

Range-Wide Conservation Strategy for the Gopher Tortoise



Chris Potvin/Mississippi Army National Guard

Common Name: Gopher Tortoise

Scientific Name: *Gopherus polyphemus*

Listing Status and Date:

Threatened: (populations west of the Mobile and Tombigbee Rivers in AL, MS, and LA); July 7, 1987 (USFWS 1987)

Candidate: (populations east of the Mobile and Tombigbee Rivers in AL, GA, FL, and SC); July 27, 2011 (USFWS 2011)

This document was prepared by the U.S. Fish and Wildlife Service, in cooperation with and input from the States of Alabama, Georgia, Louisiana, Mississippi, Florida and South Carolina; and the Wildlife Diversity Committee of the Southeastern Association of Fish and Wildlife Agencies.

Purpose

The Range-Wide Conservation Strategy for the Gopher Tortoise is meant to serve as a guide to help the U.S. Fish and Wildlife Service (Service), other federal agencies, the six states in the gopher tortoise range, and many other public and private partners work together to proactively conserve the gopher tortoise.

If the strategy is fully implemented — and threats are minimized — the tortoise may not need the ultimate protection of the Endangered Species Act (ESA) in its eastern range, where it is now a candidate for listing. In the western portion of the range, where it is listed as federally threatened, the Service and its partners are learning more about the gopher tortoise with the goal of recovering the species so that one day it will not need federal protection. This conservation strategy will support that effort.

The strategy is designed for partners to:

- Collect and provide information needed to address the threats to the species;
- Outline and implement the highest priority conservation actions for the gopher tortoise; and
- Identify those agencies and organizations best suited to effectively undertake those efforts.

The Service, in close coordination with and active participation from the states, intends to annually evaluate progress on this strategy. This document is also intended to be adaptive, and will be revised as new information is received from the public and partners.



Shauna Ginger/USFWS

Gopher tortoises emerge from their burrows to bask in the sunlight, feed and reproduce.



The gopher tortoise is a listed species under the Endangered Species Act in its western range, and a candidate for listing in its eastern range.

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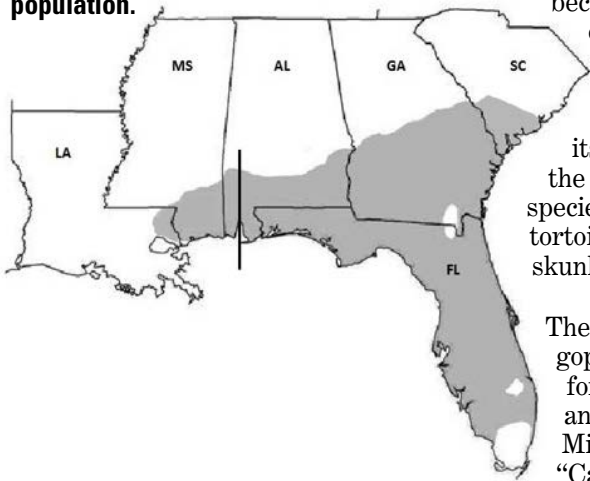
Overview



Matt Hindertier/USFWS

Gopher tortoises typically use several burrows each year. More than 300 other species are known to share their burrows for shelter.

Figure 1. Distribution of the gopher tortoise (FWC 2012). The vertical line in western Alabama shows the approximate boundary between the western (federally listed) population and eastern (candidate) population.



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. One is that the species is easy to detect because of the distinctive burrows they create. Another is due to its high ecological value as a keystone species, which means many other wildlife species benefit from its presence and abundance within the ecosystem. More than 300 other species have been known to use gopher tortoise burrows, including snakes, foxes, skunks and lizards.

The current federal status of the gopher tortoise is “Threatened” for populations west of the Mobile and Tombigbee Rivers in Alabama, Mississippi, and Louisiana. It is a “Candidate” for listing for populations east of the Mobile and Tombigbee Rivers in Alabama, Georgia, Florida, and South Carolina. (Candidates are those species that the Service has determined warrant listing, but are precluded due to lack of resources and higher listing priorities). Throughout this document, the term “eastern range” refers to the geographic area where the tortoise is a candidate for listing, while “western range” refers to the area where it is currently federally listed. See Figure 1. The gopher tortoise is also protected by the states. The status of the tortoise in all six states can be found in Figure 2.

