

# U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

## Scientific Name:

Pituophis ruthveni

## Common Name:

Louisiana Pine snake

## Lead region:

Region 4 (Southeast Region)

## Information current as of:

04/16/2012

## Status/Action

Funding provided for a proposed rule. Assessment not updated.

Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

New Candidate

Continuing Candidate

Candidate Removal

Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status

Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species

Range is no longer a U.S. territory

Insufficient information exists on biological vulnerability and threats to support listing

Taxon mistakenly included in past notice of review

Taxon does not meet the definition of "species"

Taxon believed to be extinct

Conservation efforts have removed or reduced threats

\_\_\_ More abundant than believed, diminished threats, or threats eliminated.

## Petition Information

\_\_\_ Non-Petitioned

X Petitioned - Date petition received: 07/19/2000

90-Day Positive:05/04/2004

12 Month Positive:05/04/2004

Did the Petition request a reclassification? **No**

### For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing?  
**Yes**

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The Progress on Revising the Lists section of the current CNOR (<http://endangered.fws.gov/>) provides information on listing actions taken during the last 12 months.

### Historical States/Territories/Countries of Occurrence:

- **States/US Territories:** Louisiana, Texas
- **US Counties:**County information not available
- **Countries:** United States

### Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories:** Louisiana, Texas
- **US Counties:** Bienville, LA, Natchitoches, LA, Sabine, LA, Vernon, LA, Angelina, TX, Jasper, TX, Newton, TX, Sabine, TX
- **Countries:**Country information not available

### Land Ownership:

Current potentially occupied habitat in Louisiana and Texas is estimated to be approximately 64,251 hectares (ha) or 158,765 acres (ac); 53 percent (33,908 ha or 83,789 ac) occurring on public lands (Kisatchie, Angelina, and Sabine National Forests and U.S. Department of Defense (DOD) lands at Fort Polk, Louisiana) and 47 percent (30,343 ha or 74,976 ac) in private and state ownership.

### Lead Region Contact:

## **Lead Field Office Contact:**

LOUISIANA ESFO, Michael Sealy, 337 291-3123, michael\_sealy@fws.gov

## **Biological Information**

### **Species Description:**

Pine snakes (genus *Pituophis*) are large, short-tailed, 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 good 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 length of adult Louisiana pine snakes ranges from 122 to 142 centimeters (cm) (48 to 56 inches (in)) (Conant and Collins 1991, p. 203).

### **Taxonomy:**

Stull (1929, pp. 2-3) formally described the Louisiana pine snake as a pine snake subspecies (*P. m. 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). We have carefully reviewed the taxonomic research for the Louisiana pine snake and conclude that this species is a valid taxon.

### **Habitat/Life History:**

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). These 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. 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). Telemetry data indicate that Louisiana pine snakes are most often 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). Pocket gophers are the primary prey of the Louisiana pine snake (Himes 2000, p. 97; Rudolph et al. 2002, p. 58), although the species has also been known to eat eastern moles (*Scalopus aquaticus*), mice (*Peromyscus* sp.), cotton rats (*Sigmodon hispidus*), and turtle (probably *Trachemys scripta*) eggs (Rudolph et al. 2002, p. 59). Abundant ground layer herbaceous vegetation is important for Louisiana pine snakes and their primary prey, the Baird's pocket gopher. 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 feet (ft)) per day. Furthermore, Louisiana pine snakes 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). Louisiana pine snakes used Baird's pocket gopher burrows (80.9 percent), decayed or burned stumps (15.4 percent), or nine-banded armadillo (*Dasyurus novemcinctus*) burrows (3.7 percent) as underground refugia (Ealy et al. 2004, p. 389). Himes et al. (2006, p. 107) found that Louisiana pine snakes moved 118 m (387 ft) (range 2 to 1159 m (6.6 to 3,802 ft)) between consecutive days, and that the average home range size was 33.2 ha (82 ac) (range 6.5 to 108 ha (16 to 267 ac)). Due to its semi-fossorial habits, rarity, and secretive nature, 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.

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). Captive Louisiana pine snakes can live over 30 years, but females have not reproduced beyond the age of 18 years (Reichling 2008, p. 4, Appendix A). Captive Louisiana pine snakes have a low reproductive rate, with a mean clutch size of 4 eggs (Reichling 1990, p. 221).

### **Historical Range/Distribution:**

The Louisiana pine snake historically occurred in portions of west-central Louisiana and extreme east-central Texas. This area coincides with a disjunct portion and the most westerly occurrence of the longleaf pine ecosystem situated west of the Mississippi River. The U.S. Forest Service (USFS) Wildlife Habitat and Silviculture Laboratory in Nacogdoches, Texas, has compiled a 'historical records' database of all known Louisiana pine snake locations (excluding telemetry data) from 1927 to 2011 (n = 220 occurrence records of 207 individuals at 160 unique locations). 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). Single Louisiana pine snake records exist for Calcasieu and Jefferson Davis Parishes in Louisiana (Williams and Cordes 1996, p. 35), but these records are considered suspect by the Natural Heritage Division of the Louisiana Department of Wildlife and Fisheries (Shively 1999, pers. comm.) and have not been included in the historical records database. Similarly, a previously reported Louisiana pine snake record from Cherokee County, Texas, was erroneous (Pierce 2009, pers. comm.), and two historical Louisiana pine snake records from Montgomery and Walker Counties in Texas were excluded from the database because these specimens have been re-classified as *Pituophis catenifer* (Pierce 2008, pers. comm.). Two records from Wood County, Texas (1956 and 1973) were outside of the longleaf pine habitat in what was recently observed to be oak savanna (Rudolph 2011, pers. comm.). The USFS, Southern Research Station conducted limited trapping (10,980 trap days over 4 years) in the vicinity of the historic collection sites with negative results (Rudolph 2011, pers. comm.). 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 other 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).

### **Current Range Distribution:**

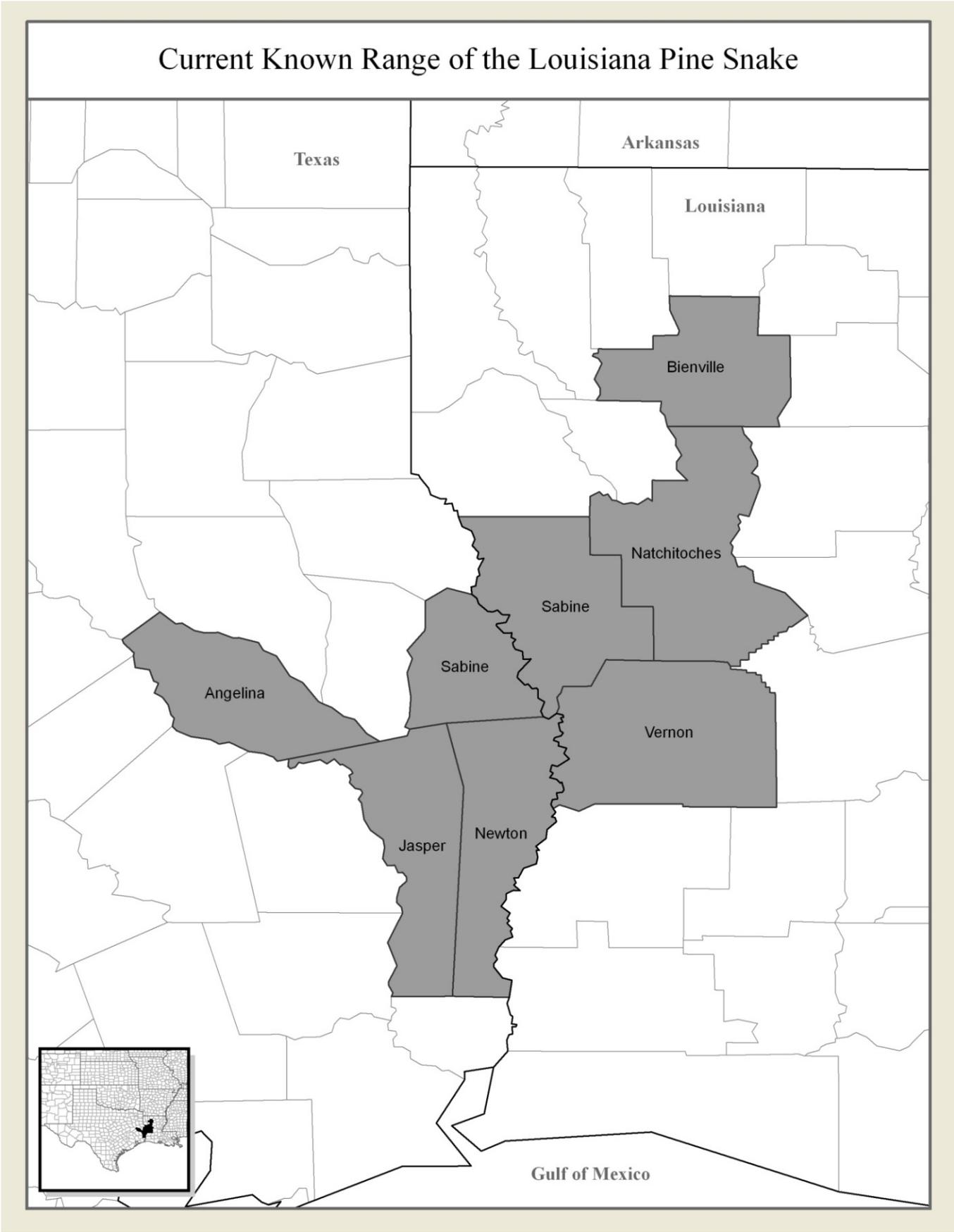


Figure 1. Parishes of Louisiana and counties of Texas with known extant Louisiana pine snake populations.

Louisiana pine snake trapping has been conducted by the USFS, the DOD (Fort Polk), the Memphis Zoo, and

the Louisiana Department of Wildlife and Fisheries (LDWF). In total, trapping from throughout the historic range of the Louisiana pine snake has resulted in 79 captures during 328,396 trap days (1992-2011). Based on counties or parishes with multiple recent (1990 to 2011) observations, 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. However, the distribution of Louisiana pine snakes within these parishes and counties is restricted because intensive land use activities and the disruption of natural fire regimes has decreased the quantity and quality of the intervening areas as habitat for this species (Rudolph et al. 2006, p. 470). Existing Louisiana pine snake populations occur in seven general areas, all of which 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. A single observation of a Louisiana pine snake crossing a road in 1994 may indicate that an additional remnant Louisiana pine snake population exists in Tyler County, Texas. Furthermore, a single observation of a Louisiana pine snake found dead along a road in 2001 indicates that the current Louisiana pine snake population in Natchitoches Parish may extend into extreme northwestern Rapides Parish, Louisiana.

In their status assessment, Rudolph et al. (2006, p. 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. This assertion is supported by range-wide trapping results and the historical records database. Based on the absence of Louisiana pine snake captures during 118,052 trap days, and the lack of sightings between 1990 to 2011, the Louisiana pine snake has likely been extirpated from three parishes (Beauregard, Jackson, and Rapides) in Louisiana and seven counties (Hardin, Houston, Nacogdoches, Polk, San Augustine, Trinity, and Wood) in Texas (U.S. Forest Service 2011, pers. com.).

Rudolph et al. (2006, p. 467) assessed habitat conditions during 1999 and 2000 at the locations of all historical Louisiana pine snake records (n = 118 localities) known at that time. Rudolph et al. (2006, p. 467) stated that 70 percent (26 of 37) of the localities on public lands met their criteria as excellent or good condition, whereas only 33 percent (27 of 81) of the localities on private lands met their criteria as excellent or good condition. Due to habitat fragmentation, most sites with excellent or good habitat were isolated and small (typically a few hundred hectares, or less (Rudolph et al. 2006, p. 466)). 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.

Currently, trapping (which is expensive, labor intensive, and has a low success rate) is the only available method for surveying Louisiana pine snake populations. Although the general habitat requirements for the Louisiana pine snake are known, currently available habitat models, which delineate the distribution of potential habitat within the currently estimated, occupied range of extant populations, are based primarily on preferable soil types. Due to the expense and time required for trapping and the only recently available (Wagner et al. 2009a) predictive habitat model, 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 (see below); the estimates derived from these data are approximations.

A population is defined here as a group of Louisiana pine snakes with the potential for genetic exchange, that is isolated from other such groups. In their status assessment paper, Rudolph et al. (2006, p. 467) used a combination of individual records and the presence of contiguous habitat to determine that six Louisiana pine snake populations were in existence. However, since the time of that assessment, an additional Louisiana pine snake population has been located on the Kisatchie District of the Kisatchie National Forest in Louisiana. To estimate the area of habitat occupied by each of these seven populations, recent 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 the clusters of records within each population, and a one kilometer (km) (0.6 mile (mi)) buffer was drawn around each MCP. The MCP was buffered to accommodate the fact that trap locations were not placed on the landscape with the intent of delineating population boundaries. Because trapping results are a function of trap location selection, trap success, and true presence or absence, trapping data only approximates Louisiana pine snake use of an area. 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 (Rudolph 2008a, pers. comm.). For each extant Louisiana pine snake population, the buffered MCP (Occupied Habitat MCP as used below in Population Estimates/Status) was used to estimate the area of occupied habitat by land ownership. Using this method, the Occupied Habitat MCP is an underestimation if undocumented Louisiana pine snakes occur outside of the current estimated population boundaries. Conversely, even though unsuitable features (i.e., water and cities) were excluded from these estimates, the Occupied Habitat MCP can be an overestimation because the actual amount of suitable habitat (based on soils, pocket gopher abundance, and vegetation) within each polygon is currently unknown.

Using this methodology, the seven extant Louisiana pine snake populations occur on 12,278 ha (30,338 ac) of DOD lands, 21,630 ha (53,451 ac) of USFS lands, 84 ha (206 ac) of State Lands, and 30,259 ha (74,770 ac) of private lands (Table 1). In Louisiana, the following populations have been identified: (1) the Bienville, LA population 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 population located on USFS lands (the Kisatchie District of the Kisatchie National Forest in Natchitoches Parish); (3) the Peason Ridge, LA population located on DOD lands (Peason Ridge Military Reservation in Vernon and Sabine Parishes) and a small amount of private lands; and (4) the Fort Polk, LA population 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. In Texas, the following populations have been identified: (5) the Sabine, TX population 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 population located on privately owned industrial timberlands in Newton County; and (7) the Angelina, TX population located on USFS lands (the southern section of the Angelina National Forest in Angelina and Jasper Counties) and private lands.

Table 1. Land ownership (hectares (acres)) of estimated Louisiana pine snake populations (Occupied Habitat MCP)

State	Population	U.S. Forest Service	Department of Defense	State Lands	Private	Total for Population
<b>Louisiana</b>	Bienville	1,034 (2,555)		84 (206)	27,519 (68,002)	18,637 (70,763)
	Kisatchie	1,553 (3,838)				1,553 (3,838)
	Peason Ridge		1,463 (3,614)		12 (29)	1,475 (3,643)
	Fort Polk	14,886 (36,785)	10,815 (26,724)		36 (88)	25,737 (63,597)
<b>Louisiana Total</b>		17,473 (43,178)	12,278 (30,338)	84 (206)	27,567 (68,119)	57,402 (141,841)
<b>Texas</b>	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)

<b>Texas Total</b>		4,157 (10,273)			2,692 (6,651)	6,849 (16,924)
<b>Total Ownership</b>		21,630 (53,451)	12,278 (30,338)	84 (206)	30,259 (74,770)	64,251 (158,765)

In the past, many estimates on Federal lands of “potential” Louisiana pine snake habitat have been based on county and parish soils data and selection of sandy soil-types that were believed to be suitable for Baird’s pocket gophers and Louisiana pine snakes. However, some estimates of “potential” habitat were based upon lands that were actively managed for the federally endangered red-cockaded woodpecker (*Picoides borealis*; RCW) on Habitat Management Units (HMUs) (Table 2) or on forest compartments designated for management for Louisiana pine snakes described in a Candidate Conservation Agreement (CCA 2003) (Table 3). Currently, all areas that are actively managed for RCWs (i.e. potentially possess the surface vegetation conditions that are viewed as optimal for Louisiana pine snakes), regardless of soil-type, are analyzed below as “potential” habitat (Table 2).

Improvement of habitat modeling and additional field surveys in “potential” habitat areas are needed to improve estimates of the amount and location of currently occupied and preferred Louisiana pine snake habitat. Towards that end, Wagner et al. (2009a, p. 15) developed a preliminary Landscape-scaled Resource Selection Functions Model of Potential Louisiana Pine Snake Habitat (LRSF Model) using available Louisiana pine snake location data to delineate used and available units, and county and parish soil survey data as edaphic factor-independent variables. Selection of preferred habitat using resource selection functions that estimate the proportionate probability of use of the resource units, which in this case are soil-type characteristics, were modeled. A set of a priori resource-selection function models based on combinations of soil attributes that were expected to influence the Louisiana pine snake's use were developed and the model that best fits the data from that a priori set was identified. Model predictions have been extrapolated across the Louisiana pine snake’s historic range, providing a continuous map of the relative probability that an area possesses the edaphic factors selected by Louisiana pine snakes (Tables 2 and 3). That map has been used to analyze management actions below (see Population Estimates/Status) to better assess the effect of management on potentially preferable habitat that Louisiana pine snakes are more likely to select, if available.

Table 2: Total hectares (acres) of Louisiana pine snake habitat on federal lands within Louisiana populations; Occupied Habitat MCP: the area within the population boundary polygon based on occurrence data, “Potential”: areas that support or are managed for RCWs, may exclude areas without sandy, well-drained soils, LRSF-Model: Landscape Resources Selection Function Model (Wagner et al., 2009)

<b>Population</b>	<b>Federal Land</b>	<b>Occupied Habitat MCP on Federal Land</b>	<b>LRSF-Model within Occupied MCP</b>	<b>Total "Potential"</b>	<b>LRSF-Model within "Potential"</b>	<b>Total LRSF-Model within District</b>
<b>Bienville, LA</b>	Winn Dist. (KNF)	1,034 (2,555)	1,027 (2,538)	38,431 (94,964)	5,143 (12,708)	19,882 (49,129)
<b>Kisatchie, LA</b>	Kisatchie Dist. (KNF)	1,553 (3,838)	820 (2,025)	23,957 (59,200)	9,213 (22,765)	11,904 (29,416)
<b>Peason Ridge, LA</b>	Peason Ridge	1,463 (3,614)	672 (1,651)	11,169 (27,600)	3,344 (8,262)	3,446 (8,535)
<b>Fort Polk,</b>				16,410	15,642	16,306

<b>LA</b>	Fort Polk	10,815 (26,724)	10,652 (26,322)	(40,551)	(38,653)	(40,292)
<b>Fort Polk, LA</b>	Vernon Unit (KNF)	14,886 (36,785)	10,883 (26,893)	40,323 (99,641)	30,463 (75,276)	33,869 (83,691)

Table 3. Total hectares (acres) of Louisiana pine snake habitat on federal lands within Texas populations; Occupied Habitat MCP: the area of a population based on occurrence data, LRSF-Model: Landscape Resources Selection Function Model (Wagner et al., 2009), CCA: land designated within the Candidate Conservation Agreement (CCA, 2003), HMA+CCA: total of all land included in both the RCW/LPS Habitat Management Area and CCA.

<b>Population</b>	<b>Federal Land</b>	<b>Occupied Habitat MCP on Federal Land</b>	<b>LRSF-Model within Occupied MCP</b>	<b>Total CCA</b>	<b>HMA+CCA</b>	<b>Total LRSF-Model within CCA</b>	<b>Total LRSF-Model within HMA+CCA</b>
<b>Sabine, TX</b>	Sabine NF	391 (967)	181 (447)	12,285 (30,357)	18,751 (46,335)	2,691 (6,650)	3,401 (8,405)
<b>Angelina, TX</b>	Angelina NF	3,837 (9,482)	1,954 (4,828)	9,680 (23,920)	15,177 (37,502)	5,911 (14,606)	7,835 (19,360)

### **Population Estimates/Status:**

The Louisiana pine snake is recognized as one of the rarest snakes in North America (Young and Vandeventer 1988, p. 203; Himes et al. 2006, p. 114). 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/>). Because basic life history information is lacking for this species, no estimates exist regarding the acreage or population size necessary to support a viable Louisiana pine snake population. Additionally, 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.

Due to its semi-fossorial habits, rarity, and secretive nature, Louisiana pine snakes are difficult to locate and trap, even in areas where they are known to occur (Ealy et al. 2004, p. 384). To date, most Louisiana pine snake records have been from trapping and opportunistic sightings. Trapping effort data are used to estimate trap success (i.e., the number of trap days required to catch one snake) for each extant population. Trapping has provided important information on Louisiana pine snake occurrences. However, population densities cannot be reliably estimated from trapping data because mark-recapture analyses cannot be conducted due to insufficient numbers of Louisiana pine snake recaptures. Consequently, no estimates of Louisiana pine snake population densities exist. The best available indices of Louisiana pine snake population abundance are trap success and the number of occurrence records per population. Although we report these indices for each extant population, it is unknown how these metrics relate to true population size.

(1) The Bienville, LA population. Based on historic trap success and occurrence records (31 records from 2000 to 2011), 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). While trap success varies annually, the trap success in this area has been consistently better than for any other population. Trap success for this population (including data from the Winn District, LA) is estimated to be 1:1,316 (27 captures (excluding 6 recaptures) out of 35,541 trap days) from 2000 to 2011. Furthermore, trapping efforts for this population

during the last three years (2009 to 2011) have resulted in two captures (plus one recapture) with a 1:3,156 success rate (6,311 trap days). Although, trapping from a previous effort on the Winn District portion of this population between 2000 to 2001 provided 2 captures (in addition to one recapture), trap efforts in the same area from 2004 to 2011 have produced zero captures in 5,719 trap days. Within the Occupied Habitat MCP, most records for this population (n = 25, 21,802 trap days during 2000 to 2011) have occurred on a 12,353 ha (30,525 ac) parcel of privately-owned industrial timberland (Reichling et al. 2008, p. 1). Within this 12,353 ha (30,525 ac) of privately-owned timberland, two disjunct Louisiana pine snake Core Management Areas (CMAs) (the 344 ha (851 ac) Kepler Lake site and the 348 ha (859 ac) Sandy Lands site) have been voluntarily established by the landowners. These sites are managed for the Louisiana pine snake with thinning, longleaf pine restoration, targeted herbicide use, and prescribed burning. The Kepler Lake CMA had demonstrated the greatest trap success (1:436) and number of occurrence records (n = 17, 7,409 trap days during 2000 to 2011) of any site sampled within the range of the species. Consequently, Reichling et al. (2008, p. 10) believed this site was critical for the preservation of this species.

Based on information from the current landowner (Cook 2011, pers. comm.), 51 percent (177 ha (438 ac)) of the Kepler Lake CMA and 60 percent (210 ha (518 ac)) of the Sandy Lands CMA have been converted to longleaf pine since 2001. Through a U.S. Fish and Wildlife Service (USFWS) Private Stewardship Grant, the present landowner completed prescribed burning of 66 percent (227 ha (560 ac)) of the Kepler Lake CMA and 74 percent (259 ha (639 ac)) of the Sandy Lands CMA during early 2011 (Cook 2011, pers. comm.). Beneficial understory (hardwood and shrub) control by application of herbicide in banded rows instead of broadcast spray occurred on 426 ha (1,053 ac) of sandy soils during 2009 to 2011 (Cook 2011, pers. comm.). Many of the timberlands surrounding those CMAs are managed with intensive silvicultural practices. No estimates of the amount of habitat necessary to support a viable Louisiana pine snake population exist. Nonetheless, Reichling et al. (2008, p. 10) did not believe that isolated management areas that were 324 to 405 ha (800 to 1,000 ac) or less in size were sufficient to support viable Louisiana pine snake populations, and therefore concluded the snakes in the Kepler Lake CMA were likely dependent upon the surrounding habitat. Consequently, Reichling et al. (2008, p. 10) felt that it was essential to Louisiana pine snake conservation to restore and preserve the thousands of hectares (acres) of privately-owned upland xeric habitat that surround the Kepler Lake CMA. Increasingly intensive land use within occupied habitat outside of the two CMAs has likely degraded the quality of this habitat for the Louisiana pine snake. Furthermore, this 12,353 ha (30,525 ac) parcel of timberland in Bienville Parish was purchased by a Timber Investment Management Organization (TIMO) in 2006. In 2008, that parcel was sold to another TIMO.

Within the small portion of the Occupied Habitat MCP for this population located on the Winn District of the Kisatchie National Forest, 43 percent (444 ha (1,096 ac)) was prescribed-burned from 2009 to 2011. The LRSF Model indicated that 19,882 ha (49,129 ac) of potentially preferable habitat exists at the Winn District compared to the potential habitat estimate based upon the RCW HMA boundary (38,431 ha (94,964 ac)) (Table 2); however, the LRSF model may underestimate the potentially preferable habitat for this population due to a soil data (upon which the LRSF Model depends) discrepancy apparent along parish-line boundaries. On the entire Winn District, 23 percent (4,502 ha (11,125 ac)) of LRSF Model habitat was prescribed burned during 2009 to 2011 and 830 ha (2,050 ac) were thinned in 2011 (USDA Forest Service 2011, pers. comm.). Despite habitat improvements on the Winn District and the privately owned Core Management Areas, this population has experienced and continues to endure habitat loss and degradation as a result of conversion to pine plantation management throughout the remaining privately owned portion this population's range. Additionally, other than effort on the Winn District, this population has not been trapped since 2009. Consequently, the status of this Louisiana pine snake population is uncertain.

(2) The Kisatchie, LA population. Two relatively recent Louisiana pine snake records (one non-capture sighting (2003) and one hand-capture (2007)) exist for this population. No Louisiana pine snakes were captured during 12,011 trap days (1997 to 2003) on the Kisatchie District of the Kisatchie National Forest. However, past trapping did not occur in the locations of these new Louisiana pine snake records. Furthermore, despite the presence of substantial amounts of suitable habitat on the Kisatchie District, past trapping did not sample the best habitat (Rudolph et al. 2006, p. 469).

Active habitat management for the RCW and the Louisiana pine snake occur within the Occupied Habitat MCP of this population. All the Louisiana pine snake Occupied Habitat MCP area was prescribed burned during 2009 to 2011 (USDA Forest Service 2011, pers. comm.). The Kisatchie District has 23,957 ha (59,200 ac) of “potential” Louisiana pine snake habitat (areas that support or are managed for RCWs, Table 2) of which 22,847 ha (56,455 acres) were prescribed burned during 2009 to 2011. Additionally, commercial timber harvest (thinning) occurred on 274 ha (678 ac) of “potential” habitat in 2011. Results from the LRSF Model indicated that 11,904 ha (29,416 ac) of potentially preferable habitat exists within the entire Kisatchie District and that 9,213 ha (22,765 ac) of the LRSF Model habitat is actively managed for the RCW (RCW Habitat Management Area (HMA)) (Table 2) (USDA Forest Service 2011, pers. comm.). Seventy-one percent (8,456 ha (20,894 ac)) of LRSF Model habitat was prescribed burned during 2009 to 2011. Thinning occurred on 131 ha (324 ac) of LRSF Model habitat on the RCW HMA during 2009 to 2011 (USDA Forest Service 2011, pers. comm.). This population is not threatened by ongoing habitat loss. The existence of two Louisiana pine snake sightings since 2003 is encouraging, but estimates of trap success are not currently useful because insufficient trapping efforts have occurred in potential suitable habitat. In addition, it is unknown whether past habitat loss and degradation has reduced the current size of this population to the point where it is vulnerable to decreased demographic viability or stochastic environmental factors (e.g., weather events, disease). Consequently, the status of this population is uncertain. Due to the lack of recent trapping effort (none since 2003), assessment of this population remains difficult. Resumption of trapping efforts in potentially preferable habitat (as indicated by the LRSF Model and pocket gopher presence), as is planned in 2012, would strengthen the assessment of this population.

(3) The Peason Ridge, LA population. Three individual records (from 2000 to 2011, all observed after 2005) exist for this population; one of which was a non-trap sighting. Trap success for this population during 2000 to 2011 has been estimated to be 1:7,569 (2 captures out of 15,138 trap days). The trapping effort for the last three years (2009 to 2011 (4,513 trap days)) produced one capture in 2010.

On DOD lands, 45 percent (654 ha (1,617 ac)) of the Occupied Habitat MCP was prescribed burned during 2009 to 2011 (U.S. Department of the Army 2011, pers. comm.). However, a large portion of potentially occupied habitat occurs within an artillery impact range which is known to experience wildfires but the frequency and area burned is unknown. Furthermore, the DOD prescribed burned 70 percent (7,764 ha (19,185 ac)) of “potential” Louisiana pine snake habitat during 2009 to 2011. Additionally, 685 ha (1,693 ac) of potential habitat was thinned during 2009 to 2011. The LRSF Model indicated that only 3,454 ha (8,535 ac) of potentially preferable habitat exists at the Peason Ridge Training Area compared to the potential habitat estimate used for past analyses (11,169 ha (27,600 ac)) (U.S. Department of the Army 2010, pers. comm.) (Table 2). Eighty-one percent (2,804 ha (6,930 ac)) of LRSF Model habitat was prescribed burned during 2009 to 2011 (U.S. Department of the Army 2011, pers. comm.). Active habitat management for the RCW and the Louisiana pine snake occurring at this site has stabilized or increased the amount of potential habitat that exhibits suitable vegetative characteristics. However, trap success and occurrence records continue to remain low, and it is unknown whether past habitat loss and degradation has reduced the current size of this population to the point where it is vulnerable to decreased demographic viability or stochastic environmental factors. Additionally, the LRSF Model suggests that significantly less potentially preferable habitat exists at Peason Ridge than was previously determined. Consequently, the status of this population is uncertain. Currently, increased trapping effort in potentially preferable habitat (as indicated by the LRSF Model and pocket gopher presence) is currently ongoing to strengthen the assessment of this population.

(4) The Fort Polk, LA population. Twenty-four records from 2000 to 2011 including five non-trap sightings and three trap-recaptures exist for this population, all on DOD land. Trap success for this population from 2000 to 2011 has been estimated to be 1:3,398 (16 captures out of 54,360 trap days). Trap success for this population over the last three years (2009 to 2011) is estimated to be 1:1,623 (6 captures out of 9,736 trap days). All captures during this period occurred on Main Post and no captures occurred on the Vernon Unit of the Kisatchie National Forest.

Fort Polk Main Post prescribed burned 74 percent (8,001 ha (19,771 ac)) of the Occupied Habitat MCP and

69.4 percent (11,382 ha (28,125 ac)) of “potential” Louisiana pine snake habitat on DOD land during 2009 to 2011. Additionally, 123 ha (303 ac) of occupied and 146 ha (360 ac) of “potential” habitat were thinned in 2009 to 2011. The LRSF Model indicated that 16,306 ha (40,292 ac) of potentially preferable habitat exists at the Fort Polk Main Post compared to the potential habitat estimate used for past analyses (16,410 ha (40,551 ac)) (U.S. Department of the Army 2010, pers. comm.) (Table 2). Seventy-two percent (11,776 ha (29,099 ac)) of LRSF Model habitat was prescribed burned during 2009 to 2011 (U.S. Department of the Army 2011, pers. comm.).

On the Vernon Unit/Calcasieu Ranger District of the Kisatchie National Forest, 79 percent (11,808 ha (29,178 ac)) of the Occupied Habitat MCP area was prescribed burned from 2009 to 2011. Approximately 343 ha (970 ac) of occupied and 685 ha (1,693 ac) of potential habitat was thinned in 2011. The LRSF Model indicated that 33,869 ha (83,691 ac) of potentially preferable habitat exists on the Vernon Unit (USDA Forest Service 2011, pers. comm.) (Table 2). Ninety-two percent (31,022 ha (76,656 ac)) of LRSF Model habitat at the Vernon Unit was prescribed-burned during 2009 to 2011 (USDA Forest Service 2011, pers. comm.). Extensive occupied and potential Louisiana pine snake habitat exists at this site, and active habitat management for the RCW and the Louisiana pine snake has stabilized or increased the amount of habitat that has suitable vegetative characteristics. The relatively moderate trap success, large number of occurrence records and large amount of potentially suitable habitat under active management suggest that this Louisiana pine snake population is stable. Increased trap effort in potentially preferable habitat (as indicated by the LRSF Model and pocket gopher presence) is currently ongoing to strengthen the assessment of this population.

(5) The Sabine, TX population. Only four individual records (all from trapping data obtained during 1993 to 1995) exist for this population. No trap success (0 captures per 2,695 trap days during 2009 to 2011, 0 captures per 14,245 trap days during 2000 to 2011) or any other sighting has occurred within this population since 1995.

The Sabine National Forest contains approximately 4,047 ha (10,000 ac) of potential Louisiana pine snake habitat which currently exhibit suitable vegetative characteristics (USDA Forest Service 2007, pers. comm.). Despite the large amount of potentially suitable habitat, the majority of the Occupied Habitat MCP for this population occurs on one Habitat Management Area (HMA) within the Sabine National Forest. Active habitat management for the RCW and the Louisiana pine snake occurs within additional HMAs at this site. Twenty-one HMA compartments (12,285 ha (30,357 ac)) (including occupied compartments of Fox Hunter’s Hill tract) of the Sabine National Forest have specific management conditions described within a Candidate Conservation Agreement (CCA) (CCA 2003, p. 12). The entire South Sabine HMA including additional land of the HMA not described in the CCA, plus the Stark Tract (which is not in the HMA but is in the CCA), (South Sabine HMA+CCA) is 18,751 ha (46,335 ac) (Table 3). The Sabine National Forest prescribed burned 60 percent (11,180 ha (27,627 ac)) of the South Sabine HMA+CCA and 82 percent (320 ha (791 ac)) of the Occupied Habitat MCP area during 2009 to 2011. In 2010, 209 ha (517 ac) were thinned within the Occupied Habitat MCP area at the Fox Hunter’s Hill tract (CCA and HMA land) (USDA Forest Service 2010, pers. comm.). The LRSF Model indicated that 3,401 ha (8,405 ac) of potentially preferable habitat exists within the entire South Sabine HMA+CCA of 18,751 ha (46,335 ac) (USDA Forest Service 2011, pers. comm.) (Table 3). This population is surrounded by lands that have become unsuitable for the Louisiana pine snake due to intensive silviculture and fire suppression (Rudolph 2008b, pers. comm.). In addition, Louisiana pine snakes in this population have experienced vehicular mortality along many of the roadways that traverse this area (Rudolph 2008b, pers. comm.). No Louisiana pine snake records have been reported from this population since 1995. In addition, no Louisiana pine snakes were captured from this population during 2,695 trap days in 2009 through 2011 and a cumulative total of 14,245 trap days from 2000 to 2011. The information above suggests that this population may have become extirpated or that it is vulnerable to decreased demographic viability or stochastic environmental factors. Consequently, the status of this population is uncertain, but possibly extirpated. However, the lack of recent trap captures suggests that increased trap effort in potentially preferable habitat (as indicated by the LRSF Model and pocket gopher

presence) would strengthen the assessment of this population.

(6) The Scrappin' Valley, TX population. Five individual records (2000 to 2011) exist for this population; however, two of those were found dead on roadways and one was sighted but not captured. Trap success for this population is estimated to be 1:7,361 (2 captures out of 14,721 trap days) during 2000 to 2011. During the last three years (2009 to 2011), no trap success (0 captures out of 10,339 trap days) has occurred within this population. The most recent trap capture at this site was in 2008.

Approximately 405 ha (1,000 ac) of potential habitat have been maintained as suitable Louisiana pine snake habitat for several decades because of active prescribed-burning that has occurred on this site for game and RCW management (Rudolph 2008b, pers. comm.). Additional potential habitat (approximately 4,047 ha (10,000 ac) in size) surrounding this population has historically been fire suppressed and unsuitable for the Louisiana pine snake. However, active management is currently improving the suitability of much of this area as habitat for the Louisiana pine snake (Rudolph 2008b, pers. comm.). Within the Scrappin' Valley hunting preserve boundary, the LRSF Model indicated that 4,538 ha (11,214 ac) of potentially preferable habitat exists (USDA Forest Service 2010, pers. comm.) (Table 3). Despite Louisiana pine snake occurrences as recent as 2008, and proactive habitat management by the private landowner, the relatively low levels of trap success suggests that this population may be vulnerable to decreased demographic viability or stochastic environmental factors and indicate that the status of this population is uncertain. Relatively low trap success suggests that increased trap effort in potentially preferable habitat (as indicated by the LRSF Model and pocket gopher presence) would strengthen the assessment of this population.

(7) The Angelina, TX population. Six individual records (2000 to 2011) exist for this population (five were captured in traps, one was hand-caught alive on a road). However, one previously captured and pit-tagged individual was found dead on a road in 2009. Trap success for this population is estimated to be 1:4,420 (5 captures out of 22,098 trap days) during 2000 to 2011. During the last three years (2009 to 2011), no trap success (0 captures out of 7,097 trap days) has occurred within this population. The most recent trap capture at this site was in 2007.

Active habitat management for the RCW and the Louisiana pine snake occurs within Habitat Management Areas (HMA) (15,179 ha (37,509 ac)) at this site. Eighteen HMA compartments of the Angelina National Forest (9,680 ha (23,920 ac)) have specific management conditions designated by agreement within the CCA for the Louisiana pine snake (CCA 2003, p. 12). The Angelina National Forest prescribed burned 76 percent (11,574 ha (28,599 ac)) of the HMA during 2009 to 2011. No thinning of HMA habitat occurred during 2009 to 2011. Furthermore, the Angelina National Forest prescribed-burned 96 percent (3,688 ha (9,114 ac)) of the Occupied Habitat MCP during 2009 to 2011. Eighty-eight percent (1,719 ha (4,247 ac)) of the LRSF Model habitat has been prescribed-burned during 2009 to 2011. Within the entire HMA, the LRSF Model indicated that 7,835 ha (19,360 ac) of potentially preferable habitat exists (USDA Forest Service 2010, pers. comm.) (Table 3). Of the LRSF Model habitat within the HMA, 72.4 percent (5,673 ha (14,019 ac)) has been prescribed-burned during 2009 to 2011. Within the entire CCA-designated lands, the LRSF Model indicated that 5,911 ha (14,606 ac) of potentially preferable habitat exists (USDA Forest Service 2011, pers. comm.) (Table 3). Despite the relatively large number of occurrence records, a 2009 road-kill recapture record, large amount of potentially occupied and preferable potentially occupied habitat under active management, and moderate trap success, the absence of a successful trap capture since 2007 suggests that the status of this population is uncertain. However, the lack of recent trap captures suggests that increased trap effort in potentially preferable habitat (as indicated by the LRSF Model and pocket gopher presence) would strengthen the assessment of this population.

Captive-Breeding Population. As of December 2011, the captive-breeding Louisiana pine snake population consists of 49 individuals (25 males and 24 females) at 17 Association of Zoos and Aquariums-accredited (AZA) institutions, which are divided into three groups of snakes separated by their different geographic origins – Bienville Parish, LA; Vernon Parish, LA; and eastern Texas (Reichling and Schad 2010, p. 1; Reichling 2012, p. 1).

# Threats

## A. The present or threatened destruction, modification, or curtailment of its habitat or range:

The historical distribution of the Louisiana pine snake corresponds with the historical range of the longleaf pine ecosystem in Louisiana and Texas. Both the quantity and quality of the longleaf pine ecosystem have declined sharply in Louisiana and Texas since European settlement. The loss and degradation 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 the 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 exists today 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). For example, only 2.9 percent of longleaf pine forests in Louisiana and Texas were uncut old-growth stands in 1935 (Bridges and Orzell 1989, p. 246). Therefore, estimates of habitat loss based on differences between 1935 and the late 1980s underestimate the true extent of habitat loss (and hence Louisiana pine snake population declines), because most of the habitat loss had already occurred by 1935. Additionally, the disruption of natural fire regimes has been detrimental to the health and extent of the remaining longleaf pine forests within the Louisiana pine snake range. Insufficient fire, due to fire suppression and inadequate prescribed burning, is considered a primary factor responsible for the degradation of the remaining longleaf pine forest. The large-scale destruction and degradation of the longleaf pine ecosystem has been implicated in the population declines of many species that are characteristic of this ecosystem, including the black pine snake (*Pituophis melanoleucus lodingi*) (a Federal candidate species), the endangered red-cockaded woodpecker, and the endangered Mississippi sandhill crane (*Grus canadensis pulla*) (Hunter et al. 2001, p. 442; USFWS 2007, p. 9).

All seven extant Louisiana pine snake populations have been affected by habitat loss, 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 lands, open pine habitats containing dense herbaceous vegetation are being converted to densely-stocked off-site pine plantations that are managed with herbicides. If herbicide use alters the composition and/or density of the ground cover vegetation and pocket gophers decline in response, Louisiana pine snakes will decline in numbers as well (Rudolph and Burgdorf 1997, p. 118). The longleaf pine savannas occupied by Louisiana pine snakes have historically been maintained by fire. The use of fire is heavily reduced on private timberlands 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. 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 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, the largest extant population (Reichling et al. 2008, p. 10), primarily occurs on private industrial forest land. Much of this industrial forest has recently been converted to short-rotation loblolly pine plantations. Although the broadcast application of herbicides has been restricted in these 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 disjunct Louisiana pine snake CMAs, are being beneficially managed (via longleaf pine restoration, prescribed burning, and understory control) for the Louisiana pine snake by the private landowners. 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 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 recent buying and selling of the Bienville properties by TIMOs adds additional uncertainty regarding the future land use priorities on these sites. The current landowner and the USFWS have finalized the Modification to transfer a Private Stewardship Grant, formerly held by a previous landowner, and have conducted habitat improvements on the two CMAs that benefit the Louisiana pine snake (i.e., prescribed burning and midstory control). Representatives from the current TIMO attended the 2009 and 2010 Louisiana pine snake stakeholders meetings and implementation of habitat management on the two CMAs is ongoing. Nonetheless, 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 lands. Despite the beneficial management in the two CMAs and the fact that trapping and occurrence records indicate this is the largest remaining Louisiana pine snake population, no formal conservation agreements 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 affected by those activities.

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 signing of the Louisiana pine snake CCA between the Service, the USFS, DOD (Fort Polk), Texas Parks and Wildlife Department (TPWD), and the LDWF in 2003, extensive beneficial habitat management (prescribed burning and thinning) within occupied and potential Louisiana pine snake habitat 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 2008c, pers. comm.). However, it has been noted that, in some instances, prescribed burning and thinning was not occurring in areas that would benefit Louisiana pine snakes because management was being prioritized for the RCW (USDA Forest Service 2007, pers. comm.). 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.

Based on our evaluation, we conclude that there is sufficient information to develop a proposed listing rule for this species due to the present or threatened destruction, modification, or curtailment of its habitat or range.

## **B. 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 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, pers. comm.) and there appears to be very little demand for this species by private collectors (Reichling 2008, pers. comm.). 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 fecundity, 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 protected by State law in Texas, and most areas in Louisiana where extant Louisiana pine snake populations occur restrict public access or prohibit collection. In addition, the secretive nature, semi-fossorial habits, and current rarity of the Louisiana pine snake make collection of this species difficult (Gregory 2008a, pers. comm.).

### **C. Disease or predation:**

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

### **D. The inadequacy of existing regulatory mechanisms:**

No State-listing protection for the Louisiana pine snake exists in Louisiana (Gregory 2008b, pers. comm.), the state having the largest known population of this species. This means that Louisiana pine snakes have no regulatory protection on non-Federal lands in Louisiana. Collection or harassment of Louisiana pine snakes is prohibited on U.S. Forest Service 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 lands) is prohibited without a special permit and only venomous snakes are permitted to be killed on Fort Polk and Peason Ridge if determined to be an immediate threat to personnel (U.S. Department of the Army 2008, p. 6). The Louisiana pine snake is listed as threatened by the State of Texas and is protected from unauthorized collection in that State. However, the regulation does not protect the habitat of the species which loss has caused the species to decline.

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 snake by humans is likely, but the extent of the impacts of this stressor are 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.

Based on our evaluation, we conclude that there is sufficient information to develop a proposed listing rule for this species due to the inadequacy of existing regulatory mechanisms and the effects to the continued existence of the species.

### **E. 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 isolated and small. Currently, the amount of habitat required to support viable Louisiana pine snake populations, and the necessary distribution of this habitat over the landscape, is not known. In addition, we currently do not know the minimum population size required to maintain self-sustaining populations of the Louisiana pine snake. Small, isolated populations experience decreased demographic viability and increased susceptibility of extirpation from stochastic environmental factors (e.g., weather events, disease). Small, isolated populations also experience increased threat of extirpation from genetic isolation and subsequent inbreeding depression and genetic drift. All seven extant Louisiana pine snake populations appear to be vulnerable to threats associated with fragmentation and isolation, and at least five of these populations (the Kisatchie, LA; Peason Ridge, LA; Scrappin' Valley, TX; Angelina, TX, and Sabine, TX populations) also appear (based on a lack of recent occurrence data) to be vulnerable to threats associated with small population size.

Roads and associated vehicular traffic, in particular, 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 could be attributed to 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 the roads (Rudolph et al. 1999, p. 130). Off-road vehicle use may also cause significant impacts to Louisiana pine snake population numbers. However, no significant data exists to quantify the impact of off-road vehicle use.

Erosion control blankets (ECBs) installed in pipeline, power line, and road rights-of-way can result in direct Louisiana pine snake mortality due to entanglement. Rudolph (2011, pers. comm.) demonstrated that synthetic erosion control blanket material caused immediate entanglement and snakes were unable to extract themselves after exposure. Extensive pipeline construction associated with Haynesville shale gas and oil exploration activities, and the subsequent increase in the use of ECBs, is a particular threat to the Bienville, LA population (Rudolph 2011, pers. comm.).

The Louisiana pine snake has an extremely low reproductive rate, producing a very small clutch of 4 eggs (Reichling 1990, p. 221). The Louisiana pine snake's low fecundity (reproductive output) and low population growth rate magnifies the effect of the above listed threats and increases the likelihood of local extirpations.

The extensive historic loss of habitat has reduced the Louisiana pine snake into seven isolated populations. Several of these populations may be vulnerable to threats associated with low population sizes. The historic and ongoing loss of potential habitat (via fire suppression, conversion to pine plantations, increases in the number and width of roads, and urbanization) on private lands 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. 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, and demographically isolated, any factor (e.g., habitat change, a loss of demographic viability, etc.) that results in a decline in Louisiana pine snake densities within a remnant population is problematic for the long-term recovery of this species. Based on the assessment of the status of the seven extant populations, only one population appears to be large enough and occur on sufficient amounts of appropriately-managed habitat as to be considered stable (the Fort Polk, LA population). The six other populations each have uncertain statuses: three because of apparently small population size (the Kisatchie, LA; Scrappin' Valley, TX; and Angelina, TX populations), two because of apparently small population size coupled with low amounts of suitable habitat (the Sabine, TX and Peason Ridge, LA populations), and one because of threats resulting from activities (habitat conversion to short-rotation pine plantations) that are expected to decrease habitat quality (the Bienville, LA population).

Based on our evaluation, we conclude that there is sufficient information to develop a proposed listing rule for this species due to other natural or manmade factors affecting its continued existence.

### **Conservation Measures Planned or Implemented :**

The CCA (2003) for the Louisiana pine snake which includes the Service, USFS, DOD, TPWD, and LDWF was completed in 2003 and is currently being implemented. The CCA is designed to identify and establish management for the Louisiana pine snake on Federal lands in Louisiana and Texas, and provides a means for the partnering agencies to work cooperatively on projects that avoid and minimize impacts to the snake. It also sets up a mechanism to exchange information on successful management practices and coordinate research efforts. The Natural Resources Conservation Service, the Association of Zoos and Aquariums (AZA), and The Nature Conservancy have discussed potentially becoming additional signatories when the

CCA is revised in 2012. Several private landowners previously indicated interest in becoming signatories to the CCA or similar agreements with the Service. Additionally, the Service is actively presenting the benefits of Candidate Conservation Agreements with Assurances (CCAAs) to willing landowners that possess land within the Occupied Habitat MCP and LRSF Model habitat that would benefit from such agreements. However, as of April 2012, no private landowners were formal signatories of the CCA or have signed CCAAs. In addition, currently proposed amendments to the CCA, if adopted, will improve the ability of land managers to prioritize management efforts to directly address identified threats such as burning in areas that will benefit Louisiana pine snakes or ORV restrictions. Federal partners to the CCA manage land representing an estimated 53 percent of occupied Louisiana pine snake habitat. These partners are addressing habitat management needs through pro-active land management including midstory removal, thinning, and prescribed-burning. All Federal lands that contain extant Louisiana pine snake populations use prescribed-burning and thinning to manage habitat for the federally endangered RCW. Because Louisiana pine snakes and RCWs both require open pine forests with fire-suppressed midstories, habitat management for the RCW generally benefits the Louisiana pine snake (Rudolph et al. 2006, p. 471). However, fire management for the RCW that is conducted in areas without well-drained sandy soils and pocket gophers will not directly benefit the Louisiana pine snake. In addition, fire management that occurs within Louisiana pine snake occupied habitat is more beneficial than fire management that occurs within potential habitat. Therefore, information on the area of prescribed-burning and thinning that is not directly related to occupied habitat overestimates the benefit of this management to the Louisiana pine snake. Trap efforts are planned for 2012-13 in areas outside of the currently defined occupied habitat in order to better refine habitat and beneficial management estimates. During 2009 to 2011, cooperating Federal agencies conducted prescribed burning on 26,468 ha (65,405 ac) of Occupied Habitat MCP lands and 66,615 ha (164,608 ac) of potentially preferable (LRSF model) Louisiana pine snake habitat. In 2001, the Service provided funds, through the Private Stewardship Grant Program to a private landowner for habitat restoration and prescribed burning at CMAs on several tracts of their Bienville Parish property containing a known Louisiana pine snake population. A habitat management plan for those sites was developed, and in August of 2005, that landowner was awarded a \$45,400 Private Stewardship Grant for continued habitat improvement (e.g., longleaf pine restoration) on that same property. Subsequently, that property has been transferred to a new landowner and a Grant Modification to transfer the remaining funds to the present landowner has been executed. Through the use of those grant funds and voluntary investment, those private landowners have converted 177 ha (438 ac) of the Kepler Lake site and 210 ha (518 ac) of the Sandy Lands site to longleaf pine within those CMAs. Furthermore, during early 2011, the present landowner completed prescribed burning of 227 ha (560 ac) at the Kepler Lake site and 259 ha (639 ac) at the Sandy Lands site (Cook 2011, pers. comm.). The Louisiana Pine Snake Conservation Group consists of representatives from a variety of organizations having an interest in Louisiana pine snake conservation and includes approximately 90 individuals representing State and Federal government, non-profit and private organizations, zoos, academia and private landowners. This group has been holding annual stakeholder meetings since 2003. At those meetings, stakeholders discuss issues and threats to the Louisiana pine snake, identify possible strategies to deal with those threats, report on land management activities beneficial to stability or recovery, and discuss and share successful results. A number of important conservation issues have been discussed at those meetings (many leading to conservation actions), including: (1) the captive propagation program and associated research begun at the Memphis Zoo and expansion of that program to a consortium of AZA institutions; (2) current field research and needs; (3) existing trapping methods and potential enhancements to increase effectiveness; (4) impacts resulting from all-terrain-vehicle (ATV) use on public lands where designated-use areas are being employed to concentrate ATV use in areas unlikely to support the Louisiana pine snake; and (5) educational outreach efforts aimed at public acceptance and conservation of reptiles as a natural component of the longleaf pine ecosystem. Five other significant activities have resulted from cooperative efforts of this group's members: (1) completion of a threats assessment (using expert opinion) for the Louisiana pine snake (Wagner et al. 2009b); (2) development and completion of a landscape-scaled resources selection function model (Wagner et al. 2009a); (3) training and experimental testing of a scent dog to assist in survey efforts; (4) initiation of an experimental captive breeding and reintroduction program; and (5) initiation of a DNA microsatellite study leading to a determination of heterozygosity for 16 loci which will help define genetic structure among populations (Kwiatkowski et al. 2010, pp. 1-4). As a result of discussion during the 2007 Louisiana pine

snake stakeholders meeting, the need to better define threats to the species in order to design improved conservation and management activities was recognized. To address this gap, in 2009, a research team consisting of private and USFS biologists developed a Delphi method survey instrument (matrix) to identify threats, stressors, stressor elements, and stressor element response levels. The matrix was designed to incorporate the traditional five-factor threats criteria used by the Service in species listing under the Endangered Species Act (ESA) as well as the Service's threats assessment guidance. This effort resulted in a "white paper" by Wagner et al. (2009b) that identifies actions needed for each population and measures of success for those actions. The resulting matrix is proposed to be incorporated into specific, stressor/response-based actions of the signatories in the 2012 planned revisions to the CCA. Although expert opinion has provided important insight into edaphic (soil-related) factors and vegetative requirements for the Louisiana pine snake, rigorous habitat models were previously not available. Landscape-scale models of potential and suitable habitat are essential to inform conservation management efforts for this species. To address this gap, in 2009, a research team consisting of private and USFS biologists developed a preliminary LRSF Model of potential Louisiana pine snake habitat, using available Louisiana pine snake location data to delineate used and available units, and county and parish soil survey data as edaphic factor-independent variables as described above in Current Range/Distribution. The team presented their final results at the 2009 Louisiana pine snake stakeholder meeting. The model is currently being used to determine: (1) if there are areas of preferable habitat within the historic range that have not been adequately surveyed for the Louisiana pine snake; (2) identify focus areas for management, restoration, and reintroduction potential (Louisiana pine snake HMUs); and (3) quantify the spatial extent and location of Louisiana pine snake habitat within protected lands. Currently, federal signatories of the CCA report their management actions specifically on LRSF Model preferable habitat. Additional Louisiana pine snake distribution data and further refinement of habitat models through collection of suitable herbaceous vegetation and Baird's pocket gopher abundance data are needed to ensure that pro-active forest management conducted by the signatories of the CCA is located in areas that are currently occupied by the Louisiana pine snake. The LRSF Model will help guide signatories to focus future trap efforts and manage additional areas of potentially preferable soils that do not currently provide suitable herbaceous ground cover. Preliminary efforts to train and use a scent dog to conduct Louisiana pine snake surveys have been inconclusive. Future efforts to revisit this survey method will include resolution of practical issues such as establishment of a handler, ownership of the trained dog, and a methodology to detect the accuracy of Louisiana pine snake detectability. Preliminary investigation has begun into the potential viability of working with existing, established, and proven programs that currently train scent dogs. In consideration of the results from the Louisiana pine snake captive breeding program, CCA habitat management activities, the threats assessment and the LRSF model presented at the 2009 stakeholders meeting, an informal committee was formed to develop and implement an experimental reintroduction of the Louisiana pine snake. The project has two goals: (1) demonstrate the feasibility of reintroducing a population to restored habitat using individuals from a captive population; and (2) establishing a viable population in restored habitat. To date, three reintroduction sites have been identified in unoccupied habitat on the Kisatchie National Forest/Catahoula District within the historic range, using the LRSF Model and site visits. Louisiana pine snakes are being reared in captivity by a consortium of zoos. As of December 2011, the captive-breeding Louisiana pine snake population consisted of 49 individuals (25 males and 24 females) at 17 AZA institutions, which are divided into three groups of snakes separated by their different geographic origins - Bienville Parish, LA; Vernon Parish, LA; and eastern Texas. The Bienville, LA portion of the captive-breeding population consists of 37 individuals (18 males and 19 females) distributed among 14 institutions. The Vernon, LA portion consists of eight individuals (four males and four females) at two institutions. The Texas portion consists of four individuals (three males and one female) at one institution (Reichling and Schad 2010, p. 1; Reichling 2012, p. 1). The reintroduction effort has been implemented (e.g., release, monitoring by radio-telemetry, etc.) by a partnership of cooperating agencies and AZA institutions. Initial reintroduction began in 2010. In 2010, three zoos (the Gladys Porter Zoo in Brownsville, TX; the Audubon Zoo in New Orleans, LA; and the Memphis Zoo in Memphis, TN) provided a total of twenty neonates (four clutches) for release. Eleven individuals were released as neonates shortly after their post-natal shed (Rudolph and Reichling 2010, p. 2). The remaining nine individuals were held at the USFS Southern Research Station (SRS) and the Ellen Trout Zoo in Nacogdoches, TX and the Memphis Zoo. Those snakes were provided with a heat source throughout the winter and fed as often as they accepted prey

(head-started). Those nine snakes were released in April 2011. In 2011, fourteen neonates were hatched at the Memphis Zoo, Audubon Zoo, and Woodland Park Zoo (Seattle, WA). Seven of those were released in August and September 2011 and the remaining seven will be head-started and released in April 2012 (Reichling 2012, p.1). In total, 11 snakes were released in 2010, 16 snakes were released in 2011, and 7 snakes are being head-started for release in early 2012. In 2011, biologists representing LDWF and the Service presented a training seminar to hunters who lease private land from the TIMO that owns the largest and possibly most important privately-owned portion of the Bienville, LA population. Those biologists also presented a seminar to foresters, land managers, and officers of that TIMO. Those seminars informed participants of the federal status and threats to the Louisiana pine snake, conservation measures that could be practiced by those stakeholders, and potential ramifications of listing of that species. Additionally, LDWF and the Service have been providing comments on pipeline development proposals within the Louisiana pine snake range in Louisiana requesting the installation of erosion control alternatives that do not utilize polypropylene ECBs. Lastly, Kwiatkowski et al. (2010) has developed DNA Microsatellite primers to allow genetic analysis within and between Louisiana pine snake populations. Preliminary results indicate low levels of heterozygosity and lack Hardy-Weinberg equilibrium suggesting that populations are small and isolated.

### **Summary of Threats :**

The Louisiana pine snake is listed as a candidate species, thereby indicating the Service has sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened. The summary below indicates that significant threats to the Louisiana pine snake continue to support the ranking as a candidate species. The primary threats to this species stem from extensive historic habitat losses, coupled with the disruption of natural fire regimes, which have reduced the Louisiana pine snake to seven isolated populations. Several of these remnant populations may be vulnerable to factors associated with low population sizes and demographic isolation such as reduced genetic heterozygosity. The historic and ongoing loss of potential habitat (via fire suppression, conversion to pine plantations, increases in the number and width of roads, and urbanization) on private lands in the matrix between these extant populations reduces the potential for dispersal among remnant populations and the potential for natural re-colonization of vacant suitable habitat patches. Because it is unlikely that corridors linking extant populations will be established, the loss of any extant population would be permanent. Louisiana pine snake populations on Federal lands have received increased management attention (via prescribed-burning and thinning) in recent years, and as a result the successional degradation of occupied and potential habitat within these populations has been stabilized or reversed. Nonetheless, not all areas of occupied habitat on Federal lands have received recent prescribed-burning, and in the absence of adequate burning Louisiana pine snake habitat becomes degraded via vegetative succession. The largest and perhaps most important extant Louisiana pine snake population exists on private industrial timberland. Although two conservation areas are managed to benefit Louisiana pine snakes on this property, the majority of the occupied habitat between the conservation areas is threatened by land management activities (habitat conversion to short-rotation pine plantations) that are expected to decrease habitat quality. Additional threats which occur even within quality Louisiana pine snake habitat include: (1) road mortality; (2) off-road mortality due to all-terrain-vehicle use; (3) mortality from entanglement in erosion control blankets installed in rights-of-way; (4) intentional killing (the public's general dislike for snakes, which also contributes to 1 and 2 above). (5) the loss of demographic viability and increased susceptibility to stochastic environmental factors resulting from small isolated population. (6) genetic isolation and susceptibility to genetic drift and inbreeding depression resulting from small isolated populations. and (7) the minimal possibility of collection for the pet trade. Finally, the Louisiana pine snake has an extremely low reproductive rate, thereby magnifying the effects of the above listed threats. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

### **For species that are being removed from candidate status:**

\_\_\_\_\_ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing

Decisions(PECE)?

## Recommended Conservation Measures :

Present the option of CCAAs to willing landowners to protect significant portions of the Louisiana pine snakes range that occur on private property. Assurances from private landowners that habitat will be managed longterm for the benefit of this snake will be required to conserve this species. Continue or reestablish Louisiana pine snake trapping within the known Occupied Habitat MCPs and additional areas that the LRSF Model has shown to be preferable to snakes outside of the Occupied Habitat MCP areas. Improved status assessment is dependent on continuing to collect recent occurrence and spatial distribution data for this species. Pursue new methods of occurrence monitoring, such as pressure-activated camera traps, that could drastically increase the potential observation of such a difficult species to trap. Improve assessment of Louisiana pine snake population status by continuing to explore better survey techniques facilitated by the Landscape-scale Resource Selection Function Model and potential use of a trained scent-detection dog. Enhance existing and/or establish longleaf pine forests within occupied and potential Louisiana pine snake habitat. Within occupied and potential Louisiana pine snake habitat, reduce and or remove midstory component within pine forest stands to a level that allows maintenance by fire. Within occupied and potential Louisiana pine snake habitat, implement a prescribed-fire program (typical 3 to 5-year intervals once the forest is in a maintenance condition) to reduce the midstory forest component and maintain the herbaceous layer. Within occupied and potential Louisiana pine snake habitat, reduce timber stand density through selective thinning to allow insolation to the ground layer thereby enhancing the herbaceous layer and pocket gopher habitat. Within occupied and potential Louisiana pine snake habitat, manage timber primarily for ecological restoration or on longer rotations and for higher end products such as saw timber and poles. Within occupied and potential Louisiana pine snake habitat, limit off-road vehicular use and consider/continue road closures. Provide conservation education to the general public, and to managers, hunters and other recreational users to avoid killing or otherwise impacting snakes in the wild. Educate collectors and other members of the public on the rarity of the Louisiana pine snake and the need to refrain from removing the species from the wild Continue captive breeding and experimental reintroduction program to enhance populations within suitable habitat actively managed for Louisiana pine snake. Assessment of captive-breeding stock and wild-caught specimen genetics to attempt to determine long-term viability of the species and inform decision-making within the captive-breeding program.

## Priority Table

Magnitude	Immediacy	Taxonomy	Priority
<b>High</b>	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		<b>Species</b>	<b>5</b>
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-Imminent	Monotype genus	10
		Species	11
		Subspecies/Population	12

## **Rationale for Change in Listing Priority Number:**

### **Magnitude:**

The Louisiana pine snake has been reduced to seven extant populations; all of these populations have been impacted by habitat loss and all require active habitat management. Most Louisiana pine snake habitat loss occurred historically and much of the habitat that remains has been degraded for reasons discussed previously. On public lands (53 percent of the potential current range) Louisiana pine snake habitat is receiving increased management emphasis. Much of this land area is now being managed on longer rotations (i.e., 70+ years) where silvicultural prescriptions include midstory removal, thinning and prescribed fire. That type of silviculture is well-suited to maintaining and/or enhancing Louisiana pine snake habitat. All extant populations are currently isolated and fragmented by the historic and ongoing loss of potential habitat (via fire suppression, conversion to pine plantations, increases in the number and width of roads, and urbanization) that has occurred on the private lands between the seven remnant populations. The loss of potential habitat in the intervening areas reduces the potential for dispersal among remnant populations and the potential for natural re-colonization of vacant suitable habitat patches. Several of the remnant populations may be vulnerable to decreased demographic viability or other factors (e.g., low genetic heterozygosity) associated with low population sizes and demographic isolation. In addition, a large portion of potentially occupied habitat for one extant Louisiana pine snake population is threatened by activities (habitat conversion to short-rotation pine plantations) that are expected to decrease habitat quality.

The potential threats to a large percentage of extant Louisiana pine snake populations leads us to conclude that the magnitude of the threats to this species remain high.

### **Imminence :**

The loss in quantity and quality of longleaf pine habitat is the most significant historical threat to the Louisiana pine snake. Several localized threats continue to impact extant Louisiana pine snake populations and their habitat. As noted above, many current silvicultural practices on private lands degrade habitat quantity and quality for the Louisiana pine snake. However, voluntary management is maintaining and improving habitat conditions within small portions of occupied habitat for two extant Louisiana pine snake populations on private land. Management by signatories of the CCA is currently stabilizing and improving the quality of habitat for Louisiana pine snake populations on Federal lands.

Based on the assessment of the status of the seven extant populations, one population (Fort Polk, LA) appears to be large enough and to occur on sufficient amounts of appropriately-managed habitat as to be considered stable. The status of the six other populations are uncertain: three because of apparently low population size based on limited occurrence data, two because of apparently low population size based on limited occurrence data coupled with low amounts of suitable habitat, and one because of threats resulting from activities that are expected to decrease habitat quality. Three extant Louisiana pine snake populations appear to be both small and isolated. These populations are therefore vulnerable to loss of demographic viability and to increased susceptibility to stochastic environmental factors (e.g., weather events, disease). Although these remnant populations are intrinsically vulnerable and thus threatened by these factors, it is not known if they are presently actually facing these threats. To the extent that conversion to short-rotation pine plantation degrades habitat quality, the Bienville population is experiencing ongoing habitat degradation in the lands outside of the Core Management Areas. The condition of occupied or potentially occupied habitat in the other six extant populations appears to be stable or improving due to active management.

Based on the above facts, we conclude that threats to the Louisiana pine snake population as a whole are non-imminent.

Yes  No Have you promptly reviewed all of the information received regarding the species for the purpose

of determination whether emergency listing is needed?

## **Emergency Listing Review**

  No   Is Emergency Listing Warranted?

No, most of the longleaf pine habitat of the Louisiana pine snake has been destroyed for decades and much of the remaining habitat has been degraded. Louisiana pine snake habitat loss is continuing at a slower rate than in the past, and is being stabilized, reduced, or recovered on Federal lands and some private lands. Voluntary, pro-active management actions to restore degraded habitat, reduce threats, and maintain Louisiana pine snake populations are being conducted on public lands in accordance with the ongoing 2003 CCA and a private landowner has successfully used a Private Stewardship Grant to directly address Louisiana pine snake conservation on a small portion of a private landholding. Private landowners are also demonstrating interest in the CCA through their presence and involvement at annual stakeholder meetings in 2003 - 2011. The Service intends to present the benefits of CCAs to any interested private landowners throughout the species' range. Additionally LDWF is actively pursuing willing private landowners interested in enrolling their property in the Louisiana Natural Areas Registry and/or committing to conservation easements within the Louisiana pine snake's occupied range.

We do not believe that emergency listing is warranted at this time.

### **Description of Monitoring:**

In 2011, trapping surveys for the Louisiana pine snake occurred within limited sections of occupied habitat for all extant Louisiana pine snake populations. The occupied habitat of the Kisatchie, LA population has never been trapped and the Bienville, LA population on private land (Winn District excluded) has not been trapped since 2009 (Rudolph 2011, pers. comm.) but is planned to resume in 2012. Results of those surveys are discussed at annual Louisiana pine snake stakeholder meetings. Starting in 2010, limited monitoring by radio-telemetry was conducted by the USFS for Louisiana pine snakes released through the captive breeding and reintroduction programs (Rudolph and Reichling 2010, p.1). Reintroduced snakes were also fitted with pit-tags and automated pit-tag (APT) recorders were deployed at the release sites (Rudolph and Reichling 2010, p.1). Those recorders could potentially generate limited dispersal and survival data for some of those reintroduced snakes and at least four, possibly six, APT recorders are planned for installation in 2012 (Rudolph 2012, pers. comm.). Since monitoring of the captive-bred released snakes began, APTs have detected three snakes. One was detected on two consecutive days. The longest duration between release and detection (maximum documented survival of captive-bred, released snakes) has been 27 days (Reichling 2012, p.1). In early 2012, traps have been installed or refurbished within the Scrappin' Valley, TX, Sabine, TX (Fox Hunter's Hill), and Angelina, TX populations and 2 new sites are planned to be trapped in Wood County, TX within 10 to 20 miles of historic localities. At the Angelina and Sabine, TX populations, some traps have been relocated and additional traps have been installed to increase the probability of capture (Rudolph 2012, pers. comm.). Twelve traps are planned for installation in 2012 within the Kisatchie, LA population at sites that have suitable potential habitat as determined by the LRSF model combined with Baird's pocket gopher colony occurrence (Kohls 2012, pers. comm.). The Fort Polk, LA, Peason Ridge, LA, and the Winn District portion of the Bienville, LA populations are also planned to continue to be trapped.

**Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:**

Louisiana, Texas

**Indicate which State(s) did not provide any information or comment:**

none

## State Coordination:

The Louisiana pine snake is included as a species of concern in the Wildlife Action Plans for both Louisiana and Texas.

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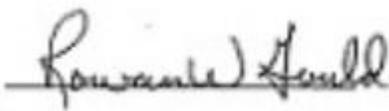
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### Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  06/12/2012  
Date

Concur:  11/06/2012  
Date

Did not concur: \_\_\_\_\_  
Date

Director's Remarks: