# APPENDIX C

# SPECIES SURVEYS AND HABITAT ASSESSMENTS

- USFWS Official Species List
- 2018-2019 Survey for Protected Amphibians/Reptiles on the Twin Pines Site, Charlton County, Georgia – Altamaha Environmental Consulting
- Results of Eastern Indigo Snake Surveys on the Twin Pines Site, Charlton County, Georgia: Year 2 – Altamaha Environmental Consulting
- 2019 Survey for Rare, Threatened and Endangered Plants, Twin Pines Mining Block 1, Charlton County, Georgia – Terra-Ignea Enterprises, LLC
- Threatened & Endangered Species Habitat Assessment Report, Approximately 53.095-acre Chip Mill Property, Saint George, Charlton County, Georgia – TTL, Inc.
- USFWS, Endangered and Threatened Wildlife and Plants; Finding for the Gopher Tortoise Eastern and Western Distinct Population Segments, 87 Fed. Reg. 196 (Oct. 12, 2022).

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Georgia Ecological Services Field Office
355 East Hancock Avenue
Room 320
Athens, GA 30601
Phone: (706) 613-9493 Fax: (706) 613-6059

In Reply Refer To:
Consultation Code: 04EG1000-2020-SLI-1378
Event Code: 04EG1000-2020-E-02535
Project Name: Saunders Demonstration Mine

February 28, 2020

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

This list identifies threatened, endangered, proposed and candidate species, as well as critical habitat, that may be affected by your proposed project. This list may change before your project is completed. Under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation.

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq*.). Projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html).

Wind energy projects should follow the wind energy guidelines http://www.fws.gov/windenergy/ for minimizing impacts to migratory birds and bats.

Guidance for minimizing impactsof communcation towers on migratory birds can be found under the "Bird Hazards" tab at: www.fws.gov/migratorybirds.

Attachment(s):

- Official Species List

# Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

**Georgia Ecological Services Field Office**
355 East Hancock Avenue
Room 320
Athens, GA 30601
(706) 613-9493

## Project Summary

Consultation Code: 04EG1000-2020-SLI-1378

Event Code: 04EG1000-2020-E-02535

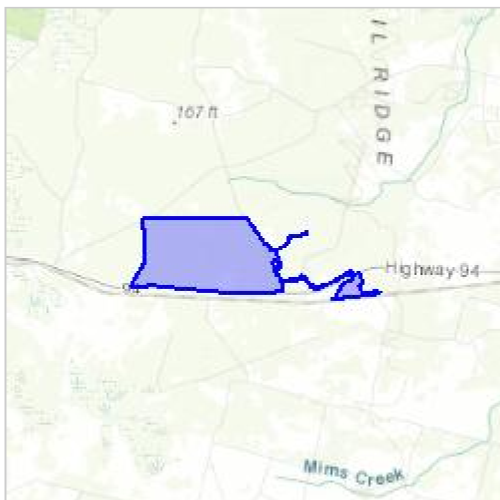
Project Name: Saunders Demonstration Mine

Project Type: MINING

Project Description: heavy mineral sand demonstration mining project

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/30.523742267443925N82.11752613020312W




Counties: Charlton, GA

# Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

## Birds

| NAME | STATUS |
|---|---|
| Red-cockaded Woodpecker *Picoides borealis*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/7614 | Endangered |

## Reptiles

| NAME | STATUS |
|---|---|
| Eastern Indigo Snake *Drymarchon corais couperi*<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/646 | Threatened |
| Gopher Tortoise *Gopherus polyphemus*<br>Population: eastern<br>No critical habitat has been designated for this species.<br>Species profile: https://ecos.fws.gov/ecp/species/6994 | Candidate |

## Amphibians

| NAME | STATUS |
|---|---|
| Frosted Flatwoods Salamander *Ambystoma cingulatum*<br>There is **final** critical habitat for this species. Your location is outside the critical habitat.<br>Species profile: https://ecos.fws.gov/ecp/species/4981 | Threatened |

## Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Altamaha Environmental Consulting

414 Club Drive
Hinesville, Georgia 31313
912.255.2003

# 2018-2019 Survey for Protected Amphibians/Reptiles on the Twin Pines Site, Charlton County, Georgia

**DIRK J. STEVENSON**

dstevenson@altamahaec.com

# 2018-2019 Survey for Protected Amphibians/Reptiles on the Twin Pines Tract, Charlton County, Georgia

## Executive Summary

*From November 2018 – April 2019, I conducted amphibian and reptile surveys on four tracts (Adirondack, Keystone, Loncala, TIAA) that are part of the Twin Pines Site, Charlton County, Georgia. These field surveys were species-specific, targeting 2 reptile species (eastern indigo snake, gopher tortoise) and 3 amphibians (frosted flatwood salamander, striped newt, gopher frog) which are federally listed and-or state listed.*

*Isolated depressional wetlands (i.e., cypress-gum ponds) on-site (n = 41) were reviewed to determine their habitat characteristics and potential suitability for the amphibian species, especially the frosted flatwoods salamander. Almost all wetlands were considered poor habitat due to historic/current disturbances from commercial forestry practices (to both wetlands and adjacent uplands). Twelve depressional wetlands were surveyed by dip-netting and minnow trapping during February-March 2019; no frosted flatwoods salamanders or striped newts were found.*

*Transect surveys for gopher tortoises identified 118 active/inactive tortoise burrows. Visual encounter surveys conducted at/near each of these gopher tortoise burrows during the winter months (conducted on 2-3 separate dates) did not document any evidence of eastern indigo snake presence on-site. Scoping gopher tortoise burrows in April 2019 with a gopher tortoise burrow camera revealed resident tortoises in 23 adult-sized burrows, 11 subadult-sized burrows, and in 1 juvenile-sized burrow; occupancy of another 4 active adult burrows, 11 active subadult burrows, and 2 active juvenile burrows could not be determined conclusively and these burrows may also contain tortoises.*

*The state-rare gopher frog was observed on-site (6 adult frogs were observed, all in tortoise burrows). Three "special concern" animal species tracked by Georgia Department of Natural Resources (redface topminnow, pine snake, black swampsnake) were documented on-site during the course of these surveys.*

Below I summarize the results of my field surveys for federal-and-state-listed amphibians and reptiles on the Twin Pines Site. Aerial photos and topographic map figures of survey sites are shown in Figures 1 and 2, respectively.

## FEDERALLY LISTED SPECIES

### Frosted Flatwoods Salamander (*Ambystoma cingulatum*)

#### *Background*

The Frosted Flatwoods Salamander (*Ambystoma cingulatum*) is federally listed as Threatened and state listed by the Georgia Department of Natural Resources as Threatened. This salamander is endemic to mesic longleaf pine-wiregrass flatwoods and savannahs where it breeds in isolated, ephemeral depressional wetlands (Palis 1997; Jensen and Stevenson 2008). Optimal breeding habitats are kept open-canopied by occasional fire events and the basins of these wetlands are typically carpeted with graminaceous vegetation (Bishop and Haas 2005, Palis 1997; US FWS 1999). Adult salamanders spend over 90% of their lives in fire-maintained, mesic longleaf/slash pine–wiregrass flatwoods surrounding breeding sites (Palis and Means 2005). Late winter-early spring surveys for larvae are the most effective and efficient way to document the presence of this salamander (Bishop et al. 2006, Bevelhimer et al. 2008).

Since 2003, the frosted flatwoods salamander has been documented from only one site in Georgia–a breeding pond on Fort Stewart (Liberty County). There are no recent records (i.e., post-2000) for Charlton County, Georgia (John Jensen, Georgia Department of Natural Resources, pers. comm., 2019). The nearest (i.e., closest to the Twin Pines site) historic frosted flatwoods salamander records (with year date of most recent collection and distance from Twin Pines, in parenthesis) include: a) Chesser Island, on what is now the Okefenokee National Wildlife Refuge, Charlton County, Georgia (1922; ca. 17 km N of Twin Pines study area); b) a site in Duval County, Florida (1980; ca. 30 km SE of the study area); c) State Hwy. 177, SSE Waycross, Ware County, Georgia (1980; ca. 56 km N of the study area) (John Jensen, Georgia Department of Natural Resources, pers. comm., 2019; Kevin Enge, Florida Fish and Wildlife Conservation Commission, pers. comm., 2019).

#### *Survey Methods*

In December, 2018, I visited all wetlands on-site that could be considered potential breeding pond habitats for the frosted flatwoods salamander (i.e., isolated depressional wetlands forested with pond cypress (*Taxodium ascendens*), black gum (*Nyssa biflora*), slash pine (*Pinus elliottii*), and myrtle-leaved holly (*Ilex myrtifolia*) (Figure 3). Earlier in 2018, these wetland systems had been delineated and mapped by TTL staff.

Each wetland (*n* = 41) was evaluated as to its potential suitability for frosted flatwoods salamander reproduction modeled after a ranking system developed by Palis (2002). Specifically, for each wetland I evaluated:

1) <u>Pond Hydrology:</u> Based on canopy-subcanopy species and other vegetation present in the wetland basin. For a site to be considered for surveys it had to be an ephemeral wetland that would possess an appropriate hydroperiod, during an average year, to allow frosted flatwoods salamander larval development.

2) <u>Presence/Absence of Graminaceous Vegetation in Pond:</u> Each pond was qualitatively scored 1, 2, or 3, as follows: 1 = Sites with abundant graminaceous vegetation (especially *Carex*, *Rhynchospora*, *Eriocaulon*, *Xyris*, and *Panicum* spp.) throughout the wetland basin; 2 = Sites with some, albeit patchy, graminaceous vegetation in basin; 3 = sites lacking, or nearly so, graminaceous vegetation.

3) <u>Fire History of Pond:</u> As above, each pond was qualitatively scored 1, 2, or 3, as follows: 1 = Sites with a regular history of fire management and/or fire events that have promoted the open-canopied and grassy conditions in the pond basin needed for salamander reproduction; 2 = Sites that are noticeably fire-suppressed, but have had some recent fire history; 3 = Sites that are severely fire-suppressed, shaded and impenetrably shrubby, and/or lacking ground cover.

4) <u>Condition of Upland Habitats Surrounding Pond:</u> As above each pond was scored a 1, 2, or 3, as follows: 1 = wetland sites surrounded by mesic, intact and fire-managed longleaf/slash pine–wiregrass flatwoods; 2 = wetland sites surrounded by planted pine habitats lacking intact ground cover layers (i.e., no wiregrass, indicating profound soil disturbance); 3 = surrounding uplands as # 2 above, significantly degraded and showing evidence of having recently been clearcut, site-prepped and bedded, and/or treated with herbicides as part of commercial forestry operations.

Wetland habitat ranks are shown in Table 1. None of the 41 ponds that I reviewed were surrounded by naturally-functioning, intact longleaf/slash pine–wiregrass flatwoods habitat and upland habitat conditions for all sites was scored a "3". In fact, at all sites, upland habitats have been grossly degraded by silvicultural practices (bedding, ditching, fire suppression, etc.) and there are no areas of upland habitat remaining that are characterized by undisturbed soil and an intact, wiregrass-dominated groundcover.

Similarly, isolated wetlands on-site are also in poor condition due to bedding (historically, beds have been plowed into the ecotones and often into the basins of depressional wetlands on-site), ditching, historic fire suppression, and other disturbances. Although some ponds on-site possessed graminaceous vegetation in their basins, we suspect these wetlands had long been fire-suppressed (with a concomitant increase in canopy and shrub layer vegetation) before being burned by a catastrophic wildfire on 6 May 2017. As it passed through the basins of isolated depressions that most likely had been fire-suppressed for many years this fire event killed many of the larger slash pine, pond cypress, black gum and myrtle-leaved holly in these wetlands. Unusually thick mats of sphagnum moss are now present in many of these wetlands.

I selected 12 of the 41 ponds, including sites spread over the entire property (i.e., ponds on the Adirondack, Keystone, Loncala and TIAA tracts) as survey sites for frosted flatwoods salamanders (Figure 4). Some graminaceous vegetation is present in the basins of these wetlands (Figure 5). The wet winter of 2018–2019 included frequent rain events and filled these pond basins − providing appropriate hydroperiod conditions for salamander reproduction. I sampled each of these 12 wetlands for frosted flatwoods salamander larvae during February-March 2019 using dipnets and minnow traps (Figure 6). Some of the minnow traps deployed (during surveys conducted from 2/28 – 3/9/2019) were provided with glow-sticks, as doing so may enhance capture rates of ambystomatid salamander larvae (Bennett et al. 2012). However, *Ambystoma* larvae, including those of the frosted flatwoods salamander, are also commonly captured in minnow traps not provided with glow-sticks (Stevenson, unpubl. data).

*Results and Discussion*

The 12 survey ponds were sampled from 27 February− 9 March 2019. My surveys included 17.25 person-hours dip netting and 175 trap-nights. No frosted flatwoods salamander larvae were found. On these surveys I captured 2 species of salamanders, 6 species of anurans, 9 species of fishes, and 4 species of snakes (Tables 2 and 3). During the same period frosted flatwoods salamander larvae were found on Fort Stewart, Georgia, indicating the species bred at this site during the fall-winter of 2018-2019 (Chris Coppola, U.S. Fish and Wildlife Service, pers. comm., 2019).

The disappearance of the frosted flatwoods salamander from Chesser Island and Okefenokee National Wildlife refuge lands is most likely attributed to anthropogenic disturbances the region suffered prior to being acquired by the U.S. Fish and Wildlife Service (Jensen 1995). Large-scale declines and extirpations of frosted flatwoods salamanders have been attributed to habitat loss and degradation from commercial forestry practices (Means et al. 1996, Palis 1997). In fact, the impetus, in part, for the federal listing of the species in 1999 was widespread loss of habitat due to silviculture (US FWS 1999). It is probable that my inability to document frosted flatwoods salamanders − as well as two easily sampled frog species typical of pine flatwoods habitats, the southern chorus frog (*Pseudacris nigrita*) and ornate chorus frog (*Pseudacris ornata*) – on Twin Pines is due to their extirpation, historically, from habitat changes caused by forestry operations (Figure 7).

The uplands on the Twin Pines site − although in some areas underlain by hydric-to-mesic flatwoods soils that historically may have supported the specific pine savannah habitats required by frosted flatwoods salamanders− are, as detailed above, grossly degraded from commercial forestry operations that (based on a review of aerial photographs) date at least to the early 1970s (Figures 8 and 9). Today, these uplands no longer support intact ground vegetation (e.g., wiregrass, *Aristida stricta*) as is typical of habitat still occupied by this species.

## Eastern Indigo Snake (*Drymarchon couperi*)

### *Background*

The eastern indigo snake was federally listed as Threatened in 1978 and is state listed by the Georgia Department of Natural Resources as Threatened. The snake is generally, albeit locally, distributed in southeastern Georgia with several recent records (i.e., 2000-present) available for Trail Ridge, Charlton County, Georgia (Enge et al. 2013). An extant eastern indigo snake population occurs at the Okefenokee National Wildlife Refuge, Charlton County, Georgia, approx. 18 km N of the Twin Pines site (Stevenson 2010). Other indigo snake records located relatively close to the Twin Pines site (with year date of most recent collection and distance from Twin Pines, in parenthesis) include Cary State Forest, Nassau County, Florida (1965; 21 km E of Twin Pines) and Whitehouse Naval Outlying Field, Duval County, Florida (1996; 29 km SE of Twin Pines) (Enge et al. 2013; Kevin Enge, Florida Fish and Wildlife Conservation Commission, pers. comm., 2019).

I conducted surveys for eastern indigo snakes following methods described by Stevenson et al. (2003, 2009) and Bauder et al. (2017) that are effective for the species in the southern Georgia portion of its range. Specifically, I conducted visual encounter surveys for indigo snakes overwintering in gopher tortoise colonies. I surveyed for basking indigo snakes, and shed skins, at/near all active/inactive gopher tortoise burrows on-site ($n$ = 118) on 2-3 dates during the cooler months (my surveys were conducted from 17 December 2018 to 19 March 2019). Maps of indigo snake survey areas and gopher tortoise burrow locations are provided (Figures 10 and 11).

On each indigo snake survey, each tortoise burrow was carefully examined for the presence of fresh snake tracks (if found, burrows with tracks are scoped with a gopher tortoise burrow camera in an effort to locate snakes resting deep inside the burrow). From 1-4 TTL biologists assisted me on these surveys.

No eastern indigo snakes or eastern indigo snake shed skins were found by my visual encounter surveys at the Twin Pines site, and no fresh snake tracks were located at burrows. A single pygmy rattlesnake (*Sistrurus miliarius*), the shed skin of an eastern coachwhip (*Coluber flagellum*) and two observations of gopher frogs (*Rana capito*) were observed during my surveys (Table 4).

In addition to the above visual encounter surveys, all active/inactive gopher tortoise burrows on-site were visited on 2-4 April 2019. As part of a tortoise survey, most subadult-and-adult-sized burrows were scoped with a tortoise burrow camera at this time (see Gopher Tortoise account below). No indigo snakes or shed skins were found during this effort.

The indigo snake is an extremely vagile species that often moves between upland and wetland habitats in search of food (Stevenson et al. 2010, Breininger et al. 2011). Individual snakes studied in southern Georgia had large home ranges, for some large males up to 3,500 acres in size (Hyslop et al. 2014). A lack of indigo snake observations during focused surveys doesn't demonstrate that the species is never present or transient on the Twin Pines site (even if the species doesn't winter on-site it is possible that snakes from adjacent tracts, if present that is, may occasionally visit the Twins Pines site to forage). However, there are no recent credible sightings known for the property (i.e., from TTL and other staff who have spent considerable field time on-site).

## STATE-LISTED SPECIES

### Gopher Tortoise (*Gopherus polyphemus*)

The gopher tortoise is a federal candidate for listing and is state-listed as Threatened by the Georgia Department of Natural Resources.

Gopher tortoise survey methods closely followed those recommended by Smith et al. (2009). From a review of soil maps and vegetation, combined with initial field reconnaissance, it became apparent that, on-site, gopher tortoise burrows were limited to habitats underlain by the soil type classified as Mandarin Fine Sand (MAA). Mandarin soils are fine to loamy sands and are somewhat poorly-drained; seasonally, the water table may be within 1.5-2 m of ground surface (we observed water ca. 1.5 - 2 m below ground surface in most burrows located at site Loncala-A during January, 2019). Mandarin is classified as a suitable soil, but not as a preferred soil, for the tortoise (U.S. Department of Agriculture Natural Resources Conservation Service, 2013).

To locate burrows, we walked line transects, with observers spaced ca. 5 m apart, through all areas of potential habitat. Except for eight burrows on the Adirondack tract that we first located in March 2019, we flagged and collected geospatial data for all active (i.e., intact burrows with fresh tortoise tracks) and inactive (i.e., intact burrows, but lacking fresh tracks) tortoise burrows on the Twin

Pines site during the summer-fall of 2018 (for a grand total of 118 active/inactive burrows) (Figures 10 and 11).

On the Twin Pines site, the sandy, well-drained environments that support gopher tortoises have historically been site-prepped and bedded and are now in planted pine, usually slash pine.  Tortoises are not especially common or widespread on Twin Pines site, occurring only in 4-5 fairly small and discrete areas of sandy, open-canopied plantation habitat; individual tortoise colonies support ca. 10-15 adult tortoises, or less.

On 2-4 April 2019, we revisited the 118 burrows and (except for 17 burrows that were now abandoned) we measured each burrow with calipers (50 cm inside the burrow entrance); burrow width is related to tortoise carapace length and thus one can estimate the size of the tortoise occupying a particular burrow from its width (Martin and Layne 1987).  We classified gopher tortoise burrow widths to size class as follows:  juvenile burrows are 0-7.85 cm in width; subadult burrows 7.86- 25.7 cm wide; adult burrows are 25.8+ cm wide (these widths correspond to carapace lengths of 0-12 cm, 12.1-24 cm, and 24+ cm, respectively.

Also on 2-4 April, to obtain an accurate tortoise population estimate for the Twin Pines site we scoped gopher tortoise burrows using a burrow camera system (burrow camera built by Emmett Blankenship, Environmental Management Systems, Inc., Canton, GA) (Figure 12). (Note: 19 burrows that were less than 14 cm in burrow width were not scoped because of their small size; however, they were closely examined using a mirror or flashlight and in doing so we observed tortoises in 5 of these burrows; we scoped all remaining burrows).

With the burrow camera (or using flashlights/mirrors), we observed gopher tortoises in 23 adult-sized burrows, 11 subadult-sized burrows, and in 1 juvenile-sized burrow.  For another 4 active adult-sized burrows, 11 active subadult-sized burrows, and 2 active juvenile burrows, we could not determine conclusively whether or not the burrow was in fact occupied by a tortoise.

Four adult gopher frogs and one Florida pinesnake were observed during these surveys. Tortoise survey data is provided in Table 5.

Striped Newt (*Notophthalmus perstriatus*)

Until recently the striped newt was considered a candidate for federal listing under the Endangered Species Act. In December 2018, the U.S. Fish and Wildlife Service determined that federal listing is not warranted at this time (US FWS 2018). The species is state listed as Threatened by the Georgia Department of Natural Resources. This amphibian is known to have declined and disappeared from portions of its historic range on Trail Ridge, near the Okefenokee Swamp National Wildlife Refuge, due to commercial forestry operations (Dodd and LaClaire 1993, Farmer et al. 2017). Since 1990, the striped newt has been found at a single site in Charlton County, Georgia, a pond on the Okefenokee NWR (located ca. 18 km N of Twin Pines); the newt was last found at this site in 1994 (Farmer et al. 2017).

My dipnet and minnow trap surveys of 12 isolated wetlands on-site did not document the striped newt. Naturally-functioning longleaf pine–wiregrass sandhills, the preferred habitat for transformed examples of this newt, are lacking on-site. Due to the profound habitat changes and perturbations from commercial forestry practices (see Frosted Flatwoods Salamander Account above) it is unlikely that the species persists on the Twin Pines site, if in fact it was ever present.

Gopher Frog (*Rana capito*)

The gopher frog, state-listed as Rare by the Georgia Department of Natural Resources, was documented on the Twin Pines site, including observations for the Adirondack, Keystone, and Loncala tracts (Figure 13). A total of six gopher frogs were observed, including three adults seen in gopher tortoise burrows during indigo snake surveys or gopher tortoise surveys and three adults observed in tortoise burrows while scoping burrows with the burrow camera. Two frogs were captured and voucher photographs were taken of these specimens. Dates and specific location information for these records are provided in Table 5.

Dipnet and minnow trap surveys of 12 isolated wetlands that I conducted on-site during February-March 2019 did not document egg masses or tadpoles of the gopher frog. On 23 April 2019, I visited two wetlands on the Loncala tract (30.57433°N, 82.11841° W and 30.57040°N, 82.12284° W) that were not among the 12 survey sites but that are located fairly close (within a quarter mile or less) of three of our gopher frog sightings; both sites were in poor condition (e.g., choked with sphagnum, thick with bay trees) and no gopher frog tadpoles were found.

An isolated wetland I surveyed in March 2019 (A-04; 30.525379°N, 82.09925° W), dry when revisited on 23 April 2019, is a potential breeding pond for the gopher frog (Figure 3). A small cypress pond, converted in part into a borrow pit and located offsite and just south of the Keystone tract (30.51613°N, 82.11790°W), may be a breeding site used by gopher frogs.

OTHER STATE-LISTED AND SPECIAL CONCERN ANIMAL SPECIES

As a by-product of the herpetofaunal surveys I conducted on the Twin Pines site from November 2018−April 2019, a total of 38 species of amphibians and reptiles were observed on-site (comprised of 3 species of salamanders, 11 species of anurans, 3 species of turtles, 7 species of lizards, 13 species of snakes, and the American alligator) (Appendix 1). The state-listed (Threatened) southern hog-nosed snake (*Heterodon simus*), state-listed (Rare) mimic glass lizard (*Ophisaurus mimicus*) and state-listed (Unusual) Spotted Turtle (*Clemmys guttata*) were not found on-site and the extremely limited, if any, suitable habitat on-site for these taxa. There are no spotted turtle records close to the Twin Pines site (Stevenson et al. 2015).

The state-listed Bachman's sparrow (*Peucaea aestivalis*) was documented from one location on-site and from a second location just east of the site boundary. Three special concern animal species that are monitored by the Georgia Department of Natural Resources Biotics Division were found on site: redface topminnow *Fundulus rubifrons*, Florida pine snake (*Pituophis melanoleucus*), and black swampsnake (*Liodytes pygaea*); locality data for these species is presented in Supplemental File 1.

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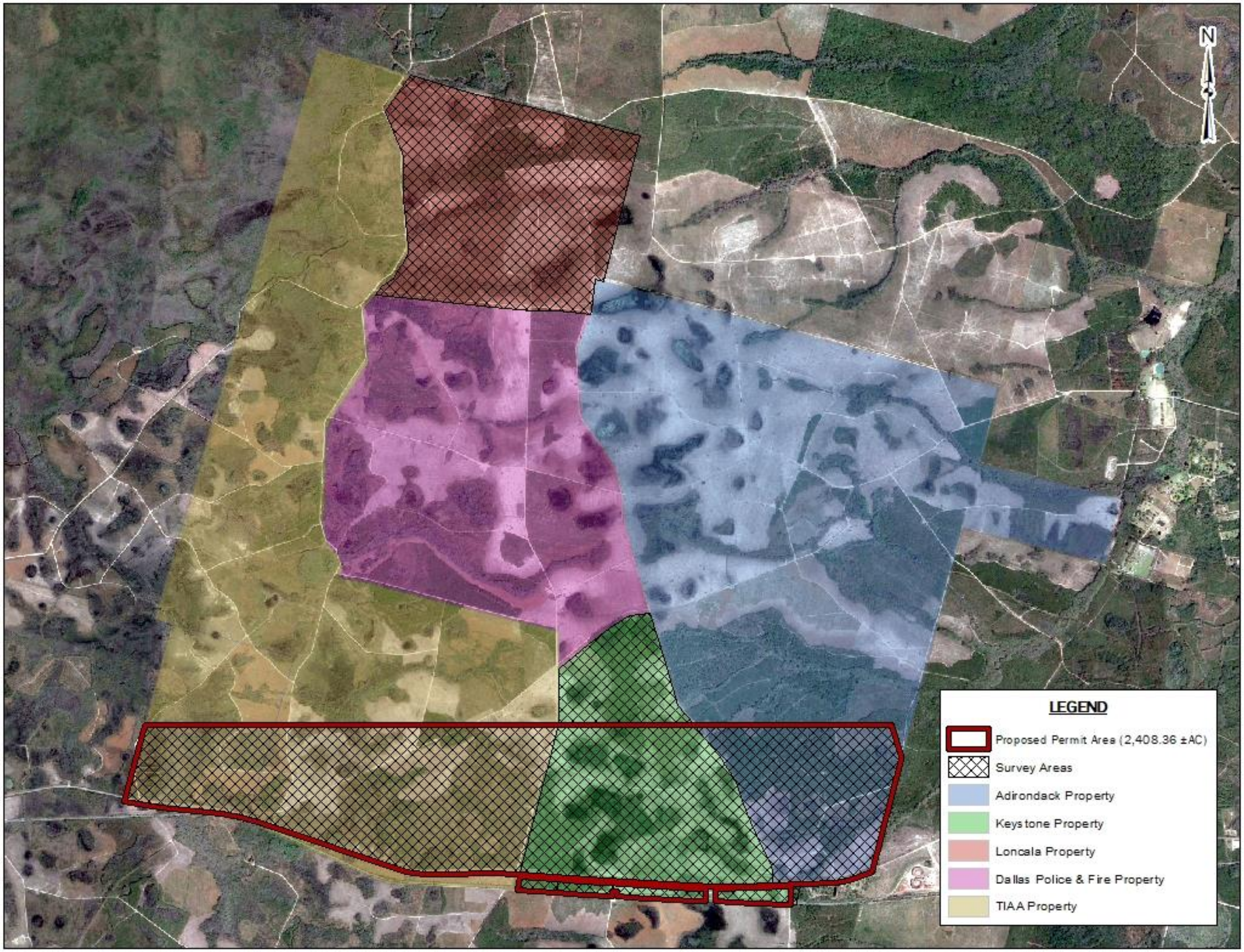


Figure 1. An aerial photograph of the Twin Pines site amphibian/reptile survey areas.

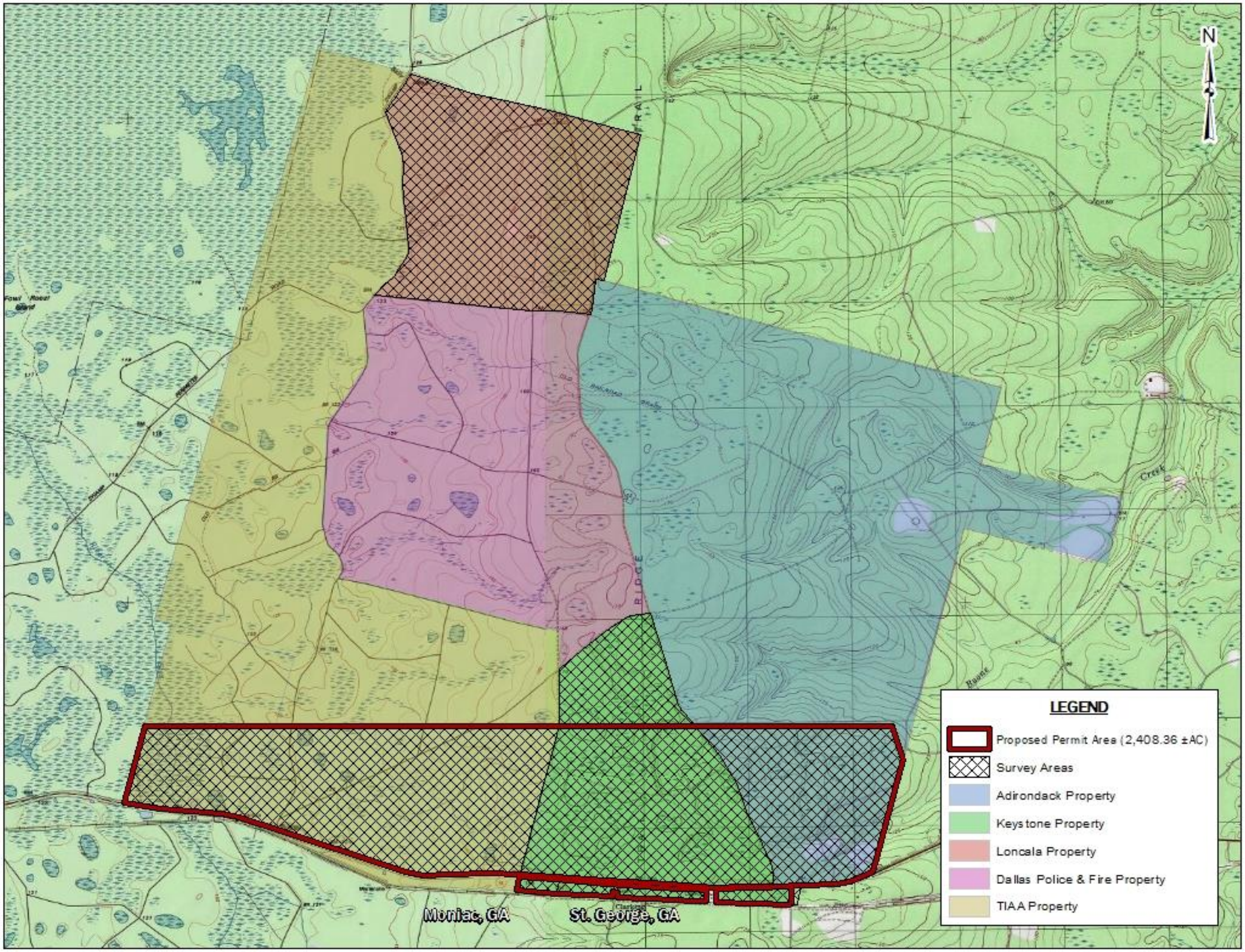


Figure 2. A USGS topographic map of the Twin Pines site amphibian/reptile survey areas.

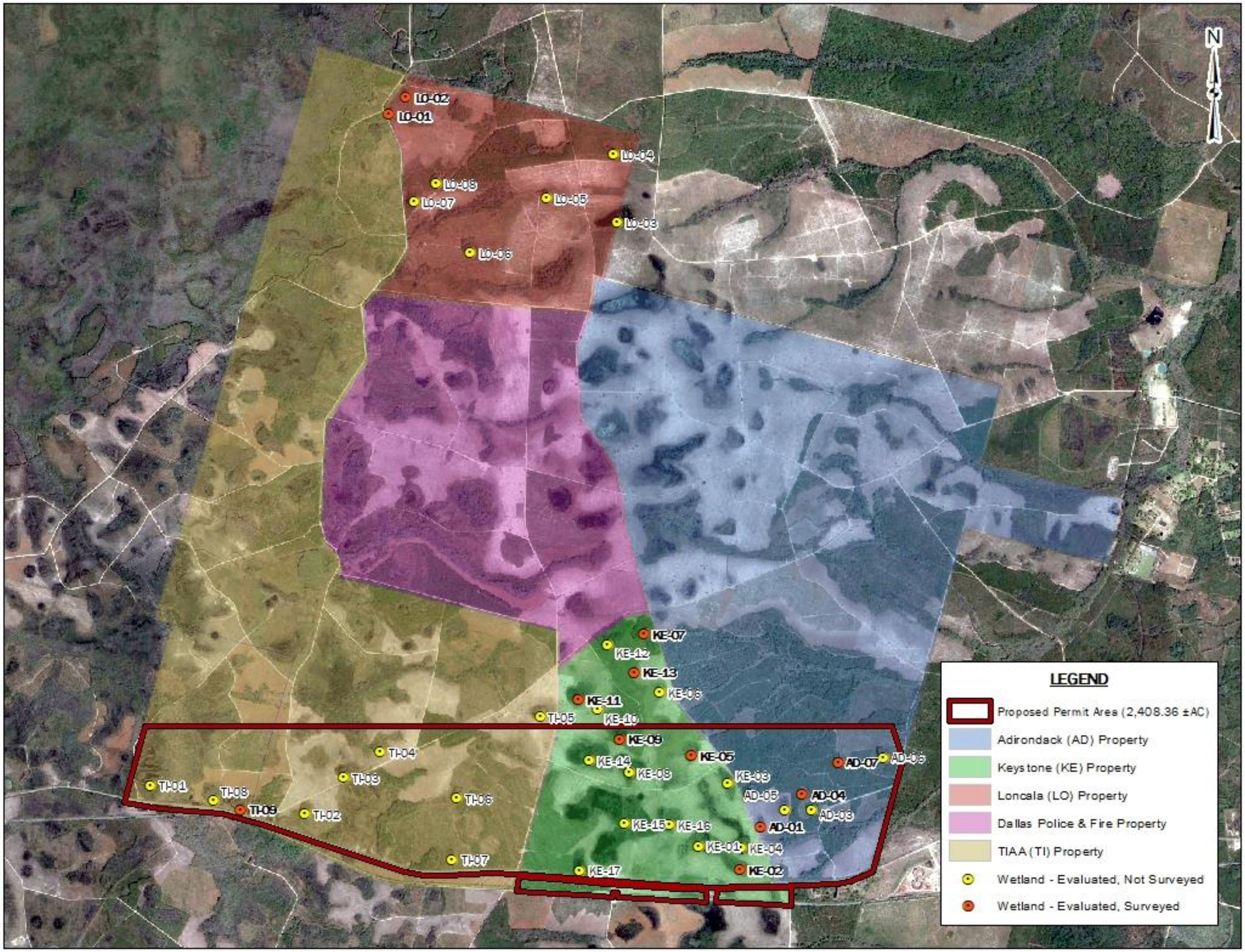


Figure 3. Locations of the 41 isolated depressional wetlands, including 12 survey sites, that were reviewed for the frosted flatwoods salamander, striped newt, and gopher frog.

Figure 4. Frosted flatwoods salamander survey site (Keystone-11). Note presence of graminacous vegetation and fire-scarred pond cypress.

Figure 5. Frosted flatwoods salamander survey site (Loncala-01). Note scattered graminacous vegetation and fire-killed trees in wetland.

Figure 6. Frosted flatwoods salamander survey site (Adirondack-04). Two minnow traps are visible in the foreground. A gopher frog was found in a gopher tortoise burrow ca. 2 km to the NE.

Figure 7. Wetland margin/pine upland ecotone of frosted flatwoods salamander survey site shown in Figure 1 (Keystone-11). Note parallel rows of beds extending into ectotone and standing water (result of soil compaction).

Figure 8. Pine upland habitat (part of a commercial slash pine plantation) adjacent to the frosted flatwoods salamander survey site shown in Figure 4 (Keystone-11). Note anthropogenic disturbance from parallel rows of deeply plowed beds (planted with slash pine) and the absence of a wiregrass-dominated ground cover.

Figure 9. Pine upland habitat adjacent to frosted flatwoods salamander survey site (Keystone-02). Pond can be seen in the background, Note incised ditