Sand Skink

Neoseps reynoldsi

Threatened (November 6, 1987) **Federal Status: Critical Habitat:** None Designated Florida Status: **Threatened Recovery Plan Status:** Revised (May 18, 1999) Geographic Coverage: **Endangered**

Figure 1. County distribution of the sand skink.



he sand skink is a small, fossorial lizard that occurs on the sandy ridges of interior central Florida from Marion County south to Highlands County. The sand skink is highly adapted for life in the sand; it spends the majority of time below the surface "swimming" in loose sand in search of food, shelter, and mates. The species is vulnerable because of habitat loss due to agricultural and residential uses and from habitat degradation due to fire exclusion. Efforts to protect the sand skink and other xeric upland species are underway and include the acquisition, protection, and management of a number of xeric upland sites. Recovery of the sand skink will require management of conservation lands, restoration of habitat and possible reintroduction of individuals into successfully-rehabilitated habitat.

This account represents a revision to the existing recovery plan for the sand skink (FWS 1993).

Description

The sand skink (Neoseps reynoldsi) reaches about 13 cm, about half of which is tail. It is slender, shiny and usually gray to grayish-white, although it may occasionally be light tan. Hatchlings have a wide black band extending from the tip of the tail to the snout along each side. This band is reduced in adults and may only occur from the eye to snout on some individuals (Telford 1959). The sand skink's legs are vestigial and practically nonfunctional. Other adaptations to a fossorial existence include greatly reduced eyes, lack of external ear openings, a wedge-shaped snout, and a countersunk lower jaw.

Taxonomy

The monotypic genus *Neoseps* was established by Stejneger (1910) in describing the uniquely fossorial sand skink of the central Florida sand ridges.

Distribution

The sand skink is endemic to the sandy ridges of central Florida, occurring in Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam counties (Figure 1) (Christman 1988). Principal populations occur on the Lake Wales and Winter Haven Ridges in Highlands, Lake, and Polk counties (Christman 1992; Mushinsky and McCoy 1995; P. Moler, GFC, personal communication 1998). The sand skink is uncommon on the Mount Dora Ridge, including sites within the Ocala NF (Christman 1970, 1992). As of 1997, there were 114 locality records for the sand skink, most of which are found within the Lake Wales Ridge.

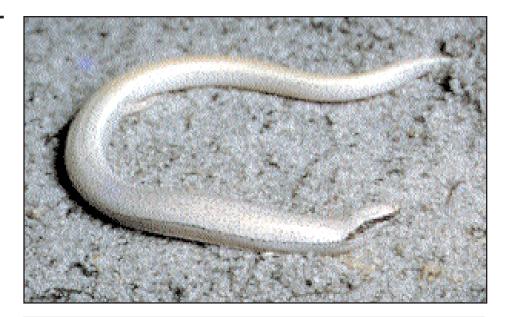
Habitat

The sand skink is widespread in xeric uplands with sandy substrates, but appears to be most abundant in ecotonal areas, typically between high pine and scrub (Telford 1996). It is also found in rosemary (*Ceratiola ericoides*) scrub, turkey oak barrens or sandy areas of the high pine community (Campbell and Christman 1982). Areas free of abundant plant roots, with open canopies, scattered shrubby vegetation, and patches of bare sand are optimal habitats (Christman 1978, 1992). However, recent surveys have located sand skinks in areas with dense undergrowth and extensive canopy closure (H. Mushinsky, University of South Florida, personal communication 1996), indicating that extensive loose, root free soils may not be a requisite for this species. Suitable habitat must also provide soil moisture conditions that provide for thermoregulation and egg incubation, as well as create conditions favorable for the skink's prey (Telford 1959).

The density of the sand skink varies considerably, ranging from about 5 to 23 individuals per 0.025 ha (Sutton 1996). Differences in abundance are attributed to habitat suitability. The sand skink is typically found 5 to 10 cm below the surface, where it burrows or "swims" (Carr 1940) through the sand to obtain its prey. Seasonally, sand skinks are most active from mid-February through mid-May and again in late summer-early fall. Activity patterns suggest sand skinks are active during the morning and evening, patterns typically associated with thermoregulatory behaviors (Andrews 1994).

Campbell and Christman (1982) had earlier characterized *Neoseps* as "colonizers of a patchy, early successional, or disturbed habitat type which occurs throughout the sandhill, scrub, and xeric hammock vegetative associations as a result of biological (*Gopherus*, *e.g.*) or catastrophic (fire) factors." Susceptibility of mature sand pine to windthrow may be an important factor in maintaining bare, sandy microhabitats required by sand skinks and other scrub endemics (Myers 1991). *Neoseps* has persisted in old growth stands of scrub (greater than 60 years old) on Archbold Biological Station in the vicinity of firelanes, suggesting that artificial clearings may be important to *N. reynoldsi*.

Sand skink. Original photograph by Sam Telford.



Behavior

Reproduction

Telford (1959) found sand skinks to be most active from early March through early May, whereas Sutton (1996) found skinks to be most active from mid-February to late April. These high-activity periods correspond to movements associated with breeding season activities. After high-activity periods, females are difficult to collect, apparently due to nesting activity. Approximately 55 days after mating, about two eggs are laid in the sand, under logs or debris, in early summer (Telford 1959). The eggs hatch from June through July. No information is available on the dispersal of this species or its territory size.

Sand skinks reach sexual maturity at 1 to 2 years (Telford 1959, Sutton 1996) and may remain reproductively active for 2 to 3 years (Sutton 1996).

Feeding

Sand skinks feed on a variety of hard and soft-bodied arthropods that occur below the ground surface. Diel patterns of activity suggest sand skinks are active during the day, and probably feed primarily during the morning and late afternoon when their preferred body temperatures are achieved (Sutton 1996). Most of their diet consists of beetle larvae and termites (*Prorhinotermes* spp.). Spiders, larval ant lions, lepidopteran larvae, roaches and adult beetles are also eaten (Myers and Telford 1965, Smith 1977).

Relationship to Other Species

Mushinsky and McCoy (1991) contrasted vertebrate species distribution in three size classes of "relatively-open canopied" and "relatively-closed canopied" scrub on the Lake Wales Ridge. Mushinsky and McCoy (1991) reported a negative correlation between the rank abundance of Florida scrub jays (*Aphelocoma c. coerulescens*) and abundance of sand skinks. It is unclear whether this relationship

is due to ecological interactions between species or differences in xeric habitat that favor one species over another. Though we know of no specific records of scrub jays preying on sand skinks, it is likely that they take them opportunistically. It has also been suggested that management of scrub habitat often focuses on maintaining habitat for the threatened scrub jay, which may not be compatible with the habitat requirements of the sand skink. The relationship between presence of scrub jays, oak canopy closure, and the sand skink requires further investigation.

In many locations, sand skinks are sympatric with the peninsula mole skink (*Eumeces egregius onocrepis*), blue-tailed mole skink (*E. e. lividus*), Florida scrub lizard (*Sceloporus woodi*), and the Florida crowned snake (*Tantilla relicta*), but these species apparently do not compete because of resource partitioning (Smith 1977, 1982; Campbell and Christman 1982).

Status and Trends

The modification and destruction of xeric upland communities in central Florida was a primary consideration in listing the sand skink as threatened under the ESA in 1987 (52 FR 42662). By some estimates, as much as 90 percent of the scrub ecosystem has already been lost to residential development and conversion to agriculture, primarily citrus groves (Florida Department of Natural Resources 1991, Kautz 1993). Xeric uplands remaining on private lands are especially vulnerable to destruction because of increasing residential and agricultural pressures.

Except for a few locations where intensive research has been conducted, we have very little information about the presence or abundance of *N. reynoldsi*, not to mention the status and trends of this species in South Florida. The species' diminutive size and secretive habits make its study difficult. For example, the status and trends of sand skinks on Ocala NF remains uncertain, despite fairly intense research efforts. A 1992 survey was conducted to provide information on the distribution of sand skinks in the Ocala NF in relation to forest management practices (clear-cutting, burning, bracke and broadcast seeding). No sand skinks were captured during 18,578 trap nights from stands close to historical locality records for *Neoseps*, although a number of other fossorial reptiles were recovered. Telford (1992) cited the ephemeral nature of early successional scrub habitats due to dynamic successional changes as an important confounding factor in the evaluation of the sand skink's present status in the Ocala NF.

