pine restoration will be prioritized to maintain or establish herbaceous-dominated vegetative understory conditions on appropriate sites.
 - Conduct an aggressive prescribed burning program that is specifically designed to reduce or eliminate existing shrub encroachment, restore

herbaceous-dominated conditions, and prevent future woody shrub encroachment, within existing and potential longleaf pine woodlands.

- Target burning in longleaf pine ecosystem areas that have the best potential to provide preferable habitat to Louisiana pine snakes.
- Ensure that burns are carried out during the most effective season and on a periodic and regular basis, preferably every 2 to 3 years in longleaf pine habitat, in order to expedite sufficient and timely restoration of herbaceous understory communities.
- Initiate monitoring to measure the success of burns at reducing woody understory and restoring herbaceous understory conditions. Modify burn program, if needed, as new information on fire management is developed.
- Consistent with the Kisatchie NF Forest Plan and within historical longleaf pine habitat, where practicable, continue aggressive thinning and early conversion of existing slash pine and loblolly pine stands to longleaf pine forest. Retain all residual longleaf pines within these stands.
- Inventory and evaluate ORV use and trails within potential Louisiana pine snake habitat to determine if and where ORV use is adversely affecting Louisiana pine snake populations. Excluding the Intensive Use Area (IUA) and Limited Use Area (LUA) on the Vernon Unit, consider roads for closure in HMUs that may have adverse effects on the Louisiana pine snake. Avoid establishing or designating ORV trails in LPS HMUs. Enforce the Motor Vehicle Use Map (MVUM) for road closures and ORV use. Prevent public vehicle use of closed roads to the extent reasonably possible, from February through September, unless the road is required for administrative purposes, access to private land, school bus route, or permitted special use (i.e.; military activity within the IUA and LUA).
- Support research, as funding and personnel are available, by establishing and maintaining herpetofaunal monitoring stations throughout longleaf pine woodland habitat to document the seasonal presence/absence of terrestrial reptiles and amphibians in the forest.
- As funding and personnel are available, support studies to determine pocket gopher dynamics within USFS boundaries, including population numbers, distribution, suitable habitat, and the effects of fire.
- Seek to acquire lands with preferable soils for Louisiana pine snakes, and that potentially connects populations and reduces habitat fragmentation.

10.3.1.3. The U.S. Forest Service Southern Research Station

- Continue, as funding permits, to assess the impacts of vehicular traffic on Louisiana pine snake populations.

- Provide research expertise to the Cooperators to assist in determining population numbers, range, distribution, habitat, behavior, and specific management requirements of the Louisiana pine snake.
- Maintain relevant databases, including the historical records and trapping geodatabase, genetic structure of wild and reintroduced populations, prey records, etc.

10.3.2. U.S. Department of Agriculture, Natural Resources Conservation Service in Louisiana

- Incorporate the Louisiana pine snake into the ranking factors for applicable Farm Bill Conservation Programs so that practices beneficial to the Louisiana pine snake (determined by USFWS and NRCS within parishes delineated by USFWS and NRCS) will receive higher priority.
- Support initiatives and projects which could potentially provide direct benefit to the Louisiana pine snake, such as the Louisiana Native Plant Initiative and the Louisiana Longleaf Pine Initiative.
- Provide information and education to local NRCS Field Office staff and clientele (private landowners) regarding Louisiana pine snake status, threats, habitat improvement actions, and reduction of potential adverse impacts to Louisiana pine snakes and their habitat.
- Seek opportunities to partner with Cooperators and others for the purpose of increasing the amount of preferable Louisiana pine snake habitat throughout the historic range in Louisiana.

10.3.3. U.S. Department of Defense, Fort Polk and the Joint Readiness Training Center

- Through guidance of the Fort Polk INRMP, specific areas of Fort Polk and Peason Ridge are designated for inclusion into LPS HMUs (Appendix D). Those areas were selected because they have significant amounts of preferable soils based on the LRSF model. Some areas with preferable soils and suitable herbaceous ground cover, such as the Geronimo Drop Zone, Multi-Purpose Range Complex, and Redleg Impact Area, were not included in the HMU because they cannot be managed due to their existing land use. However, those areas provide additional habitat for the Louisiana pine snake because they are maintained by frequent fires caused by munition detonations in the impact areas and mowing within the drop zones. Within the LPS HMUs, management actions such as prescribed burning, thinning, and longleaf pine restoration will be prioritized to maintain or establish herbaceous-dominated vegetative understory conditions on appropriate sites.
 - Conduct an aggressive prescribed burning program that is specifically designed to reduce or eliminate shrub encroachment, restore herbaceous-

dominated understory conditions, and prevent future woody shrub encroachment, within existing and potential longleaf pine woodlands.

- Ensure that burns are carried out during the most effective season and on a periodic and regular basis, preferably every 2 to 3 years in longleaf pine habitat, in order to ensure sufficient and timely restoration of herbaceous understory communities.
- Initiate monitoring to measure the success of burns at reducing woody understory and restoring herbaceous understory conditions. Modify burn program, if needed, as new information on fire management is developed.
- Within historical longleaf pine habitat, where practicable, continue aggressive thinning and early conversion of existing slash pine and loblolly pine stands to longleaf pine forest. Retain all residual longleaf pines within these stands.
- Continue to educate soldiers and civilians about the Louisiana pine snake on Fort Polk and Peason Ridge.
- Provide an education and awareness program about the Louisiana pine snake to soldiers and all Fort Polk personnel (including the 40-hour Environmental Compliance Officer's Course) regarding the importance, identification, and restrictions against and ramifications of causing harm to the Louisiana pine snake.
- Continue distribution of flyers with photos of the Louisiana pine snake and information on its habitat and status.
- Support research, as funding and personnel are available, by establishing and maintaining herpetofaunal monitoring stations throughout longleaf pine woodland habitat to document the seasonal presence/absence of terrestrial reptiles and amphibians.
- Support/conduct research, subject to availability of funds, including surveys, to determine pocket gopher dynamics including population numbers, distribution, suitable habitat, and the effects of fire. Pocket gopher surveys can provide a crude index of potential LPS distribution and occupancy of an area. If logistical access issues are overcome and personnel are available, continue the pilot study begun in 2010 which was implemented to evaluate the effectiveness of documenting gopher mounds after prescribed fires.
- Utilizing potential Army Compatible Use Buffer (ACUB) program funds, attempt to acquire property or conservation easements on lands with preferable soils for Louisiana pine snakes, and that connect populations and reduce habitat fragmentation. Priority will be given to those lands with the appropriate soils and locations that already contain "moderate to high-quality Louisiana pine snake habitat" and/or documented Louisiana pine snake occurrence.

10.3.4. U.S. Department of the Interior, Fish and Wildlife Service

- Continue to monitor and report the status of the Louisiana pine snake, as required by Congress and current policy. Report implemented and proposed conservation efforts and the status of the Louisiana pine snake at the Annual Louisiana Pine Snake Stakeholders Meeting.
- Review and comment on any development proposals that may impact the Louisiana pine snake.
- Work with Cooperators on methods to reduce adverse impacts associated with any proposed project or activity that could adversely affect the Louisiana pine snake or habitat areas covered by this CCA. Update or modify this CCA as needed to insure that adaptive management practices are implemented.
- Pursue willing private landowners and non-government entities that are interested in performing voluntary conservation actions to benefit Louisiana pine snakes in conjunction with CCAAs and conservation easements.
- Pursue funding opportunities to help support the activities of the other Cooperators.

10.3.5. Texas Parks and Wildlife Department

- Review and comment on development proposals that may impact the Louisiana pine snake within Texas.
- Work with other Cooperators on proposed projects or activities within Texas that could adversely affect the Louisiana pine snake.
- Work cooperatively to support specific projects that will create or maintain suitable habitat for the Louisiana pine snake.
- Work with private landowners who may have or could create suitable habitat for Louisiana pine snakes, including incentive programs, subject to the availability of funds.

10.3.6. Louisiana Department of Wildlife and Fisheries

- Review and comment on development proposals that may impact the Louisiana pine snake within Louisiana.
- Work with other Cooperators on any proposed project or activity within Louisiana that could adversely affect the Louisiana pine snake.
- Work cooperatively to support specific projects or agreements that will create or maintain suitable habitat for the Louisiana pine snake.
- Work with private landowners who may have or could create suitable habitat for Louisiana pine snakes, including enrollment in the Louisiana Natural Areas Registry Program.

10.3.7. The Association of Zoos and Aquariums' Louisiana Pine Snake Species Survival Plan Participants

- Maintain a self-sustaining captive population of Louisiana pine snakes as an assurance colony for wild Louisiana pine snake populations.
- Manage the captive Louisiana pine snake population with the goal of maximizing and preserving genetic heterozygosity into the future.
- Work with Cooperators to utilize captive-bred Louisiana pine snakes in research and initiatives that enhance the conservation of wild Louisiana pine snake populations. This may include preserving the genetic integrity of the geographically isolated natural Louisiana pine snake populations that are represented in the captive population. Or, after pending results from genetic analysis are available, may involve revising the breeding plan to mix individuals from those geographically isolated populations.
- In cooperation with the USFS Southern Research Station and the USFWS, generate, maintain, manage, and distribute a database of captive breeding data (including the individual snakes' origins, breeding pairings and location, egg production, hatching success, neonate survival, and disposition of individuals (release into wild or held for breeding)).

11. ADAPTIVE MANAGEMENT

This CCA is based on adaptive management principles. All Cooperators agree and recognize that implementation of the conservation actions included in this CCA will be considered experimental, consistent with the concepts of adaptive management. The experimental approach to habitat manipulations and desired forest conditions will provide managers with the most effective and efficient method to restore, enhance, maintain and/or create Louisiana pine snake habitat through the adaptive management process. The effectiveness of all conservation measures and monitoring methods will be reviewed by the Cooperators at the annual Louisiana Pine Snake Stakeholders Meeting. Based upon such evaluation, appropriate modifications to the management scheme, through the LPSCW, will be incorporated to further enhance the goals of this CCA.

