

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

SCIENTIFIC NAME: *Pituophis melanoleucus lodingi* Blanchard

COMMON NAME: Black Pine Snake

LEAD REGION: 4

INFORMATION CURRENT AS OF: March 2010

STATUS/ACTION:

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

New candidate

Continuing candidate

Non-petitioned

Petitioned - Date petition received: May 11, 2004

90-day positive - FR date: _____

12-month warranted but precluded - FR date: _____

Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is 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 the 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.

Listing priority change

Former LP: _____

New LP: _____

Date when the species first became a Candidate (as currently defined): October 1, 1999

Candidate removal: Former LP: _____

A - 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.

U - 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.

F - Range is no longer a U.S. territory.

- I - Insufficient information exists on biological vulnerability and threats to support listing.
- M - Taxon mistakenly included in past notice of review.
- N - Taxon may not meet the Act's definition of "species."
- X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Reptile - Colubridae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Alabama, Louisiana, & Mississippi

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Alabama (Clarke, Mobile, and Washington counties) and Mississippi (Forrest, George, Greene, Harrison, Jackson, Jones, Marion, Perry, Stone, and Wayne counties)

LAND OWNERSHIP: Of the total 240,143 hectares (ha) (593,385 acres (ac)) of habitat estimated to be occupied by extant black pine snake populations, 190,563 ha (470,875 ac) (79%) are on Federal land (DeSoto National Forest, Mississippi); 5,281 ha (13,050 ac) (2%) are on state land (Marion County Wildlife Management Area, Mississippi; Alabama Department of Transportation conservation area and Fred T. Stimpson State Game Sanctuary in Alabama); 225 ac (91 ha) (< 1%) are on property owned by a local government entity; and 44,207 ha (109,235 ac) (18%) are on private land.

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LEAD FIELD OFFICE CONTACT: Jackson, Mississippi Field Office, Linda LaClaire, 601/321-1126, Linda_LaClaire@fws.gov

BIOLOGICAL INFORMATION:

Species Description

Pine snakes (genus *Pituophis*) are large, short-tailed, powerful constricting snakes with keeled scales and disproportionately small heads (Conant and Collins 1991, pp. 201-202). Their snouts are pointed and they are good burrowers. Black pine snakes are distinguished from other pine snakes by being dark brown to black both on the upper and lower surfaces of their bodies. There is considerable individual variation in adult coloration (Vandeventer and Young 1989, p. 34). Some adults have russet-brown snouts. They may also have white scales on their lips, throat, and ventral surface (Lee, The Nature Conservancy, *in litt.* 2005). In addition, there may also be a vague pattern of blotches on the end of the body approaching the tail. Adult black pine snakes range from 122 to 188 centimeters (cm) (48 to 74 inches (in)) (Conant and Collins 1991, p. 202; Mount 1975, p. 226). Young black pine snakes often have a blotched pattern, typical of other pine snakes, which darkens with age.

Taxonomy

There are three recognized subspecies of *Pituophis melanoleucus* (pine snakes) distributed across the eastern United States (Crother 2000, p. 69; Rodriguez-Robles and De Jesus-Escobar 2000, p. 35).

The black pine snake, *P. m. lodingi*, was originally described by Blanchard (1924, pp. 531-532). It is geographically isolated from all other pine snakes. However, there is evidence that the black pine snake was in contact with other pine snakes in the past. A form intermediate between the black pine snake and the Florida pine snake (*P. m. mugitus*) occurs in Baldwin and Escambia counties, Alabama and Escambia County, Florida. These snakes are separated from populations of the “true” black pine snake by the extensive Tensas-Mobile River Delta and the Alabama River (Duran 1998b, p. 13). The available taxonomic information on *P. m. lodingi* has been carefully reviewed and we conclude that this species is a valid taxon.

Habitat

Black pine snakes are endemic to the upland longleaf pine forests that once covered the southeastern United States. Habitat for these snakes consists of sandy, well-drained soils with an overstory of longleaf pine, a fire suppressed mid-story, and dense herbaceous ground cover (Duran 1998b, p. 2). Duran (1998a, pp. 1-32) conducted a radio-telemetry study of the black pine snake that provided data on habitat use. Snakes in this study were usually located on well-drained, sandy-loam soils on hilltops, ridges, and toward the tops of slopes. They were rarely found in riparian areas, hardwood forests, or closed canopy conditions. More than half of the time, black pine snakes were located underground, usually in the trunks or root channels of rotting pine stumps. During two additional radio-telemetry studies, individual pine snakes were observed more frequently in riparian areas, hardwood forests, and pine plantations than in Duran’s (1998a, pp. 1-32) study indicating a requirement for some degree of patchiness and habitat heterogeneity, but in these studies they repeatedly used the same pine stump and associated rotted-out root system from year to year indicating considerable longleaf pine forest site fidelity (Yager, *et al.* 2006, pp. 34-36; Baxley 2007, pp. 48-49). Black pine snakes moved seasonally between warm weather “active areas” and winter hibernacula located in “inactive areas”. The snakes emerged from hibernacula in mid-February, made short movements within the inactive area and moved to their active area in late March. They occupied the active areas until late September when they moved back to their inactive areas. Several juvenile snakes that were radio-tracked during this same study were observed using mole or other small mammal burrows rather than the bigger stump holes used by adult snakes (Lyman *et al.* 2007, pp. 40-42).

A study conducted by Rudolph *et al.* (2007, p. 560) involved excavating five black pine snake hibernation sites. Although this study (p. 561) and a study conducted by Baxley (2007, pp. 39-40) noted that black pine snakes did not appear to exhibit true hibernation behavior because they moved above ground on warm days throughout all months of the year, the sites studied by Rudolph *et al.* (2007, p. 561) represent retreat sites used for significant periods of time from early December through late March. All black pine snakes hibernated singly at shallow depths (mean of 25 cm (9.8 in); maximum of 35 cm (13.8 in)) in chambers formed by the decay and burning of pine stumps and roots (Rudolph *et al.* (2007, p. 560). The hibernacula were not excavated by the snakes beyond minimal enlargement of the preexisting chambers.

Life History

Black pine snakes are active during the day but only rarely at night. They are accomplished burrowers. Their pointed snout and enlarged rostral scale (the scale at the tip of their snout) are

effective for tunneling in loose soil and also may be used for digging nests and excavating rodents for food (Ernst and Barbour 1989, pp. 100-101). In addition to rodents, wild black pine snakes have been reported to eat nestling rabbits and quail (Vandevert and Young 1989, p. 34). In a study conducted at Camp Shelby, Mississippi, seven (21%) of the 34 black pine snakes found in 2004 and 2005 contained food items (Lee 2009a, p. 1-2), including hispid cotton rats (*Sigmodon hispidus*), baby swamp rabbits (*Silvilagus aquaticus*), eggs of bobwhite quail (*Colinus virginianus*), eastern kingbird *Tyrannus tyrannus*, unknown species of mouse (*Peromyscus* sp.), and a baby eastern fox squirrel (*Sciurus niger*). Based on the observation of maggots on the squirrel, it was determined that it had died prior to being consumed by the black pine snake. In captivity, black pine snakes will eat rats, mice, and chicks (Vandevert and Young 1989, p. 34). During field studies of black pine snakes in Mississippi, hispid cotton rats and cotton mice (*Peromyscus gossypinus*) were the most frequently trapped small mammals within black pine snake home ranges (Duran and Givens 2001, p. 4; Baxley and Qualls 2006, p. 8). These results suggest that the two species of mammals represent essential components of the snake's diet (Duran and Givens 2001, p. 4).

Duran and Givens (2001, p. 4) estimated the average size of black pine snake home ranges (Minimum Convex Polygons (MCPs)) on Camp Shelby, Mississippi, to be 47.5 ha (117.4 ac) using data obtained during their radio-telemetry study. Observations made during this study also provided some evidence of territoriality in the black pine snake. A more recent study conducted on Camp Shelby provided home range estimates from 55 to 156 ha (135 to 385 ac) (Lee 2009a, p. 2). Additional home range calculations have been made from data collected on the DeSoto National Forest and other areas of Mississippi. The preliminary home range estimates (MCPs) from this study range from 91 ha (225 ac) to 395 ha (976 ac) (Baxley and Qualls 2006, p. 28). The smaller home range sizes from Camp Shelby may be a reflection of the higher habitat quality at the site. In the late 1980s, a gopher tortoise preserve of approximately 810 ha (2000 ac) was created there. This area has a limited amount of habitat fragmentation and has been managed with prescribed burning and habitat restoration to support the recovery of the gopher tortoise. This area, leased in large part from the DeSoto National Forest and located in Forrest, George, and Perry counties, Mississippi, is believed to have the largest population of black pine snakes in the species' range (Lee 2009a, p.2).

Very little information on breeding and egg-laying is available from the wild. Lyman *et al.* (2007, p. 40-42) described the time frame of the last two weeks of May through the first two weeks of June as the period when black pines snakes breed on Camp Shelby, and stated that mating activities generally take place in or at the entrance to armadillo burrows. Based on dates when hatchling black pine snakes have been captured, the potential nesting and egg deposition period of gravid females extends from the last week in June to the last week of August (Lyman *et al.* 2009, p. 42). In 2009, a natural nest with a clutch of 6 recently hatched black pine snake eggs was found at Camp Shelby (Lyman *et al.* 2009, p. 42). Captive breeding has been successfully induced by providing three to four months of cooling at 10° to 13° Celsius (C) (50° to 55° Fahrenheit (F)) in conjunction with a reduction in daylight hours (Vandevert and Young 1989, p. 34). Courtship in captive black pine snakes was observed from mid-May and continued into the first week of June. Clutches of 7 to 11 large eggs were laid about 50 days after breeding and hatched after 60 days of incubation at 29° C (84° F) (Vandevert and Young 1989, p. 35). Hatchlings averaged 46 cm (18 in) at birth (Vandevert and Young 1989, p. 35).

Longevity of wild black pine snakes is unknown. The longevity record for a captive male black pine snake is 14 years, 2 months (Slavens and Slavens 1999, p. 1). Recapture and growth data from black pine snakes on Camp Shelby indicate that they do not reach sexual maturity until their fourth or possibly fifth year (Yager, *et al.* 2006, p. 34).

Raccoons and red-tailed hawks have been documented as predators of black pine snakes on Camp Shelby (Yager, *et al.* 2006, p. 34). The species' defensive posture when disturbed is particularly interesting. When threatened, it throws itself into a coil, vibrates its tail rapidly, strikes repeatedly, and utters a series of loud hisses (Ernest and Barbour 1989, p. 102). Generally this display is a bluff, but some individuals will bite (Ernst and Barbour 1989, p. 102).

Historical Range/Distribution

There are historical records for the black pine snake from one parish in Louisiana (Washington Parish), 14 counties in Mississippi (Forrest, George, Greene, Harrison, Jackson, Jones, Lamar, Lauderdale, Marion, Pearl River, Perry, Stone, Walthall, and Wayne counties) and 3 counties in Alabama west of the Mobile River Delta (Clarke, Mobile, and Washington counties).

Current Range/Distribution

In a status survey, Duran (1998b, p. 9) concluded that black pine snakes have been extirpated from Louisiana and from two counties (Lauderdale and Walthall) in Mississippi. They have not been reported west of the Pearl River in either Mississippi or Louisiana in over 30 years (Duran 1998b, p. 9). There are no recent (post-1979) records for two additional Mississippi counties (Lamar and Pearl River) where they once occurred. Surveys indicated that black pine snakes remain in 3 out of 3 counties in Alabama (Clarke, Mobile, and Washington) and 10 out of 14 counties in Mississippi (Forrest, George, Greene, Harrison, Jackson, Jones, Marion, Perry, Stone, and Wayne). However, the distribution of populations within these counties has become highly restricted due to the fragmentation of the remaining longleaf pine habitat. In seven of the ten occupied Mississippi counties, populations of black pine snakes are concentrated on the DeSoto National Forest. Black pine snake populations outside of the DeSoto National Forest in Mississippi, and in Alabama, appear to be small and isolated on islands of suitable longleaf pine habitat (Duran 1998b, p. 17; Barbour 2009, p. 6-13).

Population Estimates/Status

Duran and Givens (2001, pp. 1-35) reported the results of a habitat assessment of all known black pine snake records. Habitat suitability of the sites was based on how the habitat compared to that selected by black pine snakes in a previously completed telemetry study (Duran 1998a, pp. 1-44). A probability of occurrence rating was derived for each locality using a combination of the habitat suitability rating and data on how recently and/or frequently black pine snakes had been recorded at the site. Of the 157 known records, it was determined that black pine snakes probably no longer occurred at 53 sites (34% of total). Comparing individual records gives equal weight to the many occurrences that have been recently recorded in areas of pine snake abundance, to the sparse records from areas where pine snakes have been extirpated. This greatly underestimates population losses. Removing the more recent records from 1990 to the present eliminates significant bias because during this period a concerted effort was made to locate black pine snakes, especially in areas of quality habitat. Subtracting these records would leave a total of 83 sites, which could be considered

“historical” records. Of these, black pine snakes probably no longer occur at 42 (51% of historical records).

The black pine snake is a difficult species to locate even in areas where it is known to occur. As a result, the following estimate of the number of current populations should probably be considered a minimum. The process used to generate the population estimate began by using data from Duran and Givens (2001, pp. 1-35), Hart (2002, pp. 16-23), D. Baxley, University of Southern Mississippi (*in litt.* 2006) and B. Porter, U.S. Fish and Wildlife Service (*in litt.* 2005) to generate data points representing known/assumed black pine snake localities. These points were mapped and buffered with a 3.2-kilometer (2-mile) radius to form an area estimated to be the minimum necessary to support a viable population (3,238 ha (8,000 ac)). The buffer radius distance was chosen based on movement and home range data provided by black pine snake researchers. Polygons were then drawn around the buffered points. If buffered points overlapped, touched, or were in immediate proximity to each other, they were included in the same polygon. The number of polygons was used as an estimate of the number of black pine snake populations. Following this procedure, it can be estimated that there are 16 extant populations of black pine snakes. Nine of these populations occur in Alabama and seven occur in Mississippi. Land ownership and acreage of occupied areas for these populations are given on page 2 under Land Ownership.

The estimated number of populations may give a misleading impression. The majority of the known black pine snake records, and most of the best remaining habitat, occur within one of the Mississippi populations occupying approximately 132,596 ha (327,639 ac) of Federal land in the DeSoto National Forest. This one population represents 55% of the total acreage estimated to be occupied by all sixteen populations of the black pine snake and is the location where there is the highest likelihood for long-term survival of the species. Furthermore, all black pine snake populations located on the DeSoto National Forest represent 79% of the total acreage estimated to be occupied by all sixteen populations. The Fred T. Stimpson State Game Sanctuary in Clarke County, Alabama totals 2,024 ha (5,000 ac) and represents the best opportunity for long-term survival of the black pine snake in the state of Alabama. Three gopher tortoise mitigation banks are being operated in Mobile County, Alabama. Although these sites are currently small (less than 404ha (1,000 ac) each), in terms of the area assumed to be required to support a viable black pine snake population, they probably represent the best chance for long-term survival of the black pine snake in Mobile County. Estimates of individuals per population are not available as records are opportunistic visual observations.

THREATS:

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

The historical distribution of the black pine snake is highly correlated with the historical range of the longleaf pine ecosystem in extreme southeastern Louisiana, southern Mississippi, and extreme Southwestern Alabama (Duran 1998b, p. 6). Today, the remaining longleaf pine forest in the southeast has been reduced to less than 5 percent of its original extent (Frost 1993, p. 17; Outcalt and Sheffield 1996, p. 1). In the range of the black pine snake, longleaf pine is now largely confined to isolated patches on private land, a state game sanctuary in Alabama, and the DeSoto National Forest in Mississippi. Black pine snake habitat has been eliminated through land use conversions, primarily conversion to agriculture and pine plantations and development of urban areas. Most of the

remaining patches of longleaf pine on private land are fragmented, degraded, second-growth forests.

Conversion of longleaf pine forest to pine plantation often reduces the quality and suitability of a site for black pine snakes. Duran (1998a, p. 31) found that black pine snakes prefer open canopies, reduced mid-stories, and dense herbaceous understories. He also found that these snakes are frequently underground in rotting pine stumps. Pine plantations typically have closed canopies and thick mid-stories with limited herbaceous understories. Site preparation for planting of pine plantations frequently involves clearing of downed logs and stumps used as underground refugia by black pine snakes. When a site is converted to agriculture, all vegetation is cleared and underground refugia are destroyed during soil disking and compaction.

Baxley (2007, p. 64) compared habitat at recent (post-1987) and historical (pre-1987) black pine snake localities. She found that sites recently occupied by black pine snakes were characterized by significantly less canopy cover, lower basal area, less midstory cover, greater percentages of grass, bare soil, and forbs in the groundcover, less shrubs and litter in the groundcover and a more recent burn history than currently unoccupied, but historical sites. Forest management strategies such as fire suppression (see Factor E), increased stocking densities, bedding, and removal of downed trees and stumps, all contribute to degradation of habitat attributes preferred by black pine snakes. It is possible that the presence and distribution of decaying stump holes and their associated rotting root channels may be a feature that limits the abundance of black pine snakes within their range (Baxley 2007, p. 44).

Fragmentation and degradation of longleaf pine habitat is continuing. The coastal counties of southern Mississippi and Mobile County, Alabama, are being developed at a rapid rate due to increases in the human population. Urbanization appears to have reduced historical black pine snake populations in Mobile County by approximately 50 percent (Duran 1998b, p. 17). Much of this reduction has occurred in the last 15 to 20 years. For example, Jennings and Fritts (1983, p. 8) reported that, in the 1980s, the black pine snake was one of the most frequently encountered snakes on the Environmental Studies Center (Center) in Mobile County. Urban development has now engulfed lands adjacent to the Center and black pine snakes have not been seen on the property in the last 16 years (Myers, pers. comm. in Duran 1998b, p. 10). Black pine snakes were occasionally seen in the 1970s on the campus of the University of South Alabama in western Mobile (Duran 1998b, p. 10). They have not been observed there in over a decade (Nelson, pers. comm. in Duran 1998b, p. 10). Habitat fragmentation is increasing in privately owned areas of longleaf pine habitat in southern Mississippi as residential development has moved away from coastal areas after Hurricane Katrina. Evidence of continued fragmentation, coupled with the assumption that large home range size increases extinction vulnerability, emphasizes the importance of conserving and managing large tracts of habitat to protect the black pine snake (Baxley 2007, p. 65).

In summary, the loss of habitat was a significant historical threat and remains a current threat to the black pine snake. The historic loss of longleaf pine upland habitat occupied by black pine snakes occurred primarily due to timber harvest and subsequent conversion of black pine sites to agriculture, residential development, and intensively managed pine plantations. This historic loss of habitat is presently compounded by current losses in habitat due to fire suppression (See Factor E), incompatible forestry practices, and urbanization. Therefore, we consider this threat to be of high

magnitude and imminent.

Based on our evaluation of on-going fragmentation and degradation of black pine snake habitat, we conclude that there is sufficient information to develop a proposed listing rule for this subspecies due to the present and threatened destruction, modification, or curtailment of its habitat and range.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

Although there is some indication that collecting for the pet trade may be a problem (Duran 1998b, p. 15), direct take of black pine snakes for recreational, scientific, or educational purposes is not currently considered to be a threat. Consequently, we have determined that overutilization for commercial, recreational, scientific, or educational purposes is not a threat to the black pine snake at this time.

C. Disease or predation.

Disease is not presently considered to be a threat to the black pine snake.

Red imported fire ants (*Solenopsis invicta*) have been implicated in trap mortalities of black pine snakes during field studies (Baxley 2007, p. 17). They are also potential predators of black pine snake eggs, especially in disturbed areas (Todd *et al.* 2008, p. 544). The severity and magnitude, as well as the long-term effect of fire ants on black pine snake populations, are currently unknown.

Raccoons have been documented as predators of black pine snakes on Camp Shelby, Mississippi (Yager, *et al.* 2006, p. 34). Lyman *et al.* (2007, p. 40) reported an attack on a black pine snake by a stray domestic dog (*Canis familiaris*) which resulted in the snake's death. Numbers of raccoons and stray dogs often increase with human development of natural areas. The severity and magnitude of predation by these two species is unknown.

In summary, disease is not considered to be a threat to the black pine snake at this time. However, predation by fire ants, raccoons, and stray dogs may represent a threat to the black pine snake that is exacerbated by the threats described in Factor A and Factor E. Therefore, we consider predation to be a non-imminent threat of moderate magnitude.

D. The inadequacy of existing regulatory mechanisms.

In Mississippi, the black pine snake is classified as endangered by the Mississippi Department of Wildlife, Fisheries and Parks (Mississippi Museum of Natural Science 2001, p. 1). In Alabama, it is protected as a non-game animal. Both Mississippi and Alabama regulations restrict collecting of the species. However, they do nothing to alleviate the loss of habitat that has caused the decline of this snake.

The best remaining habitat for the black pine snake is on the DeSoto National Forest in Mississippi. Forestry management that protects gopher tortoises and red-cockaded woodpeckers or re-establishes longleaf pine on the Desoto National Forest, is of benefit to the snakes. Nevertheless, the DeSoto National Forest has no management program in place specific to the black pine snake. There are no restrictions on activities such as stump removal, which may have been detrimental to black pine

snakes in the past (Duran 1998b, p. 14).

In summary, existing regulatory mechanisms provide little protection for the black pine snake. We consider the threat of inadequacy of existing regulatory mechanisms to be an imminent threat of moderate magnitude.

E. Other natural or manmade factors affecting its continued existence.

Fire is needed to maintain the longleaf pine ecosystem. Fire suppression has been considered the primary reason for the degradation of the remaining longleaf pine forest. It is a contributing factor in reducing the quality and quantity of available habitat for the black pine snake. Reduced fire frequencies and reductions in average area burned per fire event (strategies often used in management of pine plantations) produce sites with thick mid-stories. These areas are avoided by black pine snakes (Duran 1998a, p. 32). During a recent study using radio-telemetry to track black pine snakes, a prescribed burn bisected the home range of one of the study animals. The snake spent significantly more time in the recently burned area than in the area that had not been burned in several years (Smith, University of Southern Mississippi, *in litt.* 2005).

Habitat fragmentation within the longleaf pine ecosystem threatens the continued existence of all the black pine snake populations on private lands. This is frequently the result of urban development, conversion of longleaf pine sites to pine plantations, and the associated increases in number of roads. When patches of available habitat become separated beyond the dispersal range of a species, populations are more sensitive to genetic, demographic, and environmental variability and extinction becomes possible. This is likely the cause for the extirpation of the black pine snake in Louisiana and the loss of populations in two (and possibly a total of four) counties in Mississippi (Duran and Givens 2001, pp. 22-26).

In addition, roads surrounding and traversing the remaining habitat pose a threat to the black pine snake. Lalo (1987, p. 50-52) estimated that one million individual vertebrates are killed per day on roads in the United States. Black pine snakes frequent the sandy hilltops and ridges where roads are most frequently sited. Even on public lands, roads are a threat. During Duran's (1998a pp. 6, 34) study on Camp Shelby, Mississippi, 17 percent of the black pine snakes with transmitters were killed while attempting to cross a road. In a study currently being conducted on Camp Shelby, 32 percent of all black pine snakes found crossing roads were eventually found dead on the road (Lee 2009b, p. 646). These individuals represented 12 percent of all pine snakes found during the study. In addition, the majority of road crossings (56%) occurred during the breeding period and only half of these animals were found alive. In the study conducted by Baxley and Qualls (2006, pp. 11-12) on DeSoto National Forest, 25 percent of the snakes monitored with radio-transmitters were found dead on paved roads. This is an especially important issue on these public lands because the best remaining black pine snake populations are concentrated there. It suggests that population declines may be due in part to adult mortality in excess of annual recruitment (Baxley and Qualls 2009, p. 290).

Stochastic events may also play a part in the decline of the black pine snake. On-going drought is a current concern in southern Mississippi. Two black pine snakes were found dead on the DeSoto National Forest during drought conditions of mid-summer and may have succumbed due to drought-

related stress (Baxley 2007, p.41).

In many parts of Louisiana, Mississippi, and Alabama, there is a lack of understanding of the importance of snakes to a healthy ecosystem. Snakes are often killed intentionally when they are observed. During his study, Duran (1998a, p. 34) found a dead black pine snake that had been shot. In another instance, the tracks of a 4-wheel drive vehicle could be seen swerving to the wrong side of the road and into a ditch where a dead black pine snake was found. Lyman *et al.* (2008, p. 34) described finding another dead black pine snake that was intentionally run over as evidenced by vehicle tracks that went off the road to run over the snake. In addition, an individual's footprints were observed going from the vicinity of truck tracks to the snake's head with evidence that the individual had stomped on it. As development pressures increase on the remaining black pine snake's habitat, especially in Mobile County, Alabama, human/snake interactions will increase and frequently result in the death of the snake.

Duran (1998b, p. 15) suggested that reproductive rates of wild black pine snakes may be low. Thus, the loss of mature adults, through road mortality or direct killing, increases in significance. As existing occupied habitat becomes reduced in quantity and quality, low reproductive rates threaten population viability.

In summary, a variety of natural or manmade factors currently threaten the black pine snake, therefore we consider all these threats to be imminent. Fire suppression has been considered the primary reason for degradation of the longleaf pine ecosystem and we consider this threat to be of high magnitude. Isolation of populations beyond the dispersal range of the species is a serious threat due to the fragmentation of available habitat and we consider this threat to be of high magnitude. The high percentage of monitored black pine snakes killed while trying to cross roads supports our conclusion that this threat is of high magnitude. Stochastic threats such as drought have the potential to threaten black pine snake populations. We consider this threat to be of moderate magnitude. Human attitudes towards snakes represent another source of mortality in black pine snakes and we consider this threat to be of moderate magnitude. The low reproductive rate of black pine snakes threatens population viability. We consider this threat to be of moderate magnitude. In addition, the threats under Factor E may act in combination with threats listed above under Factors A through D and increase their severity.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED:

A rangewide Candidate Conservation Agreement with Assurances for the black pine snake, part of a Programmatic Safe Harbor Agreement for gopher tortoise and red-cockaded woodpecker, will be completed by the end of fiscal year 2010 (Ginger *et al.* 2010, pp. 1-52). The conservation goals of this Agreement are to protect, enhance, and expand habitat availability on private lands and allow for subsequent natural population expansion or, if feasible, reintroduction of the species. Participation under this Agreement is entirely voluntary.

The Mississippi Army National Guard (MANG) has submitted a draft Candidate Conservation Agreement for the black pine snake to the Mississippi Field Office for our review (MANG 2009, pp. 1-17). The purpose of this voluntary agreement is to implement proactive conservation and

management measures of the black pine snake and its habitat throughout the DeSoto National Forest, which includes the Camp Shelby Joint Forces Training Center. The goal of the final agreement will be to significantly reduce the threats upon the black pine snake to such a degree that listing under the Act will not be necessary.

SUMMARY OF THREATS:

Habitat loss, fragmentation, and degradation continue to represent the biggest threats to the black pine snake. Associated threats include fire suppression, removal of pine stumps during timber operations, urban development, increases in the number and width of roads, and intentional killing of snakes. Low reproductive rates increase the significance of each of these threats to long-term population viability. 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.

RECOMMENDED CONSERVATION MEASURES:

- 1 Conduct prescribed burns of black pine snake habitat and increase the frequency of these burns during the growing season
- 2 Reduce soil disturbance and leave stump holes and their associated root structure during forestry operations
- 3 Avoid the construction of new roads in occupied black pine snake habitat

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3*
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: Most of the longleaf pine habitat of the black pine snake has been destroyed. The longleaf pine ecosystem occupies less than 5 percent of its original range. The habitat that remains has been degraded. Currently occupied habitat continues to be degraded due to fire suppression, incompatible forestry practices, and urbanization. Due to the loss of most of the black pine snake's historical habitat, and on-going threats to that which remains, threats to the species are of a high magnitude.

Imminence: Habitat loss (see contributing factors listed above) is continuing at a slow and gradual rate. Data from the 1980s and 1990s show that 28 percent (3.3 million acres) of new pine plantations came from forest that was previously natural pine. Additional losses of natural pines to pine plantations are forecast as well as losses to urban uses. Although habitat in private ownership is being lost at a faster rate than that in public ownership, even on public lands the fire frequency has not been sufficient to prevent hardwood encroachment and habitat loss. Due to the ongoing nature of this habitat loss, the threats to the species are imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Although the threat to the black pine snake is high because of habitat loss, this species is not in immediate danger of becoming extinct.

DESCRIPTION OF MONITORING:

Since the last update of this assessment form, species experts and appropriate individuals with State and Federal agencies have been contacted concerning the black pine snake and asked to provide any new relevant literature and/or data. These individuals, their affiliation, and date of contact are as follows: Jim Lee, The Nature Conservancy, March 12, 2010; Danna Baxley, Kentucky Department of Fish and Wildlife Resources, March 12, 2010; Carl Qualls, University of Southern Mississippi, March 12, 2010; Mark Sasser, Alabama Department of Conservation and Natural Resources (ADCNR), March 12, 2010; Ashley Peters, ADCNR, Natural Heritage Program, March 12, 2010; Tom Mann, Mississippi Department of Wildlife, Fisheries, and Parks, Natural Heritage Program (MMNS/Heritage), March 12, 2010; Matt Smith, MMNS/Heritage, March 12, 2010; Jeanne Jones and Clint Smith, Mississippi State University, March 12, 2010; Beau Gregory and Keri Landry, Louisiana Department of Wildlife and Fisheries, Natural Heritage Program, March 12, 2010; Dan Everson, Bruce Porter, and Sergio Pierluissi, U.S. Fish and Wildlife Service, Daphne, Alabama Field Office, March 12, 2010; Jodie Smithem, U.S. Fish and Wildlife Service, Daphne, Alabama Field Office, March 30, 2010; Deborah Fuller, U.S. Fish and Wildlife Service, Louisiana Field Office, March 12, 2010; Mark Bailey, Conservation Southeast, Inc., March 12, 2010; Mike Barbour and Jim Godwin, Alabama Natural Heritage Program, March 12, 2010. New records for the species have been added to the locality database from observations shared by these agencies and researchers. A study initiated in 2004 by The Nature Conservancy on Camp Shelby, Mississippi, is continuing and is

providing information on black pine snake daily and seasonal activity patterns in some of the species' best remaining habitat. Data on habitat use will be used to provide guidance for management to benefit the black pine snake on DeSoto National Forest/Camp Shelby and for the finalization of the draft Candidate Conservation Agreement for the black pine snake. A survey for the black pine snake at selected localities in Alabama was completed in 2009 and resulted in the observation of four black pine snakes in Mobile County. Several new peer-reviewed publications on black pine snakes have resulted from recent research and have been cited within this update. A new research project has been initiated through Mississippi State University which will evaluate habitat quality of sites known to support black pine snake populations, monitor occurrence of snakes on several sites known to be occupied by the species, and determine presence/absence on several sites with potential to support black pine snake populations (Smith 2010, pp. 1-10).

COORDINATION WITH STATES:

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: Alabama, Louisiana, and Mississippi
The black pine snake is included in Alabama's Comprehensive Wildlife Conservation Strategy on a list entitled "Species of Greatest Conservation Need" and has been given a Priority Rank of "P2" which indicates taxa of high conservation concern for which timely research and/or conservation action is needed. Mississippi's Comprehensive Wildlife Conservation Strategy includes this species on a list entitled "Species of Greatest Conservation Need" and has been given a Priority Rank of "P2" which indicates taxa of high conservation concern for which timely research and/or conservation action is needed. The Louisiana Comprehensive Wildlife Conservation Strategy includes the black pine snake on the list entitled "Species of Conservation Concern in Louisiana".

Indicate which State(s) did not provide any information or comments: N/A

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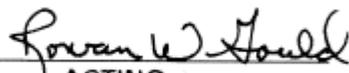
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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional 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:  _____
for Regional Director, Fish and Wildlife Service Date

Concur: 
ACTING
Director, Fish and Wildlife Service Date: October 22, 2010

Do not concur: _____
Director, Fish and Wildlife Service Date

Director's Remarks:

Date of annual review: March 2010

Conducted by: Linda LaClaire, Mississippi Field Office