More recent studies have provided new information about the distribution of *N. reynoldsi*, but little information is currently available to assess the species' status or trends. Mushinsky and McCoy (1991) captured *N. reynoldsi* during their evaluation of vertebrate use of xeric uplands of central Florida. However, their study only provided presence/absence information. Similarly, Stout and Corey (1995) reported the presence of *N. reynoldsi* at several locations during their evaluation of the ecological implications of the fragmentation of xeric upland communities. The first estimates of absolute densities of *N. reynoldsi* in various habitat types and basic life history information were provided by Sutton (1996). Unfortunately, no long-term monitoring efforts have been undertaken to evaluate the status or trends of *N. reynoldsi* at these or other sites.

At the time of Federal listing in 1987, Florida Natural Areas Inventory had recorded 31 known sites for the sand skink. By 1997, 114 localities were known. This increase is largely the result of more intensive sampling of scrub habitats in recent years and does not imply that this species is more widespread than originally thought. On the contrary, we believe that continued residential and agricultural development of xeric upland habitat in central Florida has destroyed or degraded habitat containing *N. reynoldsi*. Estimates of habitat loss range from about 60 to 90 percent for xeric upland communities (Christman 1988, Christman and Judd 1990, Kautz 1993, Center for Plant Conservation 1995).

Management

Protection of the sand skink from further habitat loss and degradation is the most important means of ensuring its continued existence. It is not certain whether existing protected areas are adequate for its survival because many life history and population characteristics relevant to long-term survival are unknown (FWS 1993). Existing protection of occupied skink habitat consists primarily of private preserves such as Archbold Biological Station, Hendry Ranch, Tiger Creek Preserve, and Saddle Blanket Lakes Scrub Preserve, coupled with publicly owned lands such as Lake Arbuckle SP and SF, Lake Louisa SP, and Highlands Hammock SP (FWS 1993). Current efforts to expand the system of protected xeric upland communities on the Lake Wales Ridge, coupled with implementation of effective land management practices, represent the most likely opportunity for securing the future of this species. Recovery of the sand skink may require rehabilitation of suitable but unoccupied habitat or restoration of potentially suitable habitat. Because sand skinks do not readily disperse, introductions into restored or created unoccupied habitat may be necessary.

Effective management will be required to maintain or restore the wide diversity of xeric upland communities found in the protected sites described above. Just as natural xeric uplands contained a mosaic of open and vegetated patches that varied in time and space, we believe good land management practices can create and maintain similar habitat conditions for *N. reynoldsi* and other xeric upland-dependent-species.

Fire has been used and is the preferred tool for managing xeric communities, such as those containing sand skink habitat. The natural patchiness created by fire in xeric vegetative communities creates and restores suitable sand skink habitat. Partitioning of protected sites into numerous small burn units also ensures habitat heterogeneity. The response of sand skinks to fire is currently being evaluated (H. Mushinsky, University of South Florida, personal communication 1996).

Mechanical disturbances have been used successfully in some locations to manage xeric vegetation, especially where the use of fire is not practical. However, these techniques may be harmful to *N. reynoldsi* and other non-vagile species. The tires of tree cutters and bushhogs and the barrels of rollerchoppers may crush individuals and compress the substrate, which may create a barrier and destroy habitat. The FWS has currently funded research to evaluate the effects, if any, of mechanical treatments on plants and reptiles inhabiting xeric uplands

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Recovery for the Sand Skink

Neoseps reynoldsi

Recovery Objective: Delist.

Recovery Criteria

In order to delist this species, efforts must continue towards the immediate protection of remaining xeric upland communities where the sand skink occurs. We must ensure that existing protected habitat, in combination with xeric uplands proposed for protection through acquisition, is adequate for recovery. The sand skink can be delisted when: risk assessment and population viability analyses demonstrate that a sufficient number of geographically distinct sand skink populations are protected to ensure a 95 percent probability of persistence of the species over the next 100 years; and when research and monitoring of the biology and ecology of this species determine the population is stable or increasing over no less than 6 years.

Species-level Recovery Actions

- S1. Determine the status and distribution of sand skinks. Archbold Biological Station maintains a geographic information system (GIS) to compile species distribution information. Scrub habitat that may support populations of sand skinks that has not yet been surveyed or needs to be re-surveyed should be targeted for subsequent efforts and tracts where the status of skinks is uncertain should be identified.
 - S1.1. Compile distribution data for sand skinks from all available sources. Existing data sources should be combined and synthesized using GIS overlays. Habitat occupied by sand skinks, suitable but unoccupied habitat, and unsurveyed but suitable habitat should be identified. Maintaining and updating a current GIS database on the distribution and status of skinks is essential for long-term monitoring needs and for developing habitat management strategies.
 - S1.2. Conduct distribution surveys to determine additional sites in need of protection. If additional surveys locate occupied habitat that is determined to be essential for the survival of sand skinks, efforts should be made to incorporate these areas into scrub protection initiatives. The development of site-specific management plans for habitat purchased in the Lake Wales Ridge NWR and the Lake Wales Ridge Ecosystem Project should include provisions for baseline and long-term monitoring efforts for sand skinks. Additional areas that may support skink populations should be surveyed, and if occupied and essential to the survival of the species, should be considered for protection under existing or new habitat acquisition programs.
- **S2.** Protect and enhance existing populations. If the proposed Federal and State purchase of

scrub and associated xeric communities is achieved, the resulting network of publicly and privately owned and protected scrub will encompass about 16,200 ha on the Lake Wales Ridge. This mosaic of varying size scrub patches should prove adequate to protect this species indefinitely provided that the communities are protected and that suitable management practices favorable to skinks are identified and implemented. Site-specific management prescriptions that assure a mixture of successional stages and ecotonal areas required by skinks should be developed for tracts purchased in the Lake Wales Ridge NWR and Lake Wales Ridge Ecosystem Project initiatives.

- S2.1. Conduct section 7 consultations on Federal activities that may affect sand skinks. Section 7 of the Endangered Species Act requires Federal agencies to consult with the FWS to ensure appropriate consideration of impacts to listed species from all Federal actions. The sand skink needs to be considered, along with other listed species in scrub habitat, in any proposed Federal actions (authorized, funded, or carried out by Federal agencies) that might adversely affect the species and their habitats. These could include but are not limited to road and facility construction, timber management practices, land clearing and conversion, wetland dredge and fill activities, and pesticide applications involving use of Federal funds.
- S2.2. Protect skinks on public lands. Develop and implement land management techniques that maintain natural diversity. Periodic burning, cutting, mowing or other techniques are needed to maintain ecotonal areas between xeric habitats. Habitat must also be protected from off-road vehicle traffic and commercial forestry practices.
- S2.3. **Protect skinks on private lands.** Where sand skinks are known to exist on private lands, efforts should be made to contact landowners, and information on the status and habitat requirements of the species should be provided. Recommendations should be provided for managing private lands. Long-term renewable leases and conservation agreements involving Federal, State, and local government agencies are options where outright acquisition is not acceptable to the landowner.
- S2.4. Control pesticide use in or adjacent to sand skink habitat. Because pesticide use on adjacent agricultural and residential lands poses a potential risk to sand skinks, management plans should consider these risks and alleviate threats whenever possible.
- S3. Conduct research on life history and population ecology of sand skinks. Adequate longterm protection of the sand skink depends on a thorough understanding of its life history. Many aspects of the life history of this species are poorly understood or remain entirely unstudied, therefore more specific studies of the life history characteristics of the sand skink are needed to ensure that land management efforts are compatible with the habitat requirements of the sand skink.
 - S3.1. Develop standardized survey techniques. Research specific habitat requirements in relation to vegetation structure. Also, develop better survey methods to assess population levels and status of sand skinks. and their response to management prescriptions. Methods to determine home range size, age of dispersal and dispersal distance are needed to evaluate recolonization capabilities and susceptibility to local extirpation. Mark-recapture methodology and radiotelemetry may soon provide feasible approaches to the study of these small, semi-fossorial reptiles. There are

- probably suitable protected sites at present to conduct baseline studies.
- **S3.2. Support studies of reproduction, fecundity, and longevity.** Obtain data on mating behavior, reproductive success, productivity, longevity, and other basic population characteristics by using captive animals.
- **S4. Monitor sand skink populations.** Once standardized survey techniques are developed, begin long- term monitoring on protected public and private lands. Start monitoring efforts at Archbold Biological Station where periodic controlled burns are used to maintain scrub habitats. Initiate efforts to assess populations at other public and private scrub preserves as we learn more about the biology of this species and appropriate monitoring techniques.
- **S5. Increase public awareness of sand skinks**. Efforts to protect this, and other scrub species, benefit from public education efforts for the scrub ecosystem. Species-specific educational materials probably will not be as effective as habitat-based efforts that currently exist, because we know very little about the biology of this species.

Habitat-level Recovery Actions

- **H1. Prevent degradation of existing scrub habitat.** The key to the long-term recovery of sand skink habitat lies in the immediate protection of as much of the remaining scrub ecosystem as is economically feasible within the Lake Wales Ridge.
 - **H1.1.** Acquisition of scrub habitat. Simple fee title, conservation easements, transfer of development rights, land trades, or other conservation measures will be necessary to protect remaining scrub habitat.
 - **H1.1.1.** Continue Federal acquisition efforts. Continue acquisition efforts within the Lake Wales Ridge NWR complex. Much of the habitat targeted for acquisition will be acquired by 1998. One or possibly two additional, but currently unidentified parcels may subsequently be targeted for acquisition.
 - **H1.1.2. Support State acquisition efforts**. The Florida Conservation and Recreation Lands (CARL) program Lake Wales Ridge Ecosystem Project includes over 30 key scrub areas (Appendix F) totaling 13,145 ha. The State's Save Our Rivers (SOR) acquisition program administered by the water management districts targets wetlands for protection, but some sites also contain xeric uplands, and potentially sand skink habitat, that also benefit from the SOR program.
 - H1.1.3. Encourage acquisition by non-government organizations. Occupied sand skink habitat not targeted in Federal and State acquisition programs may become available for private purchase and management. Scrub habitats already protected such as those at Archbold Biological Station and The Nature Conservancy's Tiger Creek Preserve, Saddle Blanket Lakes, and Lake Apthorpe areas will continue to play an important role in the long-term persistence of sand skinks.
 - **H1.2. Manage scrub habitat**. Like most vegetative communities in Florida, the scrub requires periodic fire or other sources of disturbance to maintain its diversity and distribution.
 - **H1.2.1. Develop scrub habitat management guidelines.** The Nature Conservancy

- and Archbold Biological Station have gained experience in the management of scrub communities. Information gathered by these organizations should be consolidated into a set of standardized management guidelines that could be used by other land owners wishing to effectively manage scrub.
- H1.2.2. Develop cooperative scrub management programs. Concurrently with H1.2.1., develop cooperative agreements for completing management of scrub as efficiently as possible. Public and private funding is limited and expenditures for land management can represent a large portion of operating expenses. Currently, three private organizations, one Federal and three State agencies own or are responsible for the management of scrub habitat. Large expenditures in equipment and personnel can be avoided through cooperative planning of scrub management.
- H1.2.3. Control off-road access. Fence or sign scrub habitat to eliminate off-road use. In many areas, off-road access has degraded habitat and destroyed individual rare plants. Soil stabilization, trash removal, and replanting may be necessary in some cases to effectively manage scrub.
- H2. Restore scrub to suitable habitat. Identify areas of restorable habitat and develop management plan to restore habitat. Much of the remaining scrub is degraded because fire has been excluded and the vegetation has become overgrown. Overgrown scrub can lose much of its function and value as it tend towards a more mesic condition.
 - H2.1. Control exotic species. Although exotic species are not currently a threat to most xeric communities, site-specific control measures may be needed, especially in ecotonal areas or human disturbed areas.
 - H2.2. Control overgrowth. In most situations, unmanaged scrub tends to become dense and tall, conditions which are not favorable to many scrub-dependent species. Management of overgrown scrub must include thinning, burning, mowing, or other techniques to reduce vegetative density.
- H3. Conduct research to determine habitat needs for this species. Basic life history requirements and habitat needs for this species are not known. As we learn more about the basic biology of this species, we will also gain better insight into its habitat needs. Research on sand skink habitat should be concurrent with investigations into the biology of this species.
- H4. Monitor status of sand skink habitat. Once we understand the habitat requirements for this species we will be better able to develop habitat management and monitoring recommendations. Until species-specific information is available, monitoring should ensure maintenance of ecotonal boundaries, diversity within scrub, and open sandy patches.
- H5. **Increase public awareness of the scrub ecosystem.** Efforts should highlight habitat acquisition initiatives, importance of biodiversity, and biology of scrub-dependent species. Federal, State, and county governments, as well as private organizations, should support the development and dissemination of educational materials pertaining to the conservation of the scrub ecosystem and endemic scrub species. Materials such as brochures, postcards, slide programs, and videotapes can improve public understanding of and increase appreciation for protection of scrub habitat. Environmental education programs across central Florida should be encouraged to distribute materials or develop lesson plans on scrub ecosystems, particular scrub species, and the importance of maintaining biological diversity.