12. CCA DURATION, RENEWAL, AND REVIEW

Long-term protection and management, as outlined in this CCA are needed for the continued conservation of the Louisiana pine snake. The initial duration of this CCA is five (5) years following the date of the last signature below, and will be automatically extended for another five-year term, unless terminated before the date of renewal by written notice from any Cooperator.

The LPSCW will annually review the CCA and its effectiveness to determine whether revision is needed. Any Cooperator may propose modifications to the CCA outside the annual review period by providing written notice to the other Cooperators. Any such notice will include a statement of the proposed modification and the rationale for the revision. The non-petitioning parties will make every effort to respond to the proposed modification, via written notice, within thirty (30) days of receipt of such notice. If all parties agree that the modification is warranted, then the change will become effective immediately.

If some portion of this CCA cannot continue to be carried out or if cancellation is desired, the Cooperator requesting such action will notify the other Cooperators within thirty (30) days of the changed circumstances.

13. EFFECT OF THE CCA IN EVENT OF LISTING

The conservation and management commitments made in this CCA will be considered during the process of determining whether listing is necessary under the ESA. It is the intent and expectation of the Cooperators that the execution and implementation of this CCA will reduce threats and improve conservation of the Louisiana pine snake. If, subsequent to the effective date of this CCA, the Secretary of the Interior should determine pursuant to section 4(a) of the ESA (16 U.S.C. §1533(a)), that the Louisiana pine snake is threatened or endangered, the Cooperators will participate in recovery planning for the species.

14. DUPLICATE ORIGINALS

This CCA may be executed in any number of duplicate originals. A complete original of this CCA shall be maintained in the official records of each of the Cooperators.

Appendix A: SIGNATURE PAGES

The parties identified herein have established this Louisiana Pine Snake CCA to be executed as of the date of the last signature shown on the following pages.

**U.S. Department of Agriculture,
National Forests and Grasslands in Texas
Kisatchie National Forest
Southern Research Station
Natural Resources Conservation Service**

**U.S. Department of Defense
Fort Polk and the Joint Readiness Training Center**

**U.S. Department of the Interior
Fish and Wildlife Service, Region 2
Fish and Wildlife Service, Region 4**

**Texas Parks and Wildlife Department
Louisiana Department of Wildlife and Fisheries
Association of Zoos and Aquariums**

CANDIDATE CONSERVATION AGREEMENT

For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013



MARK VAN EVERY, Forest Supervisor
U.S. Department of Agriculture
U.S. Forest Service
National Forests and Grasslands in Texas

6/30/13
DATE

CANDIDATE CONSERVATION AGREEMENT

For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013

Michael L. Balboni
MICHAEL L. BALBONI, Forest Supervisor
U.S. Department of Agriculture
U.S. Forest Service
Kisatchie National Forest

7-25-13
DATE

CANDIDATE CONSERVATION AGREEMENT

For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013

Robert L. Doudrick

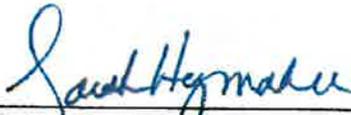
ROBERT L. DOUDRICK, Ph.D., Director
U.S. Department of Agriculture
U.S. Forest Service
Southern Research Station

07/01/2013

DATE

CANDIDATE CONSERVATION AGREEMENT

For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013



KEVIN NORTON, State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Service

7/22/13
DATE

CANDIDATE CONSERVATION AGREEMENT

For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013



T. GLENN MOORE, COL, Commanding
U.S. Department of Defense, Army
Joint Readiness Training Center and Fort Polk

22 July 13
DATE



WILLIAM B. HICKMAN, BG, Commanding
U.S. Department of Defense, Army
Joint Readiness Training Center and Fort Polk

22 July 13
DATE

CANDIDATE CONSERVATION AGREEMENT

For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013



Don R. Wilhelm, Acting Field Supervisor
U.S. Department of the Interior, Fish and Wildlife Service
Region 2, Arlington, TX Ecological Services

7/29/13
DATE

CANDIDATE CONSERVATION AGREEMENT

For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013



JEFFREY D. WELLER, Field Supervisor
U.S. Department of the Interior, Fish and Wildlife Service
Region 4, Louisiana Ecological Services

8/20/13
DATE

CANDIDATE CONSERVATION AGREEMENT

For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013



JIMMY ANTHONY, Assistant Secretary
Louisiana Department of Wildlife and Fisheries
Office of Wildlife

6-28-13
DATE

CANDIDATE CONSERVATION AGREEMENT

**For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013**

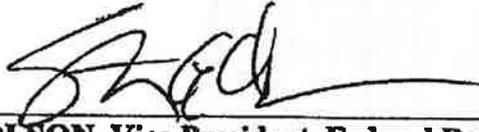


**CLAYTON WOLF, Wildlife Division Director
Texas Parks and Wildlife Department**

7/17/2013
DATE

CANDIDATE CONSERVATION AGREEMENT

**For the
Louisiana Pine Snake
Pituophis ruthveni
June 2013**



**STEVEN OLSON, Vice President, Federal Relations
Association of Zoos and Aquariums**

8/9/13

DATE

Appendix B: STRESSOR/ACTION MATRIX

Stressor ¹	Population	Cooperator	Scops ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions	
A. Present or threatened destruction, modification, or curtailment of the species habitat or range - Expected stressors that may reduce the absolute quantity of habitat, arrangement of habitat, the connectivity of habitat units, and the quality of habitat, etc.	A.1. Degradation of habitat through fire suppression or inadequate prescribed fire program	Angelina NF	M/L	I	H	M	S	M	Initiate/maintain application of frequent fire to maintain herbaceous understory.	Preferred LPS habitat restored to suitable condition; prescribed burning on a 2-3 year rotation.	Direct metric: amount of LPS HMU burned every 2-3 years over a 10-year period. Indirect metric: amount of LPS HMU with adequate herbaceous understory and pocket gophers present.	Restoration and continuation of prescribed fire regimes, forest management and harvest regimes in accordance with accepted longleaf ecosystem management guidelines and Endangered Species management goals for the RCW within the RCW and LPS HMUs.	
		Sabine, TX	M/L	I	H	Sm	S	M					
		Bienville, LA	Sm/L	I	H	SI	S	H					
		Kisatchie, LA	VS/L	I	H	M	S	H					
		Potential/Within Historic Range											
		Potential/Within Historic Range	Evangelina Unit/KNF										
		Fort Polk/Vernon, LA	Sm/L	I	H	Sm	S	L				Direct metric: % of planned burning accomplished within LPS HMU. (total area planned/ total area burned) Indirect metric: area of LPS HMU with pocket gophers present.	On Fort Polk and Peason Ridge, continue with Fort Polk INRMP management of natural resources on a 2-3 year burn cycle and cyclic compartment prescription component of the Forest Management Plan within the LPS HMUs. On USFS, restoration and continuation of prescribed fire regimes, forest management and harvest regimes in accordance with Endangered Species management goals for the RCW within the RCW and LPS HMUs.
		Fort Polk/Vernon, LA	Sm/L	I	H	Sm	S	L					
		Peason Ridge, LA	Sm/L	I	H	Sm	S	L					

Stressor ¹	Population	Cooperator	Scope ²	Intensity ³	Exposure ⁴	Response ⁵	Overall Threat Level ⁶	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions
A.2. Loss of habitat through historic or current forest management practices that result in a dense canopy and limited herbaceous understory, not resulting from fire exclusion alone.	Angelina, TX	Angelina NF	S/L	I	H M	S	H	Thinning overstocked areas, remove excess midstory, and maintain herbaceous understory.	Percentage of LPS HMU which is suitably thinned to maintain herbaceous understory.	Direct metric: Amount of LPS HMU thinned and midstory treated within 10 years. Indirect metric: Amount of LPS HMU with adequate herbaceous understory and pocket gophers present.	Restoration and continuation of prescribed fire regimes, forest management and harvest regimes in accordance with accepted longleaf ecosystem management guidelines and Endangered Species management goals for RCW within the RCW and LPS HMUs.
	Sabine, TX	Sabine NF	M/L	I	H M	S L	L				
	Blenville, LA	Winn NF	S/L	H	H S	S M	M				
	Fort Polk/Vernon, LA	Vernon Unit/KNF	I/L	H	H Sm	S L	L				
	Kisatchie, LA	Kisatchie RD/KNF	S/L	I	H M	S H	H				
	Potential/Within Historic Range	Catahoula RD/KNF									
	Potential/Within Historic Range	Evangeline Unit/KNF									
	Fort Polk/Vernon, LA	Fort Polk JRTC	I/L	H	H Sm	S L	L			Direct metric: Amount of LPS HMU thinned (Amount from previous year sold/amount from previous year requiring harvest). Indirect metric: Amount of adequately thinned LPS HMU.	Enter each compartment into the INRMP ten-year prescription process to determine inventory and stocking quantities. Prescribe areas of harvest to prevent overstocking of compartments within LPS HMUs.
	Peasum Ridge, LA	Fort Polk JRTC	Sm/L	I	H Sm	S L	L			Direct metric: area of suitable preferable LPS habitat converted to unsuitable land-use. Additionally, area of previously unsuitable preferable habitat converted to suitable. Indirect metric: area	The LPS HMUs are currently managed for RCW recovery and are anticipated to remain suitably managed forest. Any future land-use changes will require proper environmental evaluation before proceeding and efforts will be made to avoid or minimize adverse impacts to areas of known
	A.3. Loss of habitat resulting from conversion of land use from preferable habitat to unsuitable habitat.	Angelina, TX	Angelina NF	M/L	I	H I	S M	M	Encourage LPS compatible land use and habitat restoration; Avoid conversion of preferable LPS habitat to incompatible land-uses.	Prevention of conversion from suitable, preferable LPS habitat to unsuitable and conversion of unsuitable, preferable habitat	Direct metric: area of suitable preferable LPS habitat converted to unsuitable land-use. Additionally, area of previously unsuitable preferable habitat converted to suitable. Indirect metric: area
Sabine, TX		Sabine NF	M/L	I	H I	S L	L				
Blenville, LA		Winn RD	Sm/L	H	H Sm	S M	M				
Fort Polk/Vernon, LA		Vernon Unit/KNF	Sm/L	I	H Sm	S L	L				
Kisatchie, LA	Kisatchie RD/KNF	Sm/L	H	H M	S M	M					

