Dear Colleague Interested in Gopher Tortoise Conservation,

The gopher tortoise has a tremendous impact on the ecology, economy and way of life in the Southeast. The tortoise is a federally protected species under the Endangered Species Act (ESA) in Louisiana, Mississippi and in Alabama west of the Mobile and Tombigbee Rivers. In the tortoise's eastern range – southeastern Alabama, Florida, Georgia and South Carolina – it is a candidate for listing under the ESA.

Together, we hope to preclude the need to federally list the gopher tortoise in its eastern range by taking conservation actions now and over the next several years.

To that end, the Service has developed a "roadmap" to start the conversation. The purpose of the attached "DRAFT Range-Wide Conservation Strategy for the Gopher Tortoise" is to outline the highest priority conservation efforts for the tortoise. If implemented, these efforts may reduce the current threats to the species to the point where we may preclude the need to list the eastern population under the ESA.

The draft strategy is primarily guided by existing threats to gopher tortoise survival stated in the status review for the eastern population (12-month Finding, July 2011) and western-range recovery plan. After input from you and other partners, the Service and States will jointly author the strategy. Beginning **October 2012**, the Service and States will begin greater public outreach and on-the-ground implementation of this "roadmap" with all partners.

Your participation and input is critical in shaping the strategy and how we collectively move forward. We welcome your comments, ideas, assistance and leadership in finalizing the primary objectives and actions of the conservation strategy. As you review the draft, please consider the following questions: Is this strategy an appropriate approach? Are the Objectives on target? Are there actions missing?

Towards the end of August we will be hosting several 1.5-hour webinars to provide more information and solicit comments. To sign up for one of the Webinars on August 21 (3 pm EST), August 22 (3 pm EST) or August 29 (1 pm EST) please go to https://www.fws.gov/lists/listinfo/fw4candidateconservation. You may also submit written comments via email to "fw4gophertortoise@fws.gov." Matt Hinderliter, the Service's lead biologist for the gopher tortoise, will review those comments.

In addition, we intend to bring partners together annually to measure success toward conserving the gopher tortoise, reducing the threats, and revising the strategy as necessary through adaptive management.

If you have questions or would like to discuss this approach further, please contact Leo Miranda at 404-679-7085, Elsa Haubold at 850-488-3831, or Matt Hinderliter at 601-321-1132. We look forward to talking to you and continuing to partner in gopher tortoise conservation over the coming years.

Sincerely,

Leopoldo (Leo) Miranda
Assistant Regional Director
Ecological Services
U.S. Fish and Wildlife Service, Southeast

Elsa M. Haubold, PhD
Section Leader
Species Conservation Planning Section
Florida Fish and Wildlife Conservation Commission
& Chair, SEAFWA Wildlife Diversity Subcommittee

# Range-Wide Conservation Strategy for the Gopher Tortoise (*Gopherus polyphemus*)

August 2012

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| **Common Name** | Gopher Tortoise |
| **Scientific Name** | *Gopherus polyphemus* |
| **Listing Status and Date** | **Threatened** (populations west of the Mobile & Tombigbee Rivers in AL, MS, & LA); July 7, 1987 (US Fish & Wildlife Service 1987) |
| | **Candidate** (populations east of the Mobile & Tombigbee Rivers in AL, GA, FL, & SC); July 27, 2011 (US Fish & Wildlife Service 2011) |
| **Cooperating Agencies** | U.S. Fish and Wildlife Service (Region 4) in joint partnership with the States of Alabama, Florida, Georgia, Louisiana, Mississippi, and South Carolina |

**Purpose of the Conservation Strategy:** This document lays out a preliminary course of action for the conservation of the gopher tortoise. It is meant to serve as a "roadmap" for all partners to determine the highest priority conservation efforts for the tortoise, and identify those agencies and organizations best suited to effectively undertake those efforts. It is our hope that partner implementation of this plan, with progress evaluated annually, will provide the information needed to address the threats to the species and improve its conservation status range-wide. Conservation strategies are intended for internal use by the U.S. Fish and Wildlife

Service, collaborating State agencies, and Federal partners; public participation is also encouraged. This is intended to be an adaptive document that will be revised as new information is received from the public and partners.

**Agency Contacts:**

**U.S. Fish & Wildlife Service**
Matt Hinderliter
MS Ecological Services Field Office
6578 Dogwood View Parkway
Jackson, MS 39213
(601) 321-1132
matthew_hinderliter@fws.gov

Leo Miranda
Assistant Regional Director - Ecological Services
1875 Century Boulevard
Atlanta, GA 30345
(404) 679-7085
leopoldo_miranda@fws.gov

**Alabama**

AL Dept. of Conservation & Natural Resources

**Florida**

FL Fish & Wildlife Conservation Commission

**Georgia**

GA Dept. of Natural Resources

**Louisiana**

LA Dept. of Wildlife & Fisheries

**Mississippi**

MS Dept. of Wildlife, Fisheries, & Parks

**South Carolina**

SC Dept. of Natural Resources

## OVERVIEW

The gopher tortoise is one of the most heavily studied non-game vertebrate species in the southeastern United States. This is due to a variety of factors, including: 1) its value as a keystone species; 2) the high level of detectability because of the distinctive burrows they create; and 3) its role as a major indicator/surrogate species in the Longleaf Pine ecosystem. There have been dozens of peer-reviewed manuscripts since the late 1970's which have provided details of adult tortoise home range, social interactions, habitat use, movement patterns, forage requirements, predation, nesting, translocation, and disease across the full geographic range. In the last 10 years there have been vast advances in research on genetics, population viability analyses, patch size requirements, and predictive GIS modeling. However, questions remain; specifically, what is the demography and density of tortoises that make up a viable population, how large an area of appropriately-managed habitat is necessary to maintain that population, and what distribution of viable populations across the landscape is sufficient to reflect long-term stability. Ongoing deficiencies in research are the life history traits, threats, and habitat needs of juvenile tortoises, long-term effects of invasive and exotic species, analyzing range-wide survey trends, and the status of tortoise populations on public as well as private lands. Additional information on gopher tortoise life history, range, and habitat descriptions can be found in Appendix 2.