Figure 2. State listing status of the gopher tortoise throughout its range.

State	Status
Alabama	Protected non-game species
Florida	Threatened
Georgia	Threatened
Louisiana	Threatened
Mississippi	Endangered
South Carolina	Endangered

Since the late 1970s, many peer-reviewed manuscripts have provided details of the home range of an adult gopher tortoise as well as its social interactions, habitat use, movement patterns, forage requirements, predation, nesting, translocation, and disease across the full geographic range. In the last decade there have been great advances in research on genetics, population viability, habitat requirements, and predictive GIS modeling.

The range of the gopher tortoise is generally associated with the longleaf pine ecosystem (Auffenberg and Franz 1982). Longleaf is estimated to have once covered 90 million acres, but now covers approximately 3.4 million acres (America’s Longleaf 2009). Of the remaining longleaf forest, 55 percent is in private ownership; 34 percent is in federal ownership; and 11 percent is in state or local ownership (Gaines 2010). No comprehensive range-wide survey of gopher tortoises has been conducted, and the number of surveys completed to date only cover a relatively small percentage of the total range. As a result, the Service and the states have relied on modeling efforts to identify potential habitat where tortoises may be present.

More than 80 percent of that potential tortoise habitat is in private ownership, with the remainder controlled by local, state, federal, or conservation entities (Hoctor and Beyeler 2010; Florida Fish and Wildlife Conservation Commission 2011). Additional life history information can be found in Appendix 2.

Current Conservation Efforts



Gopher tortoises can live 50 to 80 years.

In the gopher tortoise's western range, the Recovery Plan (USFWS 1990) defines reasonable actions needed to recover the species. Some of those described actions include additional surveys and monitoring; management of habitat and tortoise populations on private and public lands; curbing harvest by humans; and increasing research on topics such as genetics, population viability, and barriers to reproduction.

In 2012, the Florida Fish and Wildlife Conservation Commission (FWC) updated the Florida Gopher Tortoise Management Plan (FWC 2012), which has recently undergone a five-year revision. The ultimate goal of this state plan is to: "restore and maintain secure, viable populations of gopher tortoises throughout Florida so the species no longer warrants state listing. For this 10-year plan, the overarching objective of no net loss of gopher tortoises will be accomplished by meeting all of the following objectives:

- Minimize the loss of gopher tortoises.
- Increase and improve gopher tortoise habitat.

- Enhance and restore gopher tortoise populations.
- Maintain the gopher tortoise's function as a keystone species.

To achieve these objectives, a cooperative program partnering with state, local, and private entities has been established across the state" (FWC 2012).

Another tool that has been implemented is a Candidate Conservation Agreement (CCA) for the Gopher Tortoise – Eastern Population, which was completed in 2008. The signatories represent the Service, the fish and wildlife agencies of the states of Alabama, Florida, Georgia, and South Carolina, branches of the U.S. Department of Defense, U.S. Forest Service, and various non-governmental organizations (NGOs). These types of agreements can be between the Service and any other public or private entity, and are a formal partnership created to identify and share specific conservation measures. These types of agreements can have substantial impact on alleviation of the threats affecting a species.

The goal of the Gopher Tortoise CCA is to organize a cooperative range-wide approach to tortoise conservation and management in the eastern portion of the range. The CCA uses a common conservation approach and framework and allows the signatories 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 each partner.

In the annual report, the Gopher Tortoise CCA parties provide information on:

- Acres conserved by protection level;
- Acres managed and restored;
- Invasive exotics treated;
- Population trends and survey results;
- Population manipulation;
- Education and outreach;
- Legal protection measures; and



A survey team from The Joseph W. Jones Ecological Research Center at Ichauway locates a gopher tortoise burrow on a privately owned tree farm in south-central Georgia. A camera scope is used to determine if the burrow is occupied by a tortoise.



The gopher tortoise is the only native tortoise found east of the Mississippi River.

- Research on:
 - rare plant and animal inventories and surveys;
 - disease prevalence and impacts;
 - population responses to management actions;
 - effectiveness of re-stocking tortoises;
 - habitat assessments; and
 - population dynamics assessments.

The CCA further 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...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.”

A CCA, unlike a Candidate Conservation Agreement with Assurances (CCAA), does not provide assurances or waivers regarding regulations that may be required as a result of a covered species being listed under the ESA. Due to their special obligations under the ESA, federal agencies are not eligible for assurances. However, any other entity, including private landowners, state and local governments, corporations and NGOs, can receive assurances under a CCAA. With a CCAA, the landowner would not be required to do anything more than already agreed upon, in the event the species is listed under the ESA.

There are many other collaborative efforts and government- or NGO-led actions currently ongoing which are either targeting species-specific conservation for the gopher tortoise (e.g., the Natural Resources Conservation Service’s Working Lands for Wildlife program) or ecosystem-based conservation programs (e.g., America’s Longleaf Restoration Initiative) which could benefit the tortoise. There are also many programs that are contributing to gopher tortoise conservation on private lands, illustrating the power and potential of public/private partnerships (e.g., the Service’s Partners for Fish and Wildlife Program, NRCS’s Environmental Quality

Incentives Program, Forest Service’s Private Stewardship Program).

Additionally, military installations across the Southeast complement the state and federal laws by maintaining regulations on training restrictions in areas where rare species are found, as part of their Integrated Natural Resource Management Plans. 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.

Other tools for conservation include Safe Harbor Agreements (SHA) in the listed western range, and CCAAs in the candidate eastern range. Both are voluntary agreements. An SHA involves private or other non-federal property owners whose actions contribute to the recovery of species listed as threatened or endangered under the ESA.

In return, participating property owners receive formal assurances from the Service that if they fulfill the conditions of the SHA, the Service will not require any additional or different management activities by the participants without their consent. In addition, at the end of the agreement period, participants may return the enrolled property to the baseline conditions that existed at the beginning of the SHA. There is currently one active SHA in Mississippi for gopher tortoises.

The CCAA, as previously explained, provides incentives to states, local governments, private entities and other non-federal landowners who engage in voluntary conservation activities for a non-listed species or a group of non-listed species. If the species has to be listed under the ESA, participants are assured of regulatory certainty and receive what is called an “Enhancement of Survival Permit” to cover their ongoing land and/or water uses. That means no additional conservation actions would be required of the landowner, beyond what was agreed to in the CCAA. The Service would not impose additional limitations on the land, water or resource. Currently there are no CCAAs for gopher tortoises. However, the Service and its partners are working to promote and encourage their use in the candidate range.

Population Estimates/Status



Female gopher tortoises lay about four to 10 eggs per clutch, and incubation lasts 85 to 100 days. This juvenile was found on state land in south Georgia during a survey in 2012.

A wide variety of information is available on the number and density of gopher tortoises and their burrows throughout their range. These data are the result of numerous surveys using a variety of methods ranging from one-time population counts to repeated surveys over several decades. The diversity of data poses a challenge when trying to evaluate the status of a species from a range-wide perspective. For example, in geographic areas where there is more data, the Service has higher confidence in drawing conclusions about the status of the population. In other areas, where there is little or no data, the Service's confidence in assessing the status of tortoises is lower.

Because of disparities in the type of data collected, methods used, 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, the Service considers each individual dataset in the context of all other best available science to form general conclusions about the status of the gopher tortoise. The Service used this information in its *12-Month Finding on a Petition to List the Gopher Tortoise as Threatened in the Eastern Portion of its Range* in July 2011 (<http://www.gpo.gov/fdsys/pkg/FR-2011-07-27/pdf/2011-18856.pdf>), when the gopher tortoise was classified as a candidate for listing in its eastern range.

To improve the available information about the species going forward, the Service, other federal agencies, states, NGOs and other partners are working to standardize survey protocols and monitoring schedules so that data can be more easily compared. These efforts, through the establishment of Line Transect Distance Sampling as the preferred survey methodology, are either ongoing or being implemented on DoD, state, National Wildlife Refuge System, National Forest, and privately-owned lands throughout the species' range. This effort has already led to the significant improvement in knowledge of the species' status.

What is known is that 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, which make up the majority of the species' central range (Tuberville et al. 2009).

Estimates of adult tortoise abundance include approximately:

- 785,000 in Florida (FWC 2012);
- 30,000 to 130,000 in Alabama (Guyer et al. 2011);
- 11,000 in Mississippi (Lohofener and Lohmeier 1984);
- 400-500 in South Carolina (K. Buhlmann, pers. comm.); and
- 300 in Louisiana (B. Gregory of the Louisiana Department of Wildlife and Fisheries, pers. comm.).

A state-wide population estimate is currently being calculated for Georgia.

Long-term monitoring data indicate that some populations have declined even on protected lands, although the degree to which this can be attributed to a decrease in habitat quality is unknown (McCoy et al. 2006). Small-scale, short-term or one-time surveys indicate that tortoise populations often occur in fragmented and degraded habitat, and densities of individuals are low within populations. However, there are also many populations of tortoises in the eastern portion of the range that appear to be sufficiently large to persist long-term (Service 2011).

Results from population modeling efforts have shown that gopher tortoise populations are likely to decline in the future under a wide array of demographic and environmental conditions that exist today. Even so, many tortoise populations will persist for 100 to 200 years (Miller et al. 2001; Tuberville et al. 2009). The longevity range suggested by Landers (1980; 40 to 60 years) is probably a conservative estimate. With a generation time of 31 years (Enge et al. 2006), 100 years only represents three generations of tortoises.

Over time, species experts developed models to evaluate the relationship between area of habitat occupied by gopher tortoises and abundance of tortoises. From that, they can define how many individuals constitute a viable population and how much area is required for such a population. Using that method, 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 1,865 acres, and contains 240 tortoises (Styrsky et al. 2010). A report

documenting the results of a recent workshop (organized by the Gopher Tortoise Council) on tortoise population viability is due in 2013. This report will describe the parameters of a minimum viable population of gopher tortoises as well as the minimum reserve size a viable population would require to persist long term.

In addition, Guyer et al. (2012) determined that when density falls below one tortoise every six acres, social interactions decrease dramatically because it takes too much energy to search for mates, thus potentially having a negative effect on reproduction. Therefore, the proximity of adult tortoises to one another is very important.

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. Unconstrained populations inhabited 353 to 618 acres. Recent modeling efforts recognize the need to evaluate the viability of individual populations; rank populations most appropriate for conserving them where they are; 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).



Randy Browning/USFWS

The range of gopher tortoise is generally associated with the longleaf pine ecosystem.

ESA Listing Factors/ Primary Threats to the Species



Matt Hinderliter/USFWS

Gopher tortoises require a sparse canopy and open understory for feeding and nesting.

The main purposes of the ESA are to conserve endangered or threatened species, to prevent their extinction, and “to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved.”

Under the ESA, when a species is able to survive on its own in the wild and the factors that previously threatened that species have been reduced, the species is considered “recovered,” and protection of the ESA may no longer be warranted.

The Service considers similar information in deciding whether to list a species under the ESA or to:

- Delist it, which means to remove it from endangered or threatened status;
- Reclassify it from endangered to threatened or vice versa; or
- Remove it from candidate status, which means the species no longer requires the protection of the ESA.

In every case, the Service assesses threats to the species using the five-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 warranted but precluded 12-Month Finding referenced on page 7. This information is outlined below according to each of the ESA’s five factors.

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

This factor is by far the biggest threat facing the continued existence of the gopher tortoise. There are many direct and indirect forces contributing to this threat, including, but not limited to:

- Habitat fragmentation by roads. This potentially causes road mortality, reproductive isolation, small and discontinuous populations, and edge effects that may increase predation.
- Habitat destruction from activities such as urbanization and sand extraction. This potentially causes direct mortality and/or displacement of tortoises to undesirable habitats.

- Habitat modification, either deliberate or from inattention, including conversion of open pine (e.g., longleaf pine) forests to other silvicultural or agricultural habitats; phosphate mining, shrub/hardwood/sand pine encroachment (mainly from fire exclusion or insufficient fire management); and establishment and spread of invasive species. This potentially causes the aforementioned indirect effects due to canopy closure and decline of available forage and groundcover.

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*) during “rattlesnake round-ups.” The technique of blowing fumes of noxious liquids (otherwise known as “gassing”) down tortoise burrows in order to capture the snakes undoubtedly harms or harasses the resident tortoise (Means 2009).

Factor C: Disease or predation;

Several diseases have been documented in the gopher tortoise, most notably an Upper Respiratory Tract Disease (URTD) resulting from *Mycoplasma* bacterial infection. This disease has been implicated in die-offs of gopher tortoises (Diemer Berish et al. 2010). Testing for the disease has proven challenging, and there is still debate over the extent and method of screening for the disease prior to relocating tortoises due to urbanization, restocking of depleted areas, or other reasons.

Predation, while almost exclusively a threat to eggs, hatchlings, and small juvenile tortoises, continues to be an ever-present threat. Many predators potentially having impacts that have not been fully documented. Predators include armadillos, coyotes, feral dogs, imported red fire ants, and humans.



Randy Brooming/USFWS

Longleaf and other open pine ecosystems need frequent controlled burns to benefit the gopher tortoise and many other fire-adapted species.

Factor D: The inadequacy of existing regulatory mechanisms;

Regulatory inconsistencies exist throughout the range of the gopher tortoise. Those need to be analyzed to determine which have the greatest effects on minimizing the threats to the species and therefore produce the best conservation benefits for individual tortoises, their populations, and their habitat. An example is the practice of maintaining a buffer area around known tortoise burrows when heavy machinery is used for habitat management. We need to explore and evaluate the need to have consistent buffer areas across the range, or define minimum standards to accommodate the wide arrange of ecological conditions across the range.

Factor E: Other potential natural or manmade factors affecting its continued existence.

Additional factors potentially threatening the continued existence of gopher tortoises include long-term herbicide exposure, road mortality, and climate change. However, the status of these potential threats is unknown and requires further investigation.

Current Conservation Needs

A strong conservation community is already established for the gopher tortoise throughout its range. These experts have produced innovative research studies, creative management plans, and a vast library of ecological, biological, and ethological data dating back several decades. They have documented threats to continued survival, habitat management tools, and habitat needs for the gopher tortoise. Now, through this conservation strategy, we are coalescing it 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. For the gopher tortoise and other conservation purposes, longleaf and other open pine ecosystems need frequent controlled burns that mimic historic conditions in terms of burn intervals, severity and seasonality.

Proper site-specific planning with professionals is crucial to determine at what point fire can safely be returned to an overgrown landscape, and at what point the fire return interval switches from a restoration phase to a management phase. 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 (plant and animal) are having on tortoise populations.

We need to take full advantage of the local knowledge in each state — through partnerships with federal, state, NGO, industry, and local sources — to identify the best remaining tortoise habitat and establish long-term protection of those lands. Funding sources must remain available to the research community and to land managers, specifically where potential priority areas are in drastic need of restoration and management, and where tortoise population responses to management actions are studied and can be expanded across a broader landscape. Examples of research needs can be found on pages 12, 13 and 14.



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Prescribed fire is a top priority of this conservation strategy.

Conservation Objectives and Action Plans



Randy Brouning/USFWS

For this section, action items described under Objective 1 address some overarching needs in how the Service, other federal agencies, the states and other partners define, enhance, and survey gopher tortoise populations in order to make the best conservation decisions. These needs do not specifically relate to any one of the five factors of threats to the species described previously. The remaining five objectives (Objectives 2 – 6) are organized to correlate directly to the five-factor analysis under the ESA. Objective 2 directly relates to Factor A, Objective 3 directly relates to Factor B, and so on. Coordinating federal and state partners have been or will be assigned to take the lead in addressing each objective and action item (Appendix 1).

Objective 1: Determine population viability parameters and status.

- Establish consensus within the research community on what defines a viable gopher tortoise population across various states and habitats, for example, age structure, number of individuals, acreage, recruitment rate, and spatial distribution (in progress).
- Establish consensus on the necessary number and distribution of viable gopher tortoise populations in suitable habitat, such that the species in the eastern portion of its range would be considered secure, and in the western range would be considered recovered.
- Investigate the potential use of captive-reared or head-started gopher tortoises (with starter burrows) to augment a population or re-populate a previously occupied area to increase viability of the general population.
- Integrate the use of Line Transect Distance Sampling (LTDS) as a surveying/monitoring protocol (where applicable) into state, federal, and local policy as the approved method to accurately assess gopher tortoise population levels, trends, and responses to management. In addition, determine the appropriate timeframes for surveying, and acceptable alternative survey protocols in small parcels and in scrub or flatwoods communities (in progress).
- Where appropriate and requested by the state agency, the Service's Section 6 funding may be used to conduct surveys and censuses of large, suitable public parcels that contain a substantial amount of potential gopher tortoise habitat, to estimate the number of tortoises present and evaluate those sites for potential tortoise population enhancement or re-establishment.
- Provide information and incentives to private landowners to manage their land for tortoises, possibly working with partners to offer higher cost-sharing for more aggressive habitat management.



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A gopher tortoise burrow in Georgia.



An adult gopher tortoise typically weighs between nine and thirteen pounds.

Objective 2: Address the present and threatened destruction, modification, or curtailment of gopher tortoise habitat.

- Identify, prioritize, manage and protect, viable tortoise populations and the best remaining tortoise habitat.
- Increase the size and/or carrying capacity of those viable population areas (and areas with tortoise populations just below the “viable” threshold) through applied land management, land acquisition, or incentives to adjacent landowners to properly manage for tortoises.
- Work with partners and land managers to maximize the amount of acreage appropriately maintained by prescribed fire, with specific emphasis on developing implementation plans that include recommendations on fire intensity, frequency, seasonality, and post-fire analyses.

Part of this effort should be educational outreach with the public, emphasizing the benefits of prescribed fire for both habitat management and for decreasing the chances of catastrophic wildfire.

- Create a draft document detailing Best Management Practices (BMPs) and Desired Future Conditions (DFCs) for various gopher tortoise habitat types (longleaf pine forests, sandhills, scrub, etc.) for range-wide distribution; encourage participation from the silvicultural industry, private lands foresters, and biologists in the development of these recommendations to ensure they are practical as well as compatible with existing conservation measures.
- 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. These lands are likely to be directly adjacent to current managed lands.

Objective 3: Address issues related to overutilization for commercial, recreational, scientific, or educational purposes.

- Work with partners to convert the two remaining rattlesnake round-ups to wildlife festivals.
- Work with state partners to improve protections against gassing of venomous snakes.

Objective 4: Investigate and mitigate disease and predation effects.

- With a gopher tortoise health/disease working group:
 - Do a risk assessment study to determine the level of threat of disease.
 - Investigate if and when disease testing should be performed on gopher tortoises, and for what diseases.
- Identify the predators having the largest impact on gopher tortoise populations, with special emphasis on documenting unnaturally high rates from nuisance, invasive, and introduced predators (e.g., coyotes, armadillos, feral hogs, and imported red fire ants). This should include documenting predation on various tortoise age classes, and recommendations for predator control.
- Work with local and state law enforcement to investigate the magnitude of tortoise harvest for human consumption, evaluating current regulations and creating outreach to educate the public on the ecological and cultural value of gopher tortoises, and the laws protecting them.

Objective 5: Investigate range-wide effective regulatory mechanisms.

- Develop minimum standards for regulatory mechanisms (existing or future mechanisms) that should be in place in order to minimize threats to the species.



Fire is an integral part of the longleaf ecosystem.

- Evaluate the need to adopt consistent mitigation strategies across the range to address the ongoing need to relocate tortoises in a way that minimizes loss of preferred habitat (sandy soils, open forest structure, herbaceous groundcover), maximizes site fidelity, and provides protection of relocated tortoises and the recipient site.
- Evaluate the need for each state in the species' candidate range to have a step-down action plan (State Management/Conservation Plan).
- Encourage and assist in the development and implementation of a model, programmatic and voluntary agreement for each state that details effective, measurable conservation objectives and habitat management goals.
- Complete a study investigating gopher tortoise burrow collapse, specifically to determine the minimum distance from the entrance where the burrow integrity is still maintained when run over by heavy equipment (in different representative soil types). This value can then be used as a burrow buffer recommendation range-wide for conservation measures during habitat management practices.
- Evaluate state regulatory processes to minimize and mitigate the loss and degradation of tortoise habitat resulting from agricultural land conversion.
- Work with urban development planning authorities to include considerations for gopher tortoise priority habitats and the importance of utilizing prescribed fire for management.

Objective 6: Investigate other natural or man-made factors affecting its continued existence.

- Initiate a risk assessment of the use of herbicides in gopher tortoise habitat, specifically where broad-spectrum herbicides are utilized as a common management tool and not just for treating invasive species. The study should evaluate the potential short-term and long-term impacts on forage availability, as well as tortoise health and reproduction.

Summary



Randy Brooming/USFWS

Gopher tortoises can excavate many burrows over their lifetime.

The majority of these objectives address, either directly or indirectly, the primary threat to the gopher tortoise: the destruction, modification, or curtailment of its habitat. Other 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 some form of active, sometimes intensive, habitat management to maintain the open conditions essential to population stability (Guyer et al. 2012). The good news is successful conservation of the longleaf pine ecosystem and other suitable habitats will benefit not only tortoise populations, but also other native rare species such as the red-cockaded woodpecker and eastern indigo snake. While 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 well managed and protected when possible.

One unifying action needed to reach many of these conservation objectives is to work with partners to participate in the development and implementation of conservation programs, taking advantage of private lands management-based initiatives. Through communication and coordination with landowners, we need to demonstrate that by creating a matrix of habitat types across their lands, it is possible to conserve gopher tortoises while still maintaining the economic value of their lands for silvicultural, recreational, agricultural, and other uses.

Habitat protection and restoration (e.g., adding fire on the landscape) has been and continues to be an important conservation strategy for this species. Many of the larger known populations of gopher tortoises occur on state conservation lands, national forests, and military installations, and are managed under site-specific management plans.

However, we recognize many private landowners have conserved large parcels of high-quality tortoise habitat. We need to ensure private landowners are aware of and recognize the value in the existing tortoise management programs available to them.

Past protection efforts have focused on securing high quality natural communities because of the values these habitats provide to tortoises and many other wildlife species. However, most protected habitat contains a matrix of varying quality tortoise habitat. Management of quality native habitats through acquisition or conservation easements will continue to be priorities, but it may also be desirable to protect disturbed or altered habitats when they augment existing adjacent gopher tortoise habitat or otherwise contribute towards recovery of the tortoise.

Agency Contacts



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Gopher tortoises reach reproductive maturity between 12 and 20 years of age.

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Appendix 1. Matrix of Conservation Strategy Objectives, Action Items, and Teams

Threat	FWS Lead	State Lead	Action Items
Objective 1. Determine population viability parameters and status Co-Leads: FWS (TBD), States (TBD)			
Lack of information on tortoise population viability			1. Establish consensus within the research community on what defines a viable tortoise population
			2. Establish consensus on the number and distribution of viable tortoise populations necessary to demonstrate species stability
			3. Investigate using head-started or captive-reared tortoises to augment populations
Lack of survey data and consistent survey methodology			4. Integrate the use of Line Transect Distance Sampling (LTDS) as the approved method of surveying and monitoring tortoise populations; establish recommended monitoring schedules
			5. Working with partners, provide information and incentives to private landowners to manage their lands for tortoises
			6. Investigate the use of Section 6 funding to conduct tortoise surveys of large, suitable public parcels to estimate population levels and evaluate potential population enhancement
Objective 2. Address the present and threatened destruction, modification, or curtailment of gopher tortoise habitat Co-Leads: FWS (Hinderliter), States (TBD)			
Lack of prioritization of tortoise conservation areas			1. Identify, prioritize, protect, and manage viable tortoise populations and best habitats
			2. Increase the size and/or carrying capacity of the viable population areas
			3. Locate areas of “secondary priority” where re-stocking and restoration have the best potential
Fire suppression			4. Work with land manager partners to streamline prescribed fire implementation plans
Silvicultural and agricultural compatibility with tortoise habitats			5. Create a document detailing Best Management Practices and Conservation Objectives for southeastern landscapes, with at-risk species considerations
Objective 3. Address issues related to overutilization for commercial, recreational, scientific, or educational purposes Co-Leads: FWS (Doresky), States (TBD)			
Tortoises harmed due to collection of rattlesnakes for round-ups			1. Work with partners to convert the two remaining round-ups to wildlife festivals
			2. Work with state partners to improve the laws protecting venomous snakes from gassing

Threat	FWS Lead	State Lead	Action Items
Objective 4. Investigate and mitigate disease and predation effects			
Co-Leads: FWS (Hinderliter), States (TBD)			
Disease impacts on populations			1. Investigate when and how to test tortoises for disease, and what to do with those that test positive
Predation of all tortoise life stages (egg, hatchling, juvenile, adult)			2. Identify the predators having the largest impact on tortoise populations
			3. Investigate the magnitude of tortoise harvest for human consumption
Objective 5. Investigate range-wide effective regulatory mechanisms			
Co-Leads: FWS (Imm), States (TBD)			
Inconsistent mitigation/relocation protocols range-wide			1. Develop mitigation guidelines for tortoise relocation, including methods, disease avoidance, site fidelity, habitat management, and long-term protection of recipient sites
Lack of large-scale management/conservation plans			2. Investigate whether each state should pursue a State Management Plan similar to Florida's
			3. Develop minimum standards for regulatory mechanisms
			4. Encourage development and implementation of a state-wide programmatic HCP or CCAA
Land conversion			5. Evaluate regulatory processes to minimize/mitigate for habitat loss from agricultural land conversion
			6. Work with urban development planning authorities to include gopher tortoise priority habitats and prescribed fire
Burrow collapse during habitat management			7. Design and conduct burrow collapse study to determine where burrows remain intact when run over by heavy machinery
Objective 6. Investigate other man-made or natural factors affecting its continued existence			
Co-Leads: FWS (Porter), States (TBD)			
Effects of herbicide exposure			1. Initiate a risk assessment of long-term, chronic exposure effects of herbicide usage
Road mortality			2. Work with federal, state, and local transportation agencies to identify areas with high incidence of tortoise mortality where impact minimization practices could be implemented

Appendix 2. Gopher Tortoise Species Description



The forelimbs of the gopher tortoise are shovel-like, with claws used for digging burrows.

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 has a domed, brown to grayish-black carapace typically about 10-14 inches long, and typically weighs about 9-13 lbs. 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 about 2 inches in length, with a softer, yellow-orange shell (Ernst and Lovich 2009).

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 up to 67 feet (Ashton and Ashton 2008), 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, feed, and reproduce. Tortoises typically breed from March through October (Landers et al. 1980; McRae et al. 1981; Wright 1982; USFWS 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.

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. However, 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 (Service 2011).

Habitat Description

Gopher tortoises require relatively 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, xeric Florida scrub, maritime 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 (Craul 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 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 open understory 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.