Stressor ¹	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Threat Level ⁷	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions
A.4. Landscape scale habitat fragmentation from incompatible land-use creating isolated populations	Potential/Within Historic Range	Catahoula RD/KNF								to suitable.	with adequate herbaceous understorey and pocket gophers present.	Occupied habitat or preferable habitat and known capture occurrences.
	Potential/Within Historic Range	Evangeline Unit/KNF										
	Fort Polk/Vernon, LA	Fort Polk JRTC	Sm/ L	I	H	Sm	S	L	Encourage LPS compatible land use and habitat restoration; Avoid conversion of preferable LPS habitat to incompatible land-uses through the Fort Polk decision-making process.	Direct metric: area of suitable preferable LPS habitat converted to unsuitable land-use. Additionally, area of previously unsuitable preferable habitat converted to suitable.	Utilize Installation NEPA program to ensure maximization of avoidance and minimization of adverse impacts to LPS habitat on any projects which could convert LPS HMU land to an unsuitable use.	
	Peason Ridge, LA	Fort Polk JRTC	Sm/ L	I	H	Sm	S	L				
	Angelina, TX	Angelina NF	VS/ L	I	H	Si	S	H	Encourage LPS compatible land-use and habitat restoration to develop connectivity among isolated populations	Isolated populations connected by areas of potential LPS habitat restored to suitable canopy, midstorey, and understorey conditions.	Direct metric: area of preferable LPS habitat between isolated populations being restored to suitable canopy, midstorey and understorey conditions. Indirect metric: number of populations connected by suitable habitat.	Continuation of prescribed fire regimes, forest management and harvest regimes in accordance with accepted longleaf ecosystem management guidelines and Endangered Species management goals for the RCW within the RCW and LPS HMUs.
	Sabine, TX	Sabine NF	VS/ L	I	H	Sm	S	H				
	Bienville, LA	Winn RD	VS/ L	I	H	Si	S	H				
	Fort Polk/Vernon, LA	Vernon Unit/KNF	Sm/ L	I	H	Sm	S	L				
	Potential/Within Historic Range	Catahoula RD/KNF										
	Potential/Within Historic Range	Evangeline Unit/KNF										
Kisatchie, LA	Kisatchie RD/KNF	Si/L	I	H	Si	S	H				In addition to above actions, improve or maintain habitat between the Peason Ridge and Kisatchie populations.	

Stressor ¹	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions
Fort Polk/Vernon, LA	Fort Polk JRTC	Fort Polk JRTC	Sm/L	I	H	Sm	S	L		Isolated populations connected by land in which a servitude or fee ownership has been acquired, which would enlarge or connect preferable LPS habitats.	Area for which a servitude or fee ownership has been acquired that would potentially connect isolated populations	In addition to all of the above actions, continue the West Central Ecosystem Partnership.
Pearson Ridge, LA	Fort Polk JRTC	Fort Polk JRTC	Sm/L	I	H	M	S	H				
A.5. Habitat fragmentation within a population creating isolated population segments	Angelina, TX	Angelina NF	M/L	I	H	M	S	M	Encourage LPS compatible land-use and habitat restoration to reduce isolation of population segments.	Isolated population segments connected by areas of preferable LPS habitat restored to suitable canopy, midstory, and understory conditions.	Direct metric: area of preferable LPS habitat between population segments being restored to suitable canopy, midstory and understory conditions. Indirect metric: number of population segments connected by suitable habitat.	Continuation of prescribed fire regimes, forest management and harvest regimes in accordance with accepted longleaf ecosystem management guidelines and Endangered Species management goals for the RCW within the RCW and LPS HMUs.
Sabine, TX	Sabine NF	Sabine NF	S/L	I	H	I	S	M				
Blenville, LA	Winn RD	Winn RD	M/L	F	H	M	S	M				
Kisatchie, LA	Kisatchie RD/KNF	Kisatchie RD/KNF	M/L	I	H	M	S	M				
Potential/Within Historic Range	Catahoula RD/KNF	Catahoula RD/KNF										
Potential/Within Historic Range	Evangeline Unit/KNF	Evangeline Unit/KNF										
Fort Polk/Vernon, LA	Fort Polk JRTC	Fort Polk JRTC	Sm/L	I	H	Sm	S	L				In addition to the above actions, maintain connectivity between USFS and Fort Polk habitat within the Fort Polk population.
Fort Polk, LA	Fort Polk JRTC	Fort Polk JRTC	Sm/L	I	H	Sm	S	L				In addition to all of the above actions, continue ACUB program for longleaf plus ecosystem management rights into perpetuity.
Pearson Ridge, LA	Fort Polk JRTC	Fort Polk JRTC	Sm/L	I	H	Sm	S	L				Area for which a servitude or fee ownership has been acquired that would potentially connect isolated population segments.

Stressor ¹	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions
<p>B. Over utilization for commercial, recreational, scientific, or educational purposes - Expected stressors that result in directed and incidental take for commercial, recreational, scientific and educational purposes.</p> <p>B.1. Collection for Angelina, TX pet trade</p>												
	Angelina, TX	Angelina NF	Sm/L	I	H	Sm	S	L	Prohibit collection of LPS and provide adequate enforcement of prohibition.	Prevention and conviction of illegal collection activities.	Number of LPS collection convictions. Number of attendees of public education efforts.	USFS and Fort Polk regulations prohibiting collection and accompanying enforcement regimes are currently emplaced for protection of the LPS against collection.
	Sabine, TX	Sabine NF	Sm/L	I	H	Sm	S	L				
	Bienville, LA	Winn RD	M/L	I	H	M	S	L				
	Fort Polk/Vernon, LA	Fort Polk JRTC	Sm/L	I	L	Sm	S	L				
	Kisatchie, LA	Kisatchie RD/KNF	Sm/L	H	H	Sm	S	L				
	Potential/Within Historic Range	Catahoula RD/KNF										
	Potential/Within Historic Range	Evangeline Unit/KNF										
	Fort Polk, LA	Vernon Unit/KNF	Sm/L	I	L	Sm	S	L			Number of soldiers and civilians trained as Environmental Compliance Officers in Charge and Observer Controller Trainers trained through the Sustainable Range Awareness Program	
	Peason Ridge, LA	Fort Polk JRTC	M/L	I	L	Sm	S	L				
<p>C. Disease or predation - Disease and predators that are suspected of decreasing population viability.</p> <p>C.1. Direct human predation (killing snakes not associated with collection for</p>												
	Angelina, TX	Angelina NF	M/L	I	M	M	S	L	Conduct public education to encourage people to avoid harassing or killing snakes	Public education program developed, implemented and maintained	Number of attendees of public education efforts	Implementation of an education and awareness program by USFS for Forest Users/USFS Staff and Fort Polk for soldiers/all Fort Polk personnel
	Sabine, TX	Sabine NF	M/L	I	M	M	S	L				
	Bienville, LA	Winn RD	M/L	I	H	M	S	L				

Stressor ¹ (commercial purposes)	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions emphasizing the importance of the LPS, conservation, identification, and avoidance, and restrictions against and ramifications of harm.
D. Insufficiency of existing regulatory mechanisms - Is funding for implementation and enforcement of existing mechanisms adequate? D.1. In Texas, LPS is listed as state threatened and in Louisiana, unpermitted killing or removal from the wild is prohibited. Status of funding and success of implementation or enforcement of	Fort Polk/Vernon, LA	Vernon Unit/KNF	M/L	I	M	M	S	L				
	Kisatchie, LA	Kisatchie RD/KNF	M/L	I	H	Sm	S	L				
	Potential/Within Historic Range	Catahoula RD/KNF										
	Potential/Within Historic Range	Evangelins Unit/KNF										
	Fort Polk/Vernon, LA	Fort Polk JRTC	M/L	I	M	M	S	L		Number of soldiers and civilians trained as Environmental Compliance Officers.	Number of soldiers and civilians trained as Environmental Compliance Officers.	
	Person Ridge, LA	Fort Polk JRTC	M/L	I	M	M	S	L		Number of Officers in Charge and Observer Controller Trainers trained through the Sustainable Range Awareness Program.	Number of Officers in Charge and Observer Controller Trainers trained through the Sustainable Range Awareness Program.	
	Angolina, TX	Angolina NF	I/S	H	M	I	S	L	Implementation and enforcement of existing regulations.	Implementation and enforcement of existing regulations on USFS and Fort Polk lands.	Number of LPS collection permits issued, anticipated impact to populations (if any) and permit violation convictions.	USFS regulations and accompanying enforcement regimes have been employed for protection of the LPS against collection on USFS properties.
	Sabine, TX	Sabine NF	I/S	H	M	I	S	L				
	Bierville, LA	Winn RD	SI/L	I	M	Si	S	M				
	Fort Polk/Vernon, LA	Vernon Unit/KNF	M/L	I	M	Sm	S	M				
Kisatchie, LA	Kisatchie RD/KNF	SI/L	I	M	Si	S	M					
Potential/Within Historic Range	Catahoula RD/KNF											