The gopher tortoise is considered a surrogate species for the Longleaf Pine ecosystem (Fenwood 2010), which is estimated to have once covered 90 million acres in the region, but which now covers approximately 3.4 million acres (America's Longleaf 2009). Fifty-five percent of this acreage is in private ownership, 34 percent is in Federal ownership, and 11 percent is in State or local ownership (Gaines 2010). The range of the gopher tortoise is frequently associated with the Longleaf Pine ecosystem. Since there has been no range wide survey of gopher tortoises, and there are only a limited number of comprehensive surveys over relatively small geographic areas, modeling efforts have been used to identify potential habitat where tortoises may be present. Although there is some debate about the total acreage of potential habitat within the eastern range, it is generally estimated that nearly 88 percent of the potential habitat is in private ownership, and the remainder is controlled by local, State, Federal, or conservation entities (Hoctor and Beyeler 2010; FWC 2011).

### Population Estimates/Status

A wide variety of information is available on the number and density of gopher tortoises and their burrows from many areas throughout their range. These data resulted from numerous surveys/censuses using a variety of methodologies ranging from one-time censuses to repeated surveys over several decades. The diversity of data poses a challenge when trying to evaluate the status of a species from a landscape perspective. For example, in some areas we have more data, and we have higher confidence in drawing conclusions about status of tortoises in these areas. In other areas, where there is little or no data, our confidence in assessing the status of tortoises is lower. Because of disparities in the type of data collected, methodologies in collecting data, and differences in the scope of studies, it is not possible to simply combine

datasets to evaluate the status of the gopher tortoise throughout its range. Instead, we considered each individual dataset in the context of all other best available science to form general conclusions about the status of the gopher tortoise.

The gopher tortoise is more widespread and abundant in parts of the eastern portion of its range, particularly southern Georgia and central and northern Florida. Long-term monitoring data indicate that many populations have declined and most are relatively small and fragmented. Smaller-scale, short-term or one-time surveys indicate that tortoise populations typically occur in fragmented and degraded habitat, are small, and densities of individuals are low within populations; however, there are several known populations of tortoises in the eastern portion of the range that appear to be sufficiently large to persist long-term. From population modeling efforts (Miller et al. 2001; Tuberville et al. 2009), we can draw two very general conclusions: first, gopher tortoise populations are likely to decline in the future under a wide array of demographic and environmental conditions that exist today. Second, gopher tortoise populations, although declining, and in some cases functionally extinct, will persist for 100 to 200 years. The effect of these may be that tortoises will be seen for long periods of time throughout their range, not because their populations are stable or increasing, but because they are long-lived.

Tortoises are more protected in Florida than elsewhere in the eastern portion of the range, and there is more protected habitat in Florida than in the rest of the range combined. Florida also has the strongest of the State laws protecting gopher tortoises and is the only State with a management plan for the species. But Florida is also the State facing the most development pressure in the foreseeable future, and while the State's Plan may provide considerable conservation benefits to the gopher tortoise, it is too early to evaluate its overall success. The current exact number of gopher tortoise populations and amounts of suitable and occupied habitat are uncertain; population studies and surveys are incomplete. Of those completed, very few show evidence of population increases or stability – most indicate declines.

Recently, segmented regression models were developed to evaluate the relationship between area of habitat occupied by gopher tortoises and abundance of tortoises to define how many individuals constitute a population and how much area is required for such a population. Data synthesized from 21 study sites in Alabama, Georgia, and Mississippi with varying tortoise population numbers indicated that an average gopher tortoise population consists of 444 burrows, covers 755 ha (1,865 ac), and contains 240 tortoises (Styrsky et al. 2010). However, this average population contained a density of 0.3 tortoises per ha (0.1 per ac), which is below the threshold where social interactions may be reduced. Guyer (2010) determined that when density falls below 0.4 individuals per ha (0.2 per ac), social interactions decrease dramatically because it takes too much energy to search for mates; thus potentially having a negative effect on population reproductive fitness.

McCoy and Mushinsky (2007) evaluated minimum patch size for the gopher tortoise, and determined that where populations were spatially constrained (e.g., not able to disperse) tortoises were estimated to require about 247 acres, and unconstrained populations inhabited

353–618 acres. Recent modeling efforts recognized the need to evaluate the viability of individual populations, rank populations most appropriate for in-situ protection, and determine if nonviable populations are more likely to contribute to conservation through augmentation or translocation (Tuberville et al. 2009). All baseline model scenarios resulted in a population decline of one to three percent per year, which varied as a function of habitat quality and location within the range. Only modeled populations with at least 250 tortoises were able to persist for 200 years, which was the maximum duration possible in the modeling software (Tuberville et al. 2009).

## ESA LISTING FACTORS/PRIMARY THREATS TO THE SPECIES

The goal of the Endangered Species Act (ESA) is to conserve endangered or threatened species. When a species is able to survive on its own in the wild, the species is considered to be "recovered," and protection of the ESA is no longer necessary. The current status of the gopher tortoise is "Threatened" for populations west of the Mobile & Tombigbee Rivers in AL, MS, & LA, and it is a "Candidate" (for being listed) for populations east of the Mobile & Tombigbee Rivers in AL, GA, FL, & SC.

To delist (remove it from endangered or threatened status) or downlist a species (for example, remove it from candidate status), the U.S. Fish and Wildlife Service will consider similar information used to decide whether to list a species. The Service will assess populations and achievements in eliminating or reducing threats, and we seek peer-review. In assessing threats, the Service uses the "5-factor analysis" as outlined in Section 4 of the ESA.

The following is an outline of the existing threats to the gopher tortoise, summarized primarily from the "12-Month Finding on a Petition to List the Gopher Tortoise as Threatened in the Eastern Portion of its Range." The information is outlined according to each of the 5 ESA listing factors.

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

This is by far the biggest threat facing the continued existence of the gopher tortoise. There are many direct and indirect factors contributing to this threat, including (but not limited to): 1) habitat fragmentation by roads (potentially causing road mortality, reproductive isolation, small and discontinuous populations, and edge effects such as increased predation); 2) habitat destruction from activities such as urbanization, phosphate strip-mining, and sand extraction (potentially causing direct mortality and/or displacement of tortoises to undesirable habitats); and 3) habitat modification (either deliberately or from inattention), including conversion of longleaf pine forests to other silvicultural or agricultural habitats, shrub/hardwood/sand pine encroachment (mainly from fire exclusion or insufficient fire management), and establishment and spread of invasive species (potentially causing the aforementioned indirect effects due to canopy closure and decline of available forage/groundcover).

Gopher tortoise habitat in the eastern portion of its range has been destroyed or modified in the past due to conversion of natural pine forests to intensely managed planted pine plantations or naturally regenerated stands (Hermann et. al. 2002; Siry 2002; Conner and Hartsell 2002). Additionally, loss of natural pine forests has resulted from urban development, conversion of xeric vegetative communities to citrus, phosphate mining (Kautz 1998; FWC 2006), and degradation of natural pine forest due to lack, or insufficient use, of prescribed fire (FWC 2006; Bailey and Smith 2007; Yager et al. 2007). Several of these same factors are cited in the gopher tortoise recovery plan as historical processes that resulted in habitat destruction and modification in the western portion of the tortoise's range (Service 1990). The conversion of native southern pine forests to intensively managed pine forests (planted pine plantations or regenerated forests) is anticipated to continue in the future (Bailey and Smith 2007), although the rates of projected conversion vary. The future rate of conversion to pine plantations may be lower than in the past because rates of conversion seem to have declined over the past decade compared to the rates of conversion documented in the 1980s and 1990s.

In Florida, future urban development may result in the loss of about 700,000 acres or 20 percent of the remaining gopher tortoise habitat (not defined in publication) in Florida by 2060 (FWC 2008). Some have predicted a loss of up to 50 percent of forest lands in central Florida and up to 25 percent in north Florida and southeast Alabama (Prestemon and Abt 2002). In 10 coastal Georgia counties, the human population is expected to increase 51 percent by 2030 (Center for Quality Growth and Regional Development 2006), but no estimate of impact on native habitats was provided.

In addition to habitat loss, gopher tortoise habitat will continue to be degraded due to fragmentation, conversion to intensively managed pine forests, and lack, or ineffective use of prescribed fire. The spatial and temporal scale of fragmentation from silvicultural activities will vary depending on location, size, and timing of these activities, but frequent alterations of intensely managed pine forests are unlikely to support stable tortoise populations (Diemer 1992). Typically, gopher tortoises move from intensively managed pine forests when canopies begin to close to roadsides and then to adjacent clearcuts or other peripheral habitats, if they are available (Auffenberg and Franz 1982; Diemer 1992). These peripheral areas are often road shoulders, which may give the impression that population numbers are high, even though the adjacent pine plantation is largely unoccupied (FWC 2001). Gopher tortoises are known to abandon areas that had been recently converted to pine plantations (FWC 2001).

Gopher tortoise habitat is fire-dependent, and naturally ignited fires and prescribed burning maintains an open canopy and reduces forest floor litter that combine to allow penetration of sunlight necessary for ground cover growth and gopher tortoise nest thermoregulation. In natural and planted pine stands, frequent burning is the most important management tool in sustaining gopher tortoise habitat (Landers and Buckner 1981; Breininger et al. 1994). In suitable habitats, periodic burning or shrub removal can increase gopher tortoise carrying capacity (Stewart et al. 1993). Landers (1980) found that mixed stands of longleaf pine, turkey oak, and other scrub oaks that were burned every 2 to 4 years produced the densest tortoise colonies. In south-central Florida, tortoises moved into areas that were frequently burned and

abandoned areas that were unburned or burned less frequently (Ashton et al. 2008). However, recently burned potential (but unoccupied) habitat may not be colonized by tortoises if fire has been suppressed in surrounding habitat making it unsuitable for tortoises. These areas, if properly restored, could potentially be utilized as a re-stocking site if long-term management plans have been established, it is thought to historically have been occupied by tortoises, and the reason(s) why the site was originally abandoned have been addressed.

Even though management efforts may restore habitat, previous fire- suppression can result in abandonment of adjacent habitat and create dispersal barriers (Ashton et al. 2008). Breininger et al. (1994) determined that burned habitats had more herbaceous ground cover and gopher tortoises than unburned oak-palmetto. Landers and Buckner (1981) determined that burned plantations and longleaf pine scrub oak ridges had nest densities four times higher than in unburned plantations and ridges. Landers and Speake (1980) recorded that herbaceous ground cover was 2.3 times higher and gopher tortoise density was 3.1 times higher in a frequently burned slash pine plantation as in an adjacent unburned natural sandhill area. We also know that not all potential habitats on public lands are currently suitable gopher tortoise habitat. Few lands have been acquired expressly for gopher tortoise conservation. Thus, tortoise habitat suitability is often a byproduct of other management treatments. Public lands, while less vulnerable to development, are still subject to economic pressures and constraints. Currently, public agency budgets are strained, and most are probably not adequate to provide for large-scale, intensive management specifically targeting gopher tortoise habitat. We know that periodic burning of gopher tortoise habitat is crucial to the conservation of the species. We also know that pressures to control wildfires for public safety and the adverse effects of smoke make burning more and more difficult.

Loss and alteration of gopher tortoise habitat from fire exclusion or fire suppression has a significant effect on survival of the gopher tortoise (Boglioli et al. 2000). Although burning has been accepted as a management tool, increased urbanization has limited its use in many locations (Ashton and Ashton 2008). Many southeastern pine forests have dense canopies, more mid-canopy shrubs, and herbaceous ground cover decline due to fire suppression (Yager et al. 2007). Tortoise population life expectancy was shorter than normal in fire-suppressed savanna communities (Auffenberg and Iverson 1979). Population reduction was directly correlated with the degree and rate of successional habitat modification (Auffenberg and Iverson 1979). Auffenberg and Franz (1982) recorded a decrease of 1.5 tortoises per hectare every 5 years on an unburned site for 16 years. Fire exclusion may reduce tortoise numbers by 60 to 80 percent in 8 years (Diemer 1989) or 100 percent in 16 years (Auffenberg and Franz 1982). In south-central Florida, sandhill and scrubby flatwoods were abandoned by gopher tortoise after about 20 years of fire exclusion (Ashton et al. 2008).

**Factor B: Overutilization for commercial, recreational, scientific, or educational purposes**

The primary threat associated with this factor is the harassment and mortality of gopher tortoises associated with the unregulated harvest of rattlesnakes, specifically the eastern diamondback rattlesnake (*Crotalus adamanteus*). The technique of pouring noxious liquids

(gasoline) down tortoise burrows in order to capture the exiting snakes undoubtedly harms or harasses the resident tortoise, and is thought to be used primarily to collect the snakes for rattlesnake "round-ups" (Means 2009). Before 2012 there were only three of these round-ups remaining (events offering prizes for the largest rattlesnake, followed by the killing of the snakes for skins and meat); however, this year the Claxton, GA round-up was converted to a wildlife festival, where snakes will no longer be harvested from the wild.

This threat has abated over the past several decades but still occurs in some rural areas. Conservation measures are insufficient to eliminate this risk. However, public pressure to convert the two remaining rattlesnake round-ups (one in Alabama, the other in Georgia) to wildlife festivals, in addition to regulations prohibiting the gassing of tortoise burrows (Florida, Georgia, and Alabama) should help to diminish this threat to the tortoise. Florida law specifically prohibits the use of gasoline or other chemical or gaseous substances to drive wildlife from their retreats (Florida Administrative Code 68 A.4-001(2). Georgia codes § 27-1-130 and 27-3-130 prohibit gassing of burrows, but excludes protection of venomous snakes. Alabama recently adopted regulation 220-2-.11 prohibiting the use of gas, noxious chemicals or gaseous substances into wildlife burrows, dens, or retreats. We believe these regulatory measures will reduce incidental mortality of gopher tortoises during rattlesnake collections.

**Factor C: Disease or predation**

A number of diseases have been documented in the gopher tortoise, including fungal keratitis (Myers *et al.* 2009, p. 582), iridovirus, herpesvirus, bacterial diseases related to *Salmonella*, *Mycoplasma,* and *Dermatophilus*, and numerous internal and external parasites (Ashton and Ashton 2008). Upper Respiratory Tract Disease (URTD) resulting from *Mycoplasma* infection has received the most attention recently and has been implicated in mortality of gopher tortoises on State and Federal lands in Mississippi and Florida where URTD was documented (Berish *et al*. 2010). It is considered an infectious disease which may threaten populations of free-ranging tortoises (Seigel *et al.* 2003). However, correlations between exposure to *Mycoplasma* spp. and population declines appear to be variable among geographic locations and often transient when viewed over a 10-year timeframe (McCoy *et al.* 2007).

An obstacle in the assessment of this threat's magnitude is the lack of data concerning levels of *Mycoplasma* seroprevalence across populations and across states. Currently, all tortoises in the listed range are tested for the presence of *Mycoplasma* antibodies prior to relocation. Additionally, as part of the guidelines for the establishment of conservation banks in the listed range (USFWS 2009), all resident tortoises at the bank are tested as well, and the Service reserves the right to further evaluate and determine whether a prospective property with seropositive tortoises can accept relocated seronegative tortoises, or vice versa. However, this testing method is not always 100% reliable. According to the Florida Gopher Tortoise Management Plan (FWC 2007), previous attempts to control the spread of URTD by requiring serological testing of a sample of tortoises prior to relocation were recognized as ineffective, and the requirement was suspended in August 2006. The degree to which exposure to the pathogen correlates to clinical signs of URTD or death is still unclear, as are the effectiveness of

the testing mechanisms, the degree of transfer between animals, and the potential for decreased resistance to the disease based on stresses from habitat modification or relocation. The threat of disease across the range is an ongoing challenge while we learn more about the potential pathogens in the environment and how populations respond to them.

Nest depredation by vertebrates typically has been considered substantial; from studies in southern Georgia, Landers et al. (1980) estimated about 90 percent of nests were destroyed by predators; a study in Alabama documented about 46 percent of nests (n = 11) were destroyed (Marshall 1986). Documented predators of nests, hatchlings, and juvenile gopher tortoises include Raccoons (*Procyon lotor*), Gray Fox (*Urocyon cinereoargenteus*), striped skunks (*Mephitis mephitis*), Opossum (*Didelphis virginiana*), Nine-Banded Armadillos (*Dasypus novemcinctus*), Red-Tailed Hawks (*Buteo jamaicensis*), Cottonmouths (*Agkistrodon piscivorous*), Eastern Diamondback Rattlesnakes (*Crotalus adamanteus*), Coachwhips (*Coluber flagellum*), Eastern Indigo Snakes (*Drymarchon couperi*), and red imported fire ants (RIFA - *Solenopsis invicta;* see Epperson and Heise 2003 and references therein). Dogs and large canids are the most common predator of adult tortoises (Causey and Cude 1978; Hinderliter 2008). As is the case with most turtle species, predation pressures are highest for gopher tortoises in the first year post-hatching, and diminish gradually over the next several years. In a current head-starting study in the listed range (Camp Shelby, MS), documented predation by mammals was fairly constant on tortoises across all age groups (hatchling through 5-year-olds); however, 91% of the documented predation by RIFA was on hatchling tortoises (M. Hinderliter, unpubl. data). The gopher tortoise has evolved to persist with the pressures of native predators, although the range expansions of armadillos and coyotes, combined with the introduction and invasion of other species (RIFA, constrictor snakes, and tegus) has re-defined predation as a serious threat that needs to be addressed.

**Factor D: The inadequacy of existing regulatory mechanisms**

Current Federal, State, and local regulations establish adequate regulatory protection of individual tortoises from take, but implementation of these regulations varies. All do not adequately protect gopher tortoise habitat in private ownership and most do not address the management needs of the tortoise. This is problematic because of the total forested landscape in the southeastern United States, about 3.4 million acres are longleaf pine forests, of which about 55% (2.0 million acres) are privately owned (America's Longleaf 2009). Within the gopher tortoise's range about 88% of the pine forests are privately owned (National Council for Air and Stream Improvement, Inc. 2010).

In the eastern portion of the tortoise's range, only Florida implements a regulatory program designed to mitigate the effects of habitat loss on private lands. The amount of habitat on protected lands might increase substantially if other States considered developing and implementing similar tortoise management plans, especially if those plans included best management practices within various types of tortoise habitat. While mechanisms are in place to protect tortoises, in terms of minimizing take, those processes ultimately resulting in the relocation of tortoises are not strict enough at the level where project alternatives are

sufficiently examined. Additional conservation "weight" needs to be placed on the high quality tortoise habitats, since it is those areas that have the greatest potential for persistence of the species. Replacement of one acre of pristine sandhill habitat with one acre of sub-optimal (but "suitable") habitat as a relocation site results in a net conservation loss for the tortoise, and this needs to be addressed in any project's planning phase range-wide.

There are several issues involving regulatory inconsistencies throughout the range, which need to be addressed to analyze which have the greatest conservation benefit on individual tortoises, their populations, and their habitat. The practice of maintaining a buffer area around known tortoise burrows while utilizing heavy machinery for habitat management is currently utilized in the listed range, but not everywhere in the candidate range. Additionally, the mechanisms of relocation/translocation of tortoise populations are not consistent throughout the states, specifically the methods of initial penning of relocated animals and use of "starter" burrows into which to release animals. In order to effectively assess the success of relocation, more consistency is needed in establishing long-term monitoring studies to investigate site fidelity, reproductive fitness, and population health post-relocation. It is imperative that these measures are evaluated for greatest benefit to the population and/or ecosystem, and incorporated range-wide.

**Factor E: Other natural or manmade factors affecting its continued existence)**

Additional factors potentially threatening the continued existence of gopher tortoises include herbicide application, road mortality, and climate change; however, the status of these potential threats is unknown. The application of herbicide, for invasive species control, brush management, and site preparation, is an important component of habitat management, and a valuable tool for land managers. Although where herbicide is applied there is the potential for short-term loss of forage, the primary concern is that the possible effects of long-term or chronic exposure of herbicide on adults, juveniles, and eggs are unknown and need further investigation.

We know that road mortality occurs, but the extent to which it affects populations and the species as a whole is not well documented. There is no information linking road mortality directly to population declines so the magnitude of this factor is not currently known. Climate change is not an imminent threat because we have not detected climate change-related impacts on gopher tortoise populations. There is the potential for a loss of coastal dune habitat from sea level rise, and a skewed sex ratio in some populations since tortoises have temperature-dependent sex determination. However, we are uncertain about the magnitude of this threat because we do not currently understand all potential impacts of climate change on the gopher tortoise or human responses to mitigate those effects.

**Current Conservation Efforts**

One of the major steps taken thus far in the non-listed range is the development of the Florida Gopher Tortoise Management Plan (FWC 2007), which is currently undergoing a 5-year revision.

In it, the current cause of imperilment of the gopher tortoise, as identified by the final Biological Status Report (Enge et al. 2006), is the rate of population decline, primarily due to habitat loss. Therefore, the overarching conservation goal of the management plan is to restore and maintain secure, viable populations of gopher tortoises throughout Florida so the species no longer warrants listing. Some of the conservation objectives currently under review to reach this goal are to: 1) minimize the loss of tortoises by addressing relocation, illegal harvest, best management practices, disease, and predation; 2) increase and improve tortoise habitat through management and restoration; 3) enhance and restore populations where the species no longer occurs or has been depleted; and 4) maintain the species' function as a keystone species by addressing the protection and potential relocation of commensal species.

Another tool that has been implemented to document existing population levels, management plans, and reporting/survey methods is the Candidate Conservation Agreement (CCA) for the Gopher Tortoise – Eastern Population, which was completed in 2008 and whose signatories represent the four States' fish and wildlife agencies, branches of the Department of Defense, U.S. Forest Service, Fish and Wildlife Service, and various NGOs. The goal of the CCA, which focuses on the eastern range of the tortoise, is to organize a cooperative range wide approach to gopher tortoise conservation and management in that portion of the range. The CCA uses a common conservation approach and framework and allows the signing parties to leverage knowledge and funding within it. The CCA is flexible and voluntary, so that different conservation and management actions can be adopted and implemented at varying levels by the signing parties. The signatories produce an annual report, which includes information on: hectares included by protection level; hectares managed and restored; invasive exotics treated; population trends/survey results; population manipulation; research; land conservation; education and outreach; and legal protection measures (Southeast Regional Partnership for Planning and Sustainability 2010).

Within the CCA it states, "It is the intent and expectation of the Parties that the execution and implementation of this Agreement will lead to the conservation of the gopher tortoise in its natural eastern range. If, subsequent to the effective date of this Agreement, the Secretary of the Interior should determine pursuant to section 4(a) of the ESA (16 U.S.C. §1533(a)), that the gopher tortoise is threatened or endangered, the Parties will participate in recovery planning for the gopher tortoise. It is also the expectation of the Parties that the conservation and management commitments made in this document will be considered in the event of a listing under the ESA". As compiled for the CCA Annual Report, the following conservation-related research on gopher tortoises is ongoing or recently completed by the members of the Agreement: 1) rare plant & animal inventories/surveys; 2) disease prevalence and impacts; 3) population responses to management actions; 4) effectiveness of re-stocking tortoises; 5) habitat assessments; and 6) population dynamics assessments.

Other draft versions of CCAA's (Candidate Conservation Agreements with Assurances) are currently in preparation: 1) Georgia Power Company (GPC) & Southern Nuclear Operating Company (SNC) CCAA at Plant Vogtle, Burke County, Georgia; and 2) Mosaic Fertilizer in Florida. The primary difference between these types of agreements is that through CCAA's, the Service

provides assurances that no additional conservation measures or additional land, water, or resource use restrictions, beyond those voluntarily agreed to and described in the Conservation Measures section of this document, will be required should the gopher tortoise become listed as a threatened or endangered species in the future for this portion of its range.

There are many other collaborative efforts and agency/NGO-lead actions currently ongoing which are either targeting species-specific conservation for the gopher tortoise (i.e. NRCS Working Lands for Wildlife) or ecosystem based conservation plans (i.e. America's Longleaf Restoration Initiative) which could benefit the tortoise. These organizations and initiatives are important in addressing the preservation and management needs across state lines and land ownership categories, specifically when they offer landowner incentives and cost-share programs.

**Summary Assessment of Conservation Status**

There is a strong conservation community already established for the gopher tortoise throughout its range; one with innovative research studies, creative management plans, and a vast library of ecological, biological, and ethological data dating back several decades. The threats to continued survival, habitat management tools, and habitat needs have been well documented, and must be coalesced into a singular conservation plan. A top priority is that wherever possible, prescribed fire must be returned to the landscape where it has been excluded, and given the proper burn interval, severity, and seasonality that most closely reflects ancestral conditions of the longleaf pine ecosystem. The issues of smoke management, liability, and resource limitations have been obstacles in recent fire programs at a time when these programs should be more aggressive. Additionally, although invasive, nuisance, and exotic species control programs have been integral parts of management plans for years, they must continue to be given high priority since we have yet to realize the long-term effects these species are having on tortoise populations.

We must take full advantage of the local knowledge in each state (through partnerships with federal, state, NGO, & local sources) to identify the best remaining tortoise habitat and establish protection of those lands in perpetuity. Since many recent surveys comparing long-term tortoise burrow activity data reveal moderate to drastic population declines, we can no longer assume that our actions (habitat management, relocations, etc.) are not impacting the future persistence of the species. Funding sources must remain available to the research community, specifically where tortoise population responses to management actions are studied and can be expanded across a broader landscape.

**Conservation Objectives and Action Plans**

**Objective 1: Address the present and threatened destruction, modification, or curtailment of gopher tortoise habitat**

1) Identify, prioritize, and protect viable tortoise populations;

2) Increase the size and/or carrying capacity of those viable population areas through applied management, land acquisition, or incentives to adjacent landowners to properly manage for tortoises; in order to allow for the potential expansion of those populations;

3) Working with partners/land managers, maximize the amount of acreage appropriately maintained by prescribed fire, define desired forest conditions (e.g. pine basal area, shrub cover, ground cover) and best management practices;

4) Evaluate whether each state in the candidate range for the tortoise should have a state Management Plan similar to Florida's;

5) Encourage the development and implementation of a model CCAA/HCP (preferably one that is state-wide and programmatic) that details effective conservation objectives and habitat management goals;

6) Locate areas of "secondary priority" where re-stocking and restoration can most effectively be accomplished by creating large, contiguous tracts or habitat corridors that may or may not be occupied by tortoises, specifically those directly adjacent to current managed lands;

7) Collect data on existing populations on public and private lands to more accurately assess where conservation needs to be focused; provide education and incentives to landowners to manage their land for tortoises, possibly working with partners to offer higher cost-sharing for more aggressive habitat management (where applicable);

**Objective 2: Address issues related to overutilization for commercial, recreational, scientific, or educational purposes**

1) Work with partners to convert the two remaining rattlesnake round-ups to wildlife festivals

**Objective 3: Investigate and mitigate disease and predation effects**

1) Initiate a risk assessment for the degree to which our blood testing mechanisms accurately assess the presence of *Mycoplasma* antibodies; the degree to which a positive antibody test correlates to clinical signs of URTD; and the degree to which URTD can be linked to die-offs in gopher tortoises (temporal and spatial scales);

2) Identify and reduce the factors most negatively impacting juvenile tortoise recruitment, in part by studying areas with high recruitment and performing comparative analyses;

**Objective 4: Investigate range-wide effective regulatory mechanisms**

1) Adopt mitigation strategies across the range that address the ongoing need for relocation of tortoises, but do it in a way as to minimize loss of preferred habitat (sandy soils, open forest structure, herbaceous groundcover), and provide perpetual protection of relocated tortoises and their habitat;

**Objective 5: Determine population viability parameters**

2) Establish consensus within the research community on what defines a viable gopher tortoise population (e.g., age structure, number of individuals, acreage, recruitment rate, predation pressures, spatial distribution, etc.).

3) Establish consensus on the number and distribution of viable gopher tortoise populations in suitable habitat necessary such that the species in the unlisted portion of its range would not require protection under the Endangered Species Act.

4) Establish a consistent mechanism of proper surveying/monitoring techniques and schedules, to accurately assess population levels, trends, and responses to management; and

5) Investigate using Section 6 funding to conduct surveys and censuses of the ~ 80 public parcels in Florida that contain a substantial amount of potential gopher tortoise habitat, to estimate the number of tortoises present

The majority of these objectives address, either directly or indirectly, the primary threat to the gopher tortoise, which is the destruction, modification, or curtailment of its habitat. Other major threats such as disease and predation will ultimately be addressed in the process of meeting these objectives as well. These objectives and action items, along with coordinating Federal and State partners assigned to take the lead in addressing them, have been categorized by the five-factor threat analysis and included in this document (Appendix 1).

This species will always require protection and management specific to its needs; however, successful conservation of the longleaf pine ecosystem and other suitable habitats will undoubtedly benefit tortoise populations, as it will for other native rare species such as the red-cockaded woodpecker and Eastern indigo snake. Although these objectives put emphasis on the larger occupied tracts of high-quality habitat, the smaller isolated populations may play a pivotal role in the persistence of the species, and should be protected when possible. It is possible that in the future the conservation of the species will be placed solely on protecting sizable “refuges” of tortoises on large tracts of land; however, losing the smaller, isolated groups of tortoises may ultimately be detrimental to the species if, for instance, reduced genetic diversity causes tortoises to be more susceptible to disease outbreak.

One specific action needed to reach many of these conservation objectives is to work with partners to take full advantage of private lands management-based initiatives that become available, maximizing their scope. By reaching out to private landowners with existing or

potential tortoise habitat, we need to demonstrate that they can either create a matrix of habitats across their lands or perform management that benefits the tortoise while still maintaining economically viable use of their lands for silvicultural, recreational, or agricultural use.

The CCA is a valuable tool connecting federal, state, and other entities, although additional data collection on existing populations, habitat, and effective management are still needed to demonstrate success. It should continue to be utilized as a working document, and should include more information on habitat management and population goals and how to reach those goals. In terms of research needs, any studies which actively focus on the major threats to the species need to be supported; specifically population responses to habitat management, status and surveys of populations on private lands, habitat modeling to identify previously-unknown tortoise habitat, and long-term effects of current habitat management or population manipulations.

Many of the larger populations of gopher tortoises occurring on National Forests and military installations are protected under site-specific management plans; however, we believe that there may be many other large parcels of high-quality tortoise habitat under private ownership that have not received the adequate protection to maintain a viable population in perpetuity. Habitat acquisition has been and continues to be an important element of conservation strategies for this species. Past acquisition efforts have focused on securing high quality natural communities because of the values these habitats provide to tortoises, burrow commensals, and other wildlife species. However, since all acquisitions are dependent upon the presence of willing land sellers and not all willing sellers have optimal habitat, state purchases often include both high quality natural habitats and those requiring restoration. Acquisition of quality native habitats will continue to be a priority, but disturbed or altered properties may also be purchased when they contribute towards recovery of the tortoise.

**Citation**

U.S. Fish and Wildlife Service. 2012. Range-Wide Conservation Strategy for the Gopher Tortoise. Jackson, MS. pp.

**References**

A complete list of references cited is available upon request

**APPENDIX 1.**

**Sample Matrix Addressing the Action Items Presented in the Range-Wide Gopher Tortoise Conservation Strategy**

| SAMPLE GOPHER TORTOISE STRATEGY ACTION ITEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Listing Factor** | **Primary Threats to the Species** | **Actions Needed to address the specific threat** | **Policy/regulatory partners** | **Implementation partners** | **Lead (FWS)** | **Lead (State) TBD** | **Due date** |
| **THE PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF ITS HABITAT OR RANGE (FACTOR A)** | | | | | **Hinderliter** | | |
| | Fire suppression | Work with land manager partners to develop a prescribed fire implementation plan | EPA, State Forestry Commissions | Fire teams (TNC, USFS, DoD) | | | |
| | Silvicultural & agricultural compatability | Develop Bes Management Practices for forestry management to include conservation of tortoise; Desired Future Conditions, specifically Longleaf Pine forests | | NRCS, Forestry Commissions | | | |
| | Urbanization | Work with local development planning authorities to include gopher tortoise conservation; education on management, disease, prescribed fire | All states | | | | |
| | Phosphate strip mining | State programs (FL) | | | | | |
| | Sand extraction | State programs (AL & FL) | | | | | |
| | Invasive species | Investigate data gaps, fund research, and work with partners to determine impacts | | | | | |
| | Fragmentation of habitat (I) | Determine a target population size, demography, critical area, number, and locations of viable tortoise populations throughout the range. | State Wildlife Agencies | Gopher Tortoise Council, PARC, SERRPAS, LCC | | | |
| | Fragmentation of habitat (II) | Establish baseline population estimates, monitoring population trends, and population response to habitat management (initiate new surveying protocol) | State Wildlife Agencies | Jones Center, State wildlife agencies, CCA signatories | | | |

| SAMPLE GOPHER TORTOISE STRATEGY ACTION ITEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Listing Factor** | **Primary Threats to the Species** | **Actions Needed to address the specific threat** | **Policy/regulatory partners** | **Implementation partners** | **Lead (FWS)** | **Lead (State) TBD** | **Due date** |
| **OVERUTILIZATION FOR COMMERCIAL, RECREATIONAL, SCIENTIFIC, OR EDUCATION PURPOSES (FACTOR B)** | Indirect mortality/harassment due to unregulated rattlesnake collection for roundups | Work with partners to convert the 2 remaining rattlesnake roundups to wildlife festivals (Opp, AL & Whigham, GA) | States (GA & AL) DNR | Orianne Society, Local chambers of commerce | **Doresky** | | |
| **DISEASE OR PREDATION (FACTOR C)** | | | | | **Hinderliter** | | |
| | URTDs, others of lesser importance | Research to what extent diseased animals lead to die-offs, transmission frequency, study causation and proliferation | NIH, | SCWDS, UF Vet Med | | | |
| | Predation of hatchlings and juvenile tortoises | Research to determine impact to populations (fire ant suppression study) | | Gopher Tortoise Council, MDWFP grant | | | |
| | Predation pressures on adult tortoises | Initiate risk assessment to quantify coyote predation on adult tortoises, investigate control measures | State Wildlife officials | Nokuse, DoD | | | |
| **THE INADEQUACY OF EXISTING REGULATORY MECHANISMS (FACTOR D)** | | | | | **Imm** | | |
| | Perpetual protection of relocated tortoises | Develop GT Management Plans for each state (FL is model), part of which will address proper relocation; utilize same language in all mgmt. plans, conference reports, biological opinions | FWCC, other State Agencies | FWCC, other State Agencies | | | |
| | Protection of burrows during habitat management activities | Ensure consistent language in all land managers' plans, specifically heavy equipment use | DoD, USFS, FWS (Refuges) | DoD, USFS, FWS (Refuges), NRCS | | | |

| SAMPLE GOPHER TORTOISE STRATEGY ACTION ITEMS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Listing Factor** | **Primary Threats to the Species** | **Actions Needed to address the specific threat** | **Policy/regulatory partners** | **Implementation partners** | **Lead (FWS)** | **Lead (State) TBD** | **Due date** |
| **OTHER NATURAL OR MANMADE FACTORS AFFECTING ITS CONTINUED EXISTENCE (FACTOR E)** | | | | | **Porter** | | |
| | Herbicide application | Risk assessment of effects of herbicide on tortoise populations | State Agencies | Land managers | | | |
| | Road mortality | Assess impact in high traffic areas, possible use of barriers to limit mortality | | Federal Highways, State DOTs | | | |

## Appendix 2.

## Gopher Tortoise Species Description

### Life History

The gopher tortoise is the only tortoise (family Testudinidae) east of the Mississippi River; one of five species in the genus *Gopherus* in North America. It is larger than any of the other terrestrial turtles in this region, with a domed, dark-brown to grayish-black carapace up to 14.6 inches long, weighing up to 13 lbs (6 kg). The plastron is yellowish and hingeless. A fossorial species, its hind feet are elephantine or stumpy, and the forelimbs are shovel-like, with claws used for digging. In comparison to females, males are smaller; usually have a larger gland under the chin, a longer gular projection, and more concave plastron. Hatchlings are up to 2 inches in length, with a somewhat soft, yellow-orange shell.

The burrows of a gopher tortoise are the habitat and center of normal feeding, breeding, and sheltering activity. Gopher tortoises can excavate many burrows over their lifetime, and typically use several each year. Burrows may extend for more than 30 feet, can be up to 10-12 feet deep, and provide shelter from predators, winter cold and summer heat. Tortoises spend most of their time within burrows and emerge during the day to bask in sunlight, to feed, and reproduce. Tortoises breed from May through October (Landers et al. 1980; McRae et al. 1981; Wright 1982; Service 1987; Diemer 1992; Eubanks et al. 2003), but females do not reproduce every year (estimated at 80-85%; Smith et al. 1997). Females excavate a shallow nest to lay and bury eggs, typically between early May and late June, and usually in the apron of soil at the mouth of the burrow. Range-wide, average clutch size varies from about four to 10 eggs/clutch, and incubation lasts 85-100 days.

Home range size and movements increase with age and body size, and home range area tends to vary with habitat quality, becoming larger in areas of poor habitat (Auffenberg and Iverson 1979). Males typically have larger home ranges than females. Mean home ranges of individual tortoises in Alabama, Florida, and Georgia outside the federally listed area have varied from 1.3 - 5.2 acres (3.2 - 2.2 ha) for males and 0.2 - 2.5 acres (0.09 - 1.0 ha) for females (McRae et al. 1981; Auffenberg and Franz 1982; Diemer 1992; Tuma 1996; Eubanks et al. 2003; Guyer 2003).

Some of the challenges for the conservation of this species lie in its life history traits; specifically the late age of reproductive maturity (estimated to be between 12-20 years), low reproductive output, and long lifespan (generally estimated at 50-80 years). Growth rates and sizes at sexual maturity can also vary among populations and habitat types (Landers et al. 1982; Mushinsky et al. 1994; Aresco and Guyer 1998, 1999a). Because of these traits it is difficult to ascertain the short-term success of management efforts, especially in terms of whether the reproductive viability of a population has been enhanced. An effective monitoring effort must be a multi-year

project to truly measure the results of any actions. A major obstacle is the perception that a population may appear to be stable because the number of burrows in an area remains unchanged for years, when in fact this could simply reflect a handful of aging animals in a declining population.

**Current Range/Distribution**

The gopher tortoise occurs in the southeastern Atlantic Coastal Plain from southern South Carolina west through Georgia, Alabama, and Mississippi to eastern Louisiana, and south through peninsular Florida. The eastern portion of the gopher tortoise's range includes Alabama (east of the Tombigbee and Mobile Rivers), Florida, Georgia, and South Carolina (Figure 1). The core of the current distribution of the gopher tortoise in the eastern portion of its range includes central and north Florida and southern Georgia. Long-term monitoring data indicate that many populations have declined and most are relatively small and fragmented. Smaller-scale, short-term or one-time surveys throughout the range indicate that tortoise populations typically occur in fragmented and degraded habitat, are small, and densities of individuals are low within populations. Unlike the western portion of the range, there are several known populations of tortoises in the eastern portion of the range that appear to be sufficiently large to persist long-term. Although many public parcels in the Southeast contain a substantial amount of potential gopher tortoise habitat, systematic surveys or censuses of these areas have not been conducted to estimate the number of tortoises present.

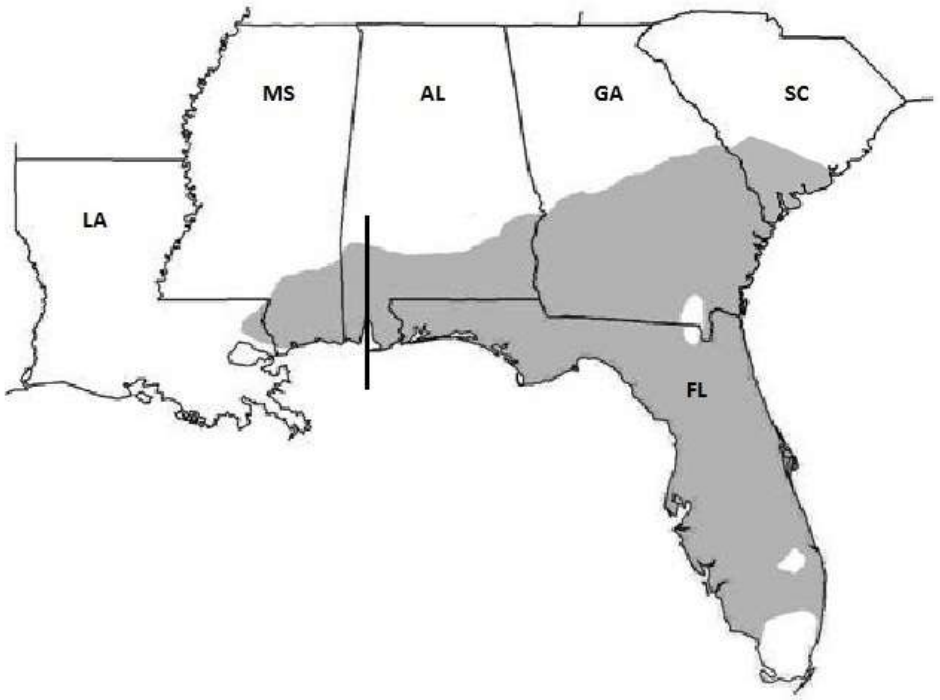


**Figure 1**. Distribution of the gopher tortoise (FWC 2007). The vertical line in western Alabama shows the approximate boundary between the western (federally listed) population and eastern (candidate) population.

**Habitat Description**

Gopher tortoises require well-drained, sandy soils for burrowing and nest construction, an abundance of herbaceous ground cover for food, and a generally open canopy that allows sunlight to reach the forest floor (Landers 1980; Auffenberg and Franz 1982). Longleaf pine and oak uplands, xeric hammock, sand pine and oak ridges (beach scrub), and ruderal (disturbed) habitat most often provide the conditions necessary to support gopher tortoises (Auffenberg and Franz 1982). Ruderal (i.e., disturbed or atypical) habitats include roadsides and utility rights-of-way, grove/forest edges, fencerows, and clearing edges. In the western range, soils contain more silt, and xeric (dry) conditions are less common west of the Florida panhandle (Crual et al. 2005). Ground cover in this Coastal Plains area can be separated into two general regions with the division in the central part of southern Alabama and northwest Florida. To the west, bluestem (*Andropogon* spp.) and panicum (*Panicum* spp.) grasses predominate; to the east, wiregrass (*Aristida stricta*) is most common (Boyer 1990). However, gopher tortoises do not necessarily respond to specific plants but rather the physical characteristics of habitat (Diemer 1986). Historic gopher tortoise habitats were open pine forests, savannahs, and xeric grasslands that covered the coastal plain from Mexico and Texas to Florida. Historic habitats might have had wetter soils at times and been somewhat cooler but were generally xeric, open, and diverse (Ashton and Ashton 2008).

Gopher tortoises have a well-defined activity range where all feeding and reproduction take place and that is limited by the amount of herbaceous ground cover (Auffenberg and Iverson 1979). Tortoises are obligate herbivores eating mainly grasses, plants, fallen flowers, fruits, and leaves. Gopher tortoises prefer grassy, open-canopy microhabitats (Boglioli et al. 2000), and their population density directly relates to the density of herbaceous biomass (Auffenberg and Iverson 1979; Landers and Speake 1980; Wright 1982; Stewart et al. 1993) and a lack of canopy (Breininger et al. 1994; Boglioli et al. 2000). Grasses and grass-like plants are important in gopher tortoise diets (Auffenberg and Iverson 1979; Landers 1980; Garner and Landers 1981; Wright 1982; Macdonald and Mushinsky 1988; Mushinsky et al. 2006; Birkhead et al. 2005). A lack of vegetative diversity may negatively impact the long-term sustainability of gopher tortoise populations (Ashton and Ashton 2008).

Gopher tortoises require a sparse canopy and litter-free ground not only for feeding, but also for nesting (Landers and Speake 1980). In Florida, McCoy and Mushinsky (1995) found that the number of active burrows per tortoise was lower where canopy cover was high. Females require almost full sunlight for nesting (Landers and Buckner 1981) because eggs are often laid in the burrow apron or other sunny spot and require the warmth of the sun for appropriate incubation (Landers and Speake 1980). At one site in southwest Georgia, Boglioli (et al. 2000) found most tortoises in areas with 30 percent or less canopy cover. Diemer (1992) found that ecotones created by clearing were also favored by tortoises in north Florida. When canopies become too dense, usually due to fire suppression, tortoises tend to move into ruderal habitats such as roadsides with more herbaceous ground cover, lower tree cover, and significant sun exposure (Garner and Landers 1981; McCoy et al. 1993; Baskaran et al. 2006). In Georgia, Hermann et al. (2002) found that open pine areas (e.g., pine forests with canopies that allow

light to penetrate to the forest floor) were more likely to have burrows, support higher burrow densities, and have more burrows used by large, adult tortoises than closed-canopy forests. Historically, open-canopied pine forests were maintained by frequent, lightning-generated fires.