Stressor ¹ existing regulations is unknown	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions
E. Other natural or man-made factors affecting the species' continued existence - Stressors that cannot be listed under one of the above categories.	E. 1. Loss of valuable genetic resources because of small population size and isolation from other populations	Evangeline Unit/KNF	M/L	I	M	Sm	S	M				Fort Polk regulations (FP 200-1) have been adopted for protection and prohibition of take on Fort Polk fee-owned and permitted properties.
		Fort Polk JRTC										
		Fort Polk JRTC	M/L	I	L	Sm	S	M				
		Fort Polk JRTC										
		Fort Polk JRTC										
		Fort Polk JRTC										
E. 1. Loss of valuable genetic resources because of small population size and isolation from other populations	Angulina, TX	Angulina NF	VS/ L	I	H	VS	S	H	Focus resources to secure long-term LPS compatible management and habitat restoration for populations with sufficient preferable habitat to meet minimum area required to achieve long-term viability (when determined) and to achieve connectivity between isolated populations	A sufficient number of populations of sufficient size (when determined) have been established to ensure long-term viability of the species. LPS re-established through reintroduction into blocks of suitable preferable habitat where extirpated.	Fraction of populations required for long-term species viability that have long-term LPS compatible management plans that are being implemented; Number of populations with inter-population connections secured and undergoing restoration; Fraction of minimum required habitat in suitable condition for targeted large populations; Number of active repatriation populations.	USFS management within the LPS HMLUs is anticipated to improve LPS habitat quality and quantity and increase LPS numbers, reducing but not eliminating the risk posed by small population size, isolation from other populations, and demographic stochasticity. USFS will continue to conduct population monitoring, cooperative genetic research and monitoring, and assistance with reintroduction goals to assist with efforts to minimize genetic losses and the effects of small population size and isolation throughout the species' range.
		Sabine, TX	VS/ L	I	H	VS	S	H				
		Bienville, LA	S/L	I	M	VS	S	H				
		Fort Polk/Vernon, LA	VS/ L	I	M	VS	S	H				
		Kisatchie, LA	VS/ L	I	H	VS	S	H				
		Potential/Within Historic Range	Catahoula RD/KNF									
Potential/Within Historic Range	Evangeline Unit/KNF											

Stressor ¹	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions	
E.2. Loss of demographic viability and increased stochastic environmental factors (e.g., weather events, disease) because of small population size and isolation from other populations	Fort Polk/Vernon, LA	Fort Polk JRTC	VS/ L	I	M	VS	S	H		N/A	N/A	No removal of individuals from Fort Polk property. Fort Polk's management within the LPS HMUs are anticipated to improve LPS habitat quality and quantity and increase LPS numbers, reducing but not eliminating the risk posed by small population size, isolation from other populations, and demographic stochasticity	
	Peason Ridge, LA	Fort Polk JRTC	VS/ L	I	M	VS	S	H		N/A			
	Angelina, TX	Angelina NP	VS/ L	I	H	VS	S	S	Focus resources to secure long-term LPS compatible management and habitat restoration for populations with sufficient preferable habitat to meet minimum area (when determined) necessary to achieve long-term viability and to achieve connectivity between isolated populations	Establishment of sufficiently sized populations (when determined) through maintenance or improvement of sufficient amounts of suitable preferable LPS habitat. LPS re-established in blocks of sufficient habitat where overtrapped.	Fraction of populations required for long-term species viability that have long-term LPS compatible management plans that are being implemented; Number populations with inter-population connections secured; Fraction of minimum required preferable habitat in suitable condition for targeted large populations; Number of active repatriation populations.	USFS management within the LPS HMUs are anticipated to improve LPS habitat quantity and quality and increase LPS numbers, reducing but not eliminating the risk posed by demographic stochasticity. USFS will continue to conduct population monitoring, cooperative genetic research and monitoring, and assistance with reintroduction goals to assist with efforts to minimize the effects of potential population loss or critical depletion.	
	Sabine, TX	Sabine NF	VS/ L	I	H	VS	S	S					
	Blenville, LA	Winn RD	S/L	I	H	VS	S	H					
	Kisatchie, LA	Kisatchie RD/KNF	VS/ L	I	H	VS	S	S					
	Potential/Within Historic Range	Catahoula RD/KNF											
	Potential/Within Historic Range	Evangeline Unit/KNF											

Stressor ¹	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Action Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions	
E.3. Increased mortality due to off-road vehicles (ORVs)	Fort Polk/Vernon, LA	Fort Polk JRTC	VS/ L	I	H	VS	S	H		Maintenance or improvement of existing habitat conditions to allow establishment of sufficiently sized Ft Polk/Vernon and Peason Ridge populations.	Number of LPS trap days. Number of LPS per trap days. Trapping, although not perfect, is the currently the best method for determination of occurrence.	Fort Polk's and USFS' HMUs are anticipated to improve LPS habitat quality and quantity and increase LPS numbers, reducing but not eliminating the risk posed by demographic stochasticity. Fort Polk/USFS will continue to conduct population monitoring and continue LPS trapping with up to 15 traps annually. To the extent possible, Fort Polk/USFS will provide fecal, shed and blood samples within a maximum 3 week detention period.	
	Fort Polk/Vernon, LA	Vernon Unit/KNF	VS/ L	I	H	VS	S	H					
	Peason Ridge, LA	Fort Polk JRTC	VS/ L	I	H	VS	S	H					
	Angelina, TX	Angelina NF	M/L	I	M	Si	S	M	Limit off-road vehicle use within LPS HMU where possible; Conduct public education to encourage ORV users to avoid hitting snakes and remain on established trails within LPS HMU.	Reduce the portion of occupied habitat subject to potential ORV perturbations; Public education program developed, implemented and maintained	Area of occupied habitat and LPS HMUs with ORV restrictions; Public education conducted	USFS has implemented ORV restrictions. When possible, research to determine likelihood of effect will be conducted in conjunction with existing education programs. Any construction and/or establishment ORV trails will go through public scoping and NEPA analysis. ORV trails will avoid LPS habitat to the maximum extent possible.	
	Sabine, TX	Sabine NF	M/L	I	M	M	S	M					
	Blenville, LA	Winn RD	M/L	I	M	M	S	M					
	Kisatchie, LA	Kisatchie RD/KNF	Si/L	I	H	Si	S	M					
	Potential/Within Historic Range	Catahoula RD/KNF											
	Potential/Within Historic Range	Evangeliste Unit/KNF											

Stream?	Population	Cooperator	Scope?	Immediacy?	Intensity?	Exposure?	Response?	Overall Threat Level?	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions	
E.4. Increased mortality due to road-bound traffic	Fort Polk/Vernon, LA	Fort Polk JRTC	S/L	I	H	SI	S	M	Conduct mortality and sighting monitoring for LPS as described in the INRMP.	No observations of LPS mortality from ORVs.	Number of snake mortalities observed and reported.	Fort Polk and USFS has implemented ORV restrictions for non-military support activities, but cannot restrict off-road usage of military support vehicles due to mission training requirements. Fort Polk will continue mortality and sighting monitoring measures for LPS as indicated in the INRMP.	
	Fort Polk/Vernon, LA	Vernon Unit/KNF	S/L	I	H	SI	S	M					
	Peason Ridge, LA	Fort Polk JRTC	S/L	I	M	SI	S	M					
	Angelina, TX	Angelina NF	S/L	I	H	SI	S	H	Close/restrict access to selected roads in critical areas where possible; Conduct public education to encourage drivers to avoid hitting snakes	Critical roads identified and closure/restrictions accomplished; Public education program developed, implemented and maintained	Critical roads identified; Critical roads closed/restricted; Public education conducted	Road bound traffic on USFS lands occurs on Federal and State Highways, County, and improved and unimproved USFS roads. USFS roads are used by relatively slower moving vehicles and are expected to have a reduced likelihood of resulting in a vehicle-caused LPS mortality compared to public roads beyond USFS control. Only roads shown on the Motor Vehicle Use Map (MVUM) will be open to the public. In critical LPS habitat, additional roads will be considered for closure which requires public scoping and NEPA analysis.	
	Sabine, TX	Sabine NF	S/L	I	H	SI	S	H					
	Blenville, LA	Winn RD	M/L	I	M	SI	S	M					
	Kisatchie, LA	Kisatchie RD/KNF	S/L	I	H	SI	S	H					
	Potential/Within Historic Range	Catahoula RD/KNF											
	Potential/Within Historic Range	Evangeline Unit/KNF	S/L	I	L	M	S	M					

Stressor ¹	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Actions Needed	Measures of Success	Annual Reporting Metric	Ongoing & Planned Actions
E-5. Entanglement in Erosion Control Blankets	Fort Polk/Vernon, LA	Fort Polk JRTC	S/L	I	M	SI	S	M	Continue mortality and sighting monitoring measures for LPS as described in the INRMP.	LPS observations per mile.	Number of snake sightings and mortalities observed and reported	conjunction with existing education programs. Road bound traffic on most of Fort Polk/USFS Vernon IUA and LJA and Peason Ridge occurs on restricted access roads, used by relatively slow moving vehicles during military training exercises and are expected to have a reduced likelihood of resulting in a LPS-vehicle mortality compared to public roads beyond Fort Polk/USFS control. Further restriction of vehicular use on training roads is not possible due to mission training requirements. Fort Polk will continue monitoring measures for LPS as indicated in the INRMP.
	Fort Polk/Vernon, LA	Vernon Unit/KNF	S/L	I	M	SI	S	M				
	Peason Ridge, LA	Fort Polk JRTC	S/L	I	L	M	S	M				
	Angelina, TX	Angelina NF							Prevent future installation of synthetic-based ECBs, and where required, use the minimum amount of biodegradable ECBs.	Minimization of the installation of ECBs. Within LPS EMUs, % of planned projects for which ECB BMP's were implemented through the NEPA process.	Number of ECB BMP's recommended annually.	Develop Best management practices for inclusion into NEPA analysis for construction and land management activities. BMP's would recommend minimization of ECBs and if unavoidable use of only biodegradable ECBs.
	Sabine, TX	Sabine NF										
	Brenville, LA	Winn RD										
	Fort Polk/Vernon, LA	Fort Polk JRTC										
	Fort Polk/Vernon, LA	Vernon Unit/KNF										
	LA	Kisatchie RD/KNF										
	Kisatchie, LA											

Stressor ¹	Population	Cooperator	Scope ²	Immediacy ³	Intensity ⁴	Exposure ⁵	Response ⁶	Overall Threat Level ⁷	Actions Needed	Measure of Success	Annual Reporting Metric	Ongoing & Planned Actions
	Peason Ridge, LA	Fort Polk JRTC										
	Potential/Within Historic Range	Catahoula RD/KNF										
	Potential/Within Historic Range	Evangeline Unit/KNF										
Notes:												
1. Stressor - a process or event having a negative impact on the LPS. Stressors are grouped into the five listing/delisting criteria.												
2. Scope - the geographic and temporal extent of the stressor. The following are used to describe geographic extent: "I" (Insignificant - stressor's geographic extent negligible); "Sm" (Small - < 10% of population's potential range); "M" (Moderate - 11-30% of population's potential range); "SI" (Significant - 31-60% of population's potential range); or "VS" (Very Significant - > 60% of population's potential range). The following are used to describe temporal extent: "L" (Long-term - stressor expected to be persistent without intervention); or "S" (short-term - stressor expected to dissipate on its own within < 5-10 years).												
3. Immediacy - the action time frame of the stressor. The following are used to describe immediacy: "F" (Future - effects anticipated in future); "I" (Imminent - effects occurring now); or "H" (Historic - effects already realized, but restorative action necessary).												
4. Intensity - the strength of the stressor itself to harm the species. The following are used to describe intensity: "L" (Low - minor reductions in range or vital rates [survival and reproductive capacity]); "M" (Moderate - moderate reductions in range or vital rates); or "H" (High - severe reductions in range or vital rates).												
5. Exposure - the extent to which a target resource or individual LPS and stressor actually overlap in space and time; the level of the total population exposed to stressor. The following are used to describe exposure: "I" (Insignificant - level of exposure negligible); "Sm" (Small - < 10% of population exposed); "M" (Moderate - 11-30% of population exposed); "SI" (Significant - 31-60% of population exposed); or "VS" (Very Significant - > 60% of population exposed).												
6. Response - the change in the species' behavior, reproductive capacity or survival due to a specific stress; level of physiological/behavioral response to exposure to stress. The following are used to describe response: "B" (Behavioral - startle, displace, etc.); "BNI" (Basic Need Inhibited - capacity to meet basic needs of feed/breed/shelter altered, possibly reducing growth or vital rates); "C" (Confirmed mortality or identifiable reduction in individual growth or vital rates); or "S" (Significant mortality or reduction in individual growth or vital rates).												
7. Overall Threat Level - the integration of the scope, immediacy, and intensity of the stressor with the exposure and response of the species measured at the population or species level. The following are used to describe the overall threat level: "L" (Low - no action needed at this time); "M" (Moderate - action is needed); "H" (High - immediate action is needed); or "S" (Severe - immediate action essential for survival of population).												

**Appendix C: LOUISIANA PINE SNAKE OCCURRENCE MAPS (COUNTIES
AND PARISHES OF OCCURRENCE, OHMCPs)**



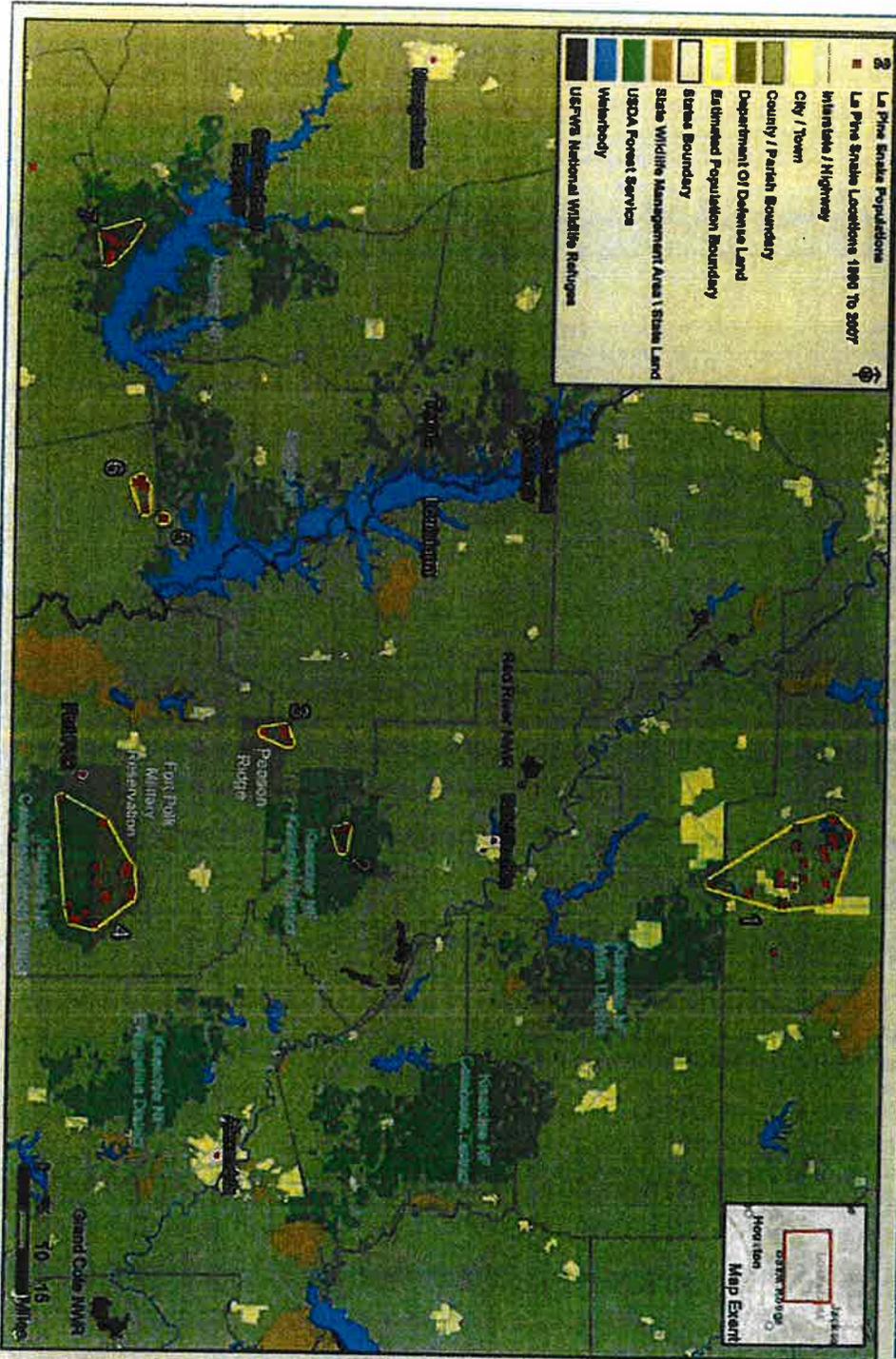
U.S. Fish & Wildlife Service

Louisiana Ecological Services Field Office

Locations (1990 - 2007) and Estimated Boundaries of Extant Louisiana Pine Snake Populations

2 La Pine Snake Populations

- La Pine Snake Locations 1990 to 2007
- Interstate / Highway
- City / Town
- County / Parish Boundary
- Department Of Defense Land
- Estimated Population Boundary
- State Boundary
- State Wildlife Management Area / State Land
- USDA Forest Service
- Waterbody
- USFWS National Wildlife Refuges

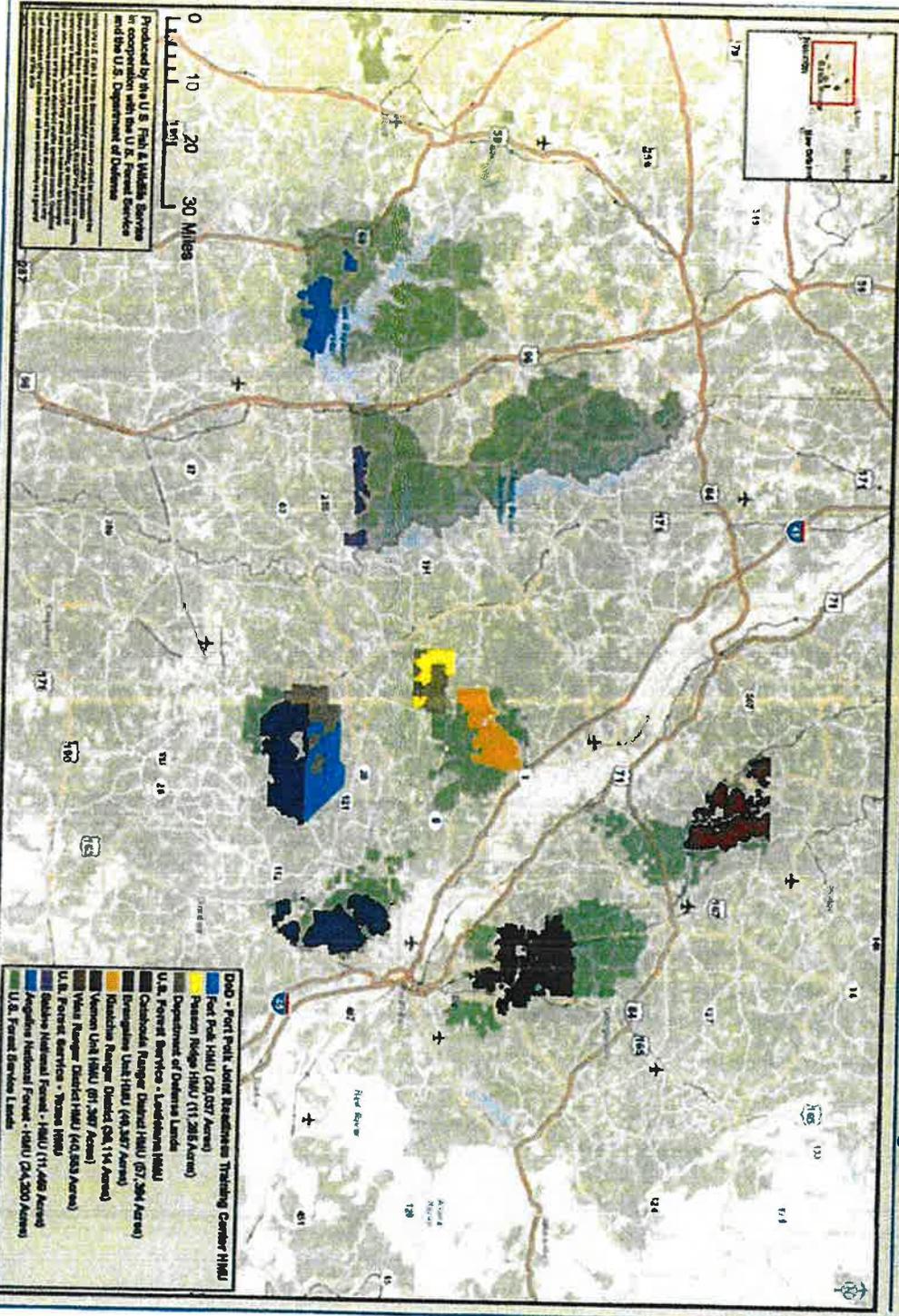


**Appendix D: LOUISIANA PINE SNAKE HABITAT MANAGEMENT UNIT
MAPS**



U.S. Fish & Wildlife Service

Louisiana Ecological Services Field Office Louisiana Pine Snake Habitat Management Units

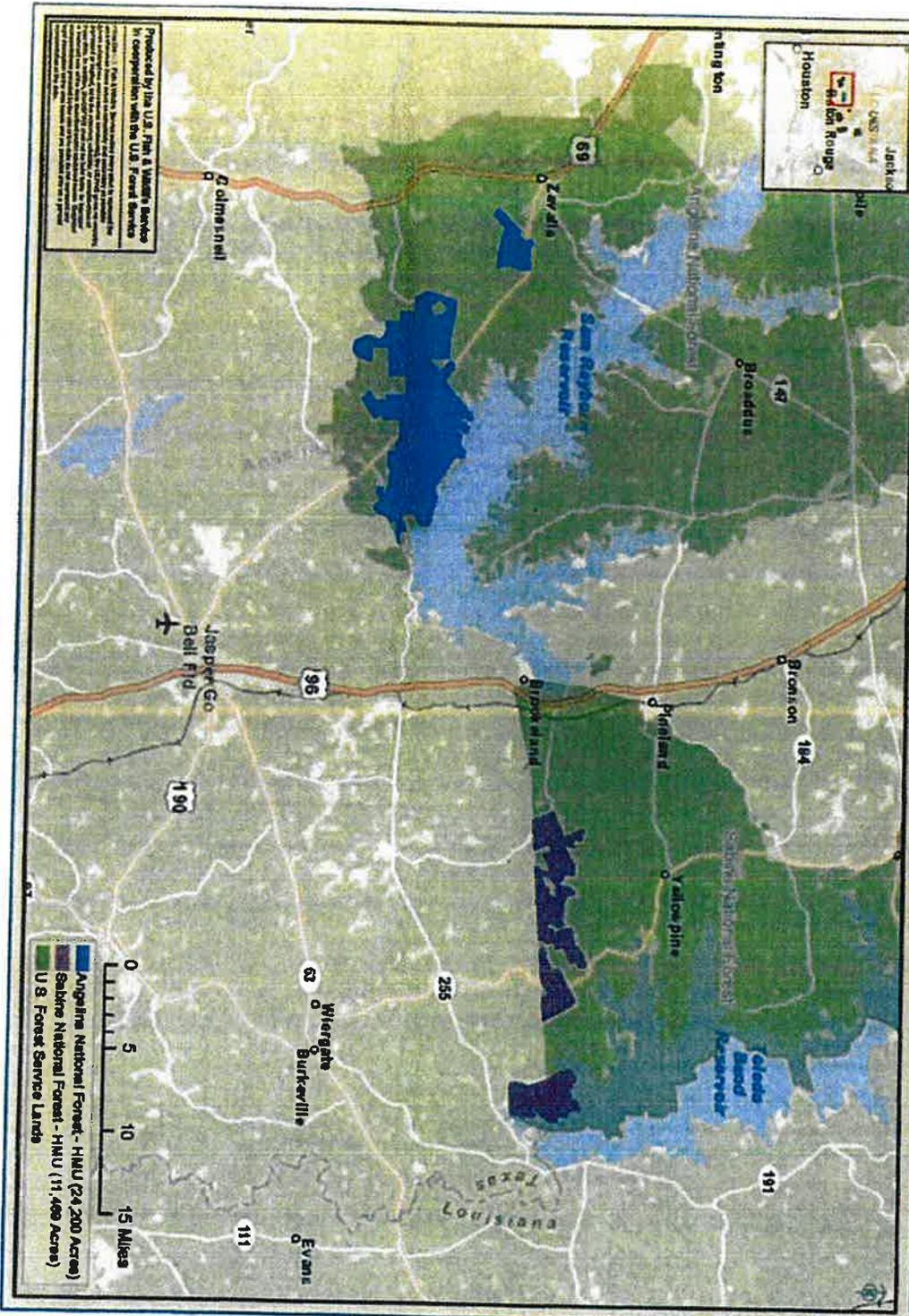




U.S. Fish & Wildlife Service

Louisiana Ecological Services Field Office

Louisiana Pine Snake Habitat Management Units - National Forests and Grasslands in Texas

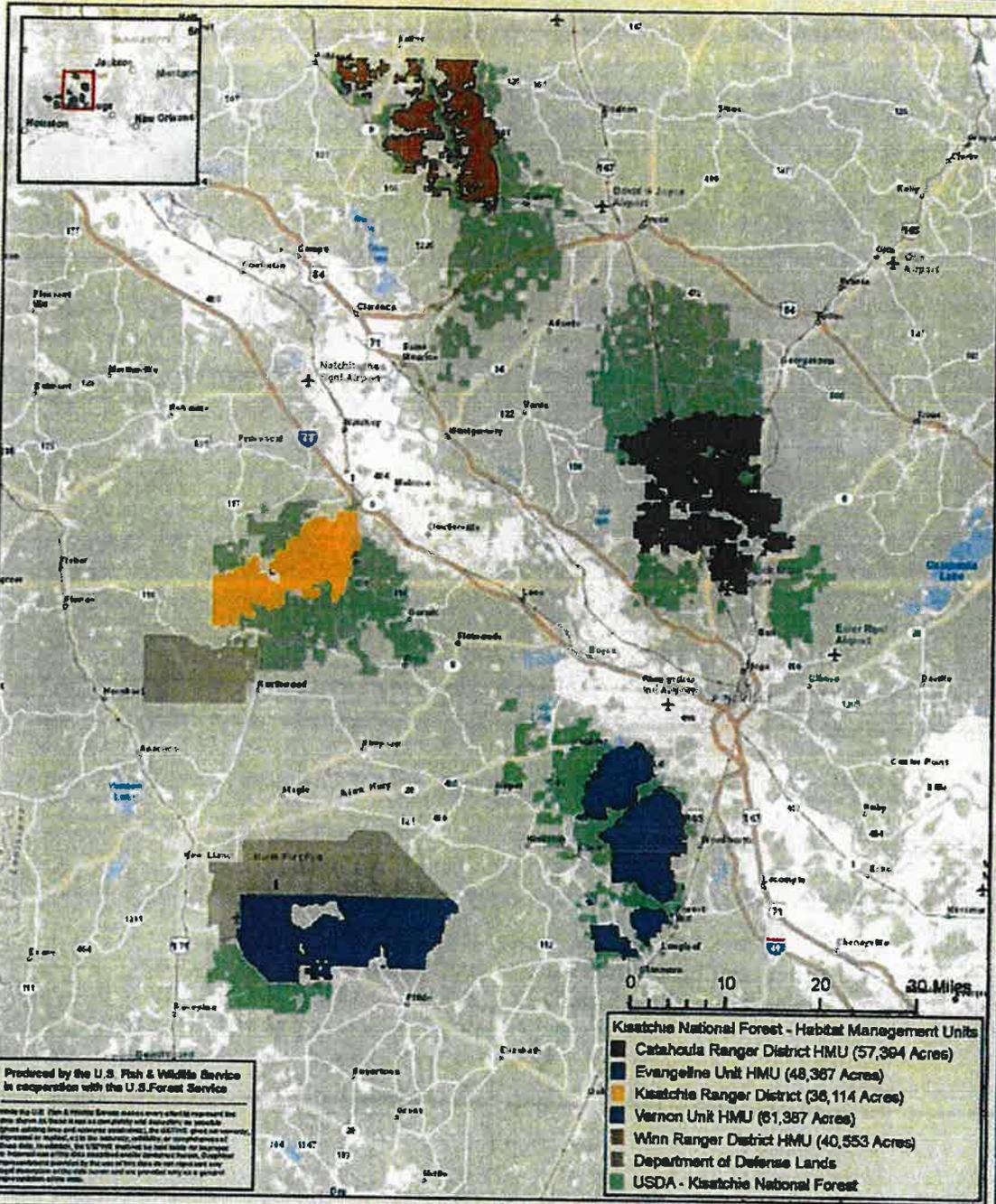




U.S. Fish & Wildlife Service

Louisiana Ecological Services

LA Pine Snake Habitat Management Units – U.S. Forest Service

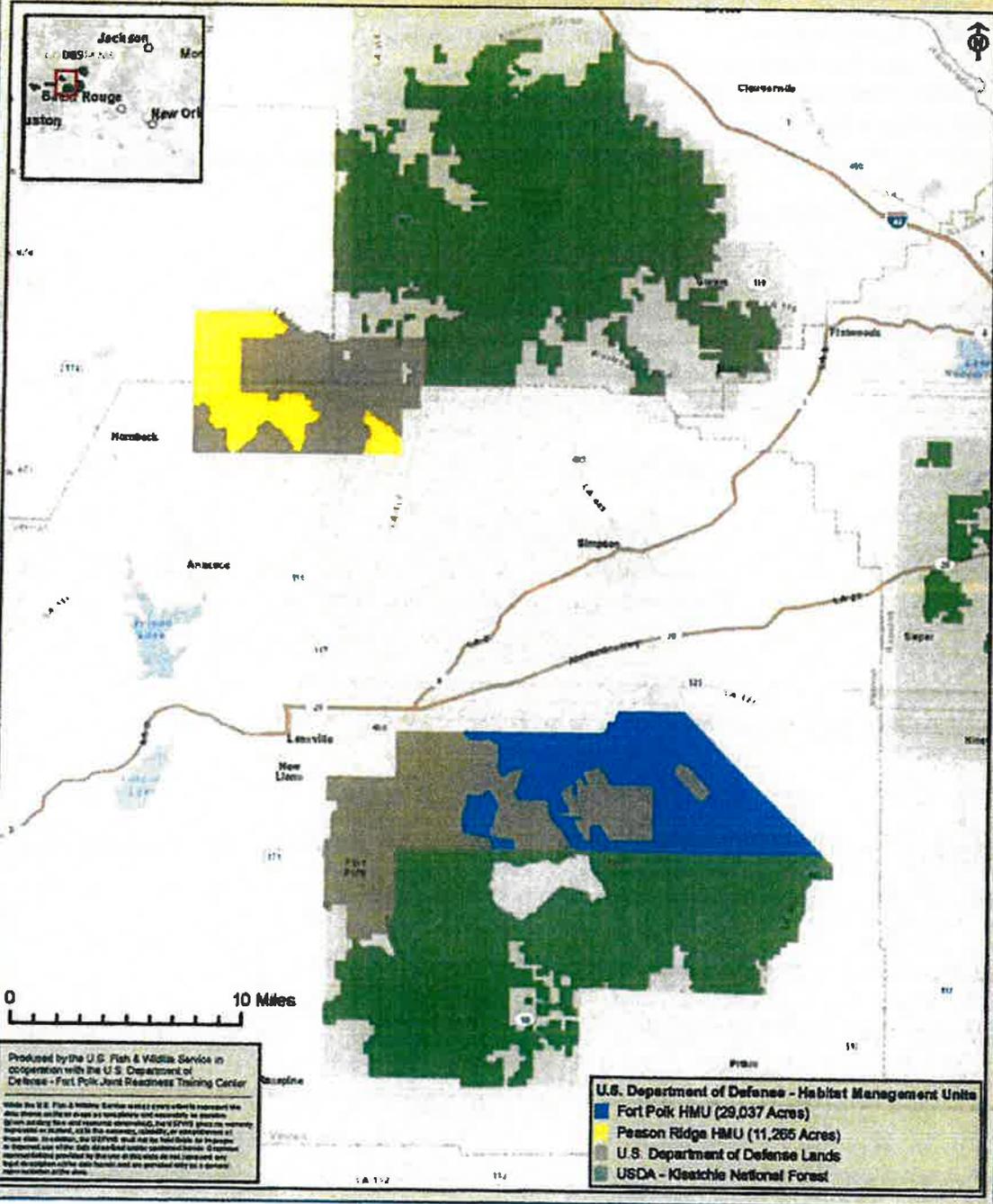




U.S. Fish & Wildlife Service

Louisiana Ecological Services

LA Pine Snake Habitat Management Units – U.S. Department of Defense



Appendix E: LOUISIANA PINE SNAKE CCA WORKGROUP MEMBERS

U.S. Department of Agriculture,

National Forests and Grasslands in Texas, Jason Engle, Ron Haskin

Kisatchie National Forest, Jason Nolde, Steve Shively, Emlyn Smith, Bradley Kohls, Al Brazzel, Jonny Fryar

Southern Research Station, Craig Rudolph, Ph.D.; Josh Pierce

Natural Resources Conservation Service, John Pitre

U.S. Department of Defense

Fort Polk and the Joint Readiness Training Center, INRMP Executive Steering Committee

U.S. Department of the Interior

Fish and Wildlife Service, Region 2, Robert Allen

Fish and Wildlife Service, Region 4, Michael Sealy

Texas Parks and Wildlife Department, Andy Gluesenkamp, Dave Holdermann

Louisiana Department of Wildlife and Fisheries, Beau Gregory

Association of Zoos and Aquariums, Steve Riechling, Ph.D.

Appendix F: LITERATURE CITED

- Bonnet, X., G. Naulleau, and R. Shine. 1999. The dangers of leaving home: dispersal and mortality in snakes. *Biological Conservation* 89:39-50.
- Boudy, J. March 13, 2008. In Literature. U.S. Fish and Wildlife Service, Lafayette, LA. Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.
- Bridges, E.L. and S.L. Orzell. 1989. Longleaf pine communities of the West Gulf coastal Plain. *Natural Areas Journal* 9:246-253.
- Collins, J.T. and T.W. Taggart. 2002. Standard common name and current scientific names for North American amphibians, turtles, reptiles, and crocodilians. Fifth Edition. Publication of the Center for North American Herpetology, Lawrence, KS. iv + 44 pp.
- Conant, R.T., 1956. A review of two rare pine snakes from the Gulf coastal plain. *American Museum Novitates*, 1781:1-31.
- Conant, R.T. and J.T. Collins. 1991. A field guide to reptiles and amphibians of eastern and central North America. 3rd ed. Houghton Mifflin Co., Boston, MA. 450 pp.
- Crother, B.I. (Editor) 2000. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. SSAR Herpetological Circular 29, Shoreview, MN. 82 pp.
- Davis, B.J. 1971. A new size record for the Louisiana pine snake, *Pituophis melanoleucus ruthveni*. *Texas Journal of Science* 23:145.
- Ealy, M.J., R.R. Fleet, and D.C. Rudolph. 2004. Diel activity patterns of the Louisiana pine snake (*Pituophis ruthveni*) in eastern Texas. *Texas Journal of Science* 56:383-394.
- Frost, C.C. 1993. Four centuries of changing landscape patterns in the longleaf pine ecosystem. Pgs. 17-43 In: S.M. Hermann (ed.). Proceedings of the Tall Timbers Fire Ecology Conference, No. 18, The longleaf pine ecosystem: ecology, restoration and management. Tall Timbers Research Station, Tallahassee, FL.
- Frost, C. 2006. History and future of the longleaf pine ecosystem. In S. Jose, E. J. Jokela, and D. L. Miller (eds.). *The Longleaf Pine Ecosystem: Ecology, silviculture, and restoration*. Springer. New York, NY. pp. 9-42.
- Gibbons, J.W. and M.E. Dorcas. 2005. *Snakes of the Southeast*. University of Georgia Press, Athens, GA.
- Gregory, B. March 14, 2008. In Literature. U.S. Fish and Wildlife Service, Lafayette, LA. Zoologist, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.
- Gregory, B. June 13, 2013. In Literature. Michael Sealy, U.S. Fish and Wildlife Service, Lafayette, LA. SOCs for CCA. Zoologist, Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA.
- Grooves, C.R., L.S. Kutner, D.M. Stoms, M.P. Murray, J.M. Scott, M. Schafale, A.S. Weakley, and R.L.

- Pressey, 2000. Owning up to our responsibilities. pp. 275-300, in *Precious heritage: the status of biodiversity in the United States*. B.A. Stein, L.S. Kutner, and J.S. Adams (eds.). Oxford University Press. 416 pp.
- Himes, J.G. 1998. Activity patterns, habitat selection, excavation behavior, growth rates, and conservation of the Louisiana pine snake (*Pituophis melanoleucus ruthveni*). Masters thesis, Louisiana State University, Shreveport, LA. 58 pp.
- Himes, J.G. 2000. Burrowing ecology of the rare and elusive Louisiana pine snake, *Pituophis ruthveni*. (Serpentes: Colubridae). *Amphibia-Reptilia* 22:91-101.
- Himes, J.G., L.M. Hardy, D.C. Rudolph, and S.J. Burgdorf. 2002. Growth rates and mortality of the Louisiana pine snake (*Pituophis ruthveni*). *Journal of Herpetology* 36(4):683-687.
- Himes, J.G., L.H. Hardy, D.C. Rudolph, and S.J. Burgdorf. 2006. Movement patterns and habitat selection by native and repatriated Louisiana pine snakes (*Pituophis ruthveni*): Implications for conservation. *Herpetological Natural History* 9:103-116.
- Jose, S., E. J. Jokela, and D.L. Miller. 2006. *The Longleaf Pine Ecosystem: ecology, silviculture, and restoration*. Springer, New York, NY. 438pp.
- LDWF. 2010. Louisiana Department of Wildlife and Fisheries five-year strategic plan, fiscal year 2011-2012 through 2015-2016. Baton Rouge, LA. 33pp.
- Lester, Gary. D., Stephen G. Sorensen, Patricia L. Faulkner, Christopher S. Reid, and Ines E. Maxit. 2005. *Louisiana Comprehensive Wildlife Conservation Strategy*. Louisiana Department of Wildlife and Fisheries. Baton Rouge. 455 pp.
- Outcalt, K.W. and R.M. Sheffield. 1996. The longleaf pine forest: trends and current conditions. *Resource Bulletin SRS-9*. Asheville, NC. U.S. Department of Agriculture, Forest Service, Southern Research Station. 23 pp.
- Pierce, J. 2013. Unpublished Data. USDA Forest Service, Southern Research Station. Nacogdoches, TX.
- Reichling, S.B. 1988. Reproduction in captive Louisiana pine snakes, *Pituophis melanoleucus ruthveni*. *Herpetological Review* 19(4):77-78.
- Reichling, S.B. 1990. Reproductive traits of the Louisiana pine snake *Pituophis melanoleucus ruthveni* (Serpentes:Colubridae). *Southwestern Naturalist* 35(2):221-222.
- Reichling, S.B. 1995. The taxonomic status of the Louisiana pine snake (*Pituophis melanoleucus ruthveni*) and its relevance to the evolutionary species concept. *Journal of Herpetology* 29(2):186-198.
- Reichling, S.B. 2008a. Louisiana pine snake species survival plan. Unpublished report submitted to the U.S. Fish and Wildlife Service, Lafayette, LA. 15 pp. + tables and appendices.
- Reichling, S.B. 2008b (March 14, 2008). In Literature. U.S. Fish and Wildlife Service, Lafayette, LA. Memphis Zoo, Memphis, TN.

- Reichling, S.B. 2012. Louisiana pine snake reintroduction, 2011 Annual Report. Unpublished report submitted to the U.S. Fish and Wildlife Service, Lafayette, LA. 2 pp.
- Reichling, S. and K. Marti. 2013. Population analysis & breeding and transfer plan, Louisiana pine snake (*Pituophis ruthveni*), AZA Species Survival Plan® Yellow Program. AZA Population Management Center, Lincoln Park Zoo, Chicago, IL. p. 4.
- Reichling, S.B. and K. Schad. 2010. Draft population analysis and breeding and transfer plan; the Louisiana pine snake (*Pituophis ruthveni*) AZA species survival plan program. Unpublished draft report. 9 pp. + tables and appendices.
- Reichling, S.B., D.C. Rudolph, D. Ferri, and C. Baker. 2008. Relative abundances of snakes in Louisiana industrial forest, with special emphasis on *Pituophis ruthveni*. Unpublished report submitted to the U.S. Fish and Wildlife Service, Lafayette, LA. 11 pp. + tables.
- Rodriguez-Robles, J.A., and Jesus-Escobar, J.M. 2000. Molecular systematics of new world gopher, bull, and pinesnakes (*Pituophis*: Colubridae), a transcontinental species complex. *Molecular Phylogenetics and Evolution* 14:35-50.
- Rudolph, D.C. 2000. Habitat quality at historical Louisiana pine snake localities. Unpublished report submitted to the U.S. Fish and Wildlife Service, Jackson, MS 11pp + tables and appendices.
- Rudolph, D.C. 2008a (March 10, 2008). In Literature. U.S. Fish and Wildlife Service, Lafayette, LA. USDA Forest Service, Southern Research Station, Nacogdoches, TX.
- Rudolph, D.C. 2008b (March 11, 2008). In Literature. U.S. Fish and Wildlife Service, Lafayette, LA. USDA Forest Service, Southern Research Station, Nacogdoches, TX.
- Rudolph, D.C. 2011. In Literature. Michael Sealy, U.S. Fish and Wildlife Service, Lafayette, LA. Erosion control blankets as a threat to Louisiana pine snakes (*Pituophis ruthveni*). USDA Forest Service, Southern Research Station, Nacogdoches, TX.
- Rudolph, D.C., and S.J. Burgdorf. 1997. Timber rattlesnakes and Louisiana pine snakes of the west Gulf Coastal Plain: hypotheses of decline. *Texas Journal of Science* 49:111-122.
- Rudolph, D.C., and R.N. Conner. 1996. Radio-telemetry study of Louisiana pine snakes in eastern Texas and western Louisiana. Unpublished report to Texas Parks and Wildlife and Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA. 7 pp.
- Rudolph, D.C., S.J. Burgdorf, R.N. Conner, and J.G. Dickson. 1998. The impact of roads on the timber rattlesnake (*Crotalus horridus*) in eastern Texas. *Proceedings of the International Conference on Wildlife Ecology and Transportation (Fort Myers, FL)*. G.L. Evink, P. Garrett, D. Zeigler, and J. Berry (eds.). Florida Department of Transportation, Tallahassee, FL.
- Rudolph, D.C., S.J. Burgdorf, R.N. Conner, and R.R. Schaefer. 1999. Preliminary evaluation of the impact of roads and associated vehicular traffic on snake populations in eastern Texas. *Proceedings of the Third*

- International Conference on Wildlife Ecology and Transportation (Missoula, MT). G.L. Evink, P. Garrett, and D. Zeigler (eds.). Florida Department of Transportation, Tallahassee, FL. FL-ER-73-99.
- Rudolph, D.C., S.J. Burgdorf, R.N. Conner, C.S. Collins, D. Saenz, R.R. Schaefer, C.M. Duran, M. Ealy, and J.G. Himes. 2002. Prey handling and diet of Louisiana pine snakes (*Pituophis melanoleucus*) and black pine snakes (*P. melanoleucus lodingi*) with comparisons to other selected colubrid snakes. *Herpetological Natural History* 9:57-62.
- Rudolph, D.C., S.J. Burgdorf, and R.R. Schaefer, R.N. Conner, and R.W. Maxey. 2006. Status of *Pituophis ruthveni* (Louisiana pine snake). *Southeastern Naturalist* 5:463-472.
- Rudolph, D.C., C.A. Melder, J.B. Pierce, R.R. Schaefer, and B. Gregory. 2012. Diet of the Louisiana Pine Snake (*Pituophis ruthveni*). *Herpetological Review* 43:243-245.
- Smith, T. March 7, 2008. Personal Communication. Ben Thatcher, U.S. Fish and Wildlife Service, Lafayette, LA. TimberSTAR SW Managers, LA.
- Stull, O.G. 1929. The description of a new subspecies of *Pituophis melanoleucus* from Louisiana. *Occasional Papers of Museum of Zoology, University of Michigan* 205:1-3.
- TPWD. 2005. Texas comprehensive wildlife conservation strategy, 2005-2010. Austin, TX. 1180 pp.
- TPWD. 2012. Natural agenda: a strategic plan for Texas Parks and Wildlife Department, fiscal years 2013-2017. 140pp.
- UNEP-WCMC. 2009. Review of non-CITES reptiles that are known or likely to be in international trade (five additional species). A Report to the European Commission. Cambridge, United Kingdom. 20 pp.
- USDA Forest Service. 1997. Forest Service Manual (FSM). 1580, 1580.1, 2670.22, 2670, 32.
- USDA Forest Service. 2002. Forest Service Manual (FSM) 2600 – Fish, wildlife, and sensitive plant habitat management. Accessed 23 April 2008.
- USDA Forest Service. 2011. Presentation at the 2011 Louisiana Pine Snake Stakeholders Meeting. Natchitoches Events Center, Natchitoches, LA. August 18, 2011.
- U.S. Department of the Army. 2008. JRTC and Fort Polk Regulation 210-18; Installation hunting, trapping, and fishing regulation. July 1, 2008. Headquarters, JRTC and Fort Polk, Fort Polk, LA. 13 pp.
- U.S. Department of the Army. 2013. JRTC and Fort Polk Regulation 210-1; Environmental quality; installation performance requirements. February 20, 2013. Headquarters, JRTC and Fort Polk, Fort Polk, LA. 177 pp.
- USFWS. 2003. Candidate conservation agreement for the Louisiana pine snake *Pituophis ruthveni* between the USFWS, USFS, Fort Polk (DOD), TPWD, and LDWF. 30pp.
- USFWS. 2007. Species assessment and listing priority assignment form for the black pine snake *Pituophis melanoleucus lodingi*. 13 pp.

- USFWS. 2012. Species assessment and listing priority assignment form for the Louisiana pine snake *Pituophis ruthveni*. 36 pp.
- Vandeventer, T.L. and R.A. Young. 1989. Rarities of the longleaf: the black and Louisiana pine snakes. *Vivarium*, 1:32-36.
- Wagner, R.O., D. Hightower, J. Pierce, D.C. Rudolph, and R. Schaefer. 2009. Landscape-scaled resource selection functions of potential Louisiana pine snake (*Pituophis ruthveni*) habitat. Unpublished report submitted to the U.S. Fish and Wildlife Service, Lafayette, LA. 19 pp.
- Webb, J.K., B.W. Brook, and R. Shine. 2002. What makes a species vulnerable to extinction? Comparative life-history traits of two sympatric snakes. *Ecological Research* 17:59-67.
- Young, R.A., and T.L. Vandeventer. 1988. Recent observations of the Louisiana pine snake, *Pituophis melanoleucus ruthveni* Stull. *Bulletin of the Chicago Herpetological Society* 23(12):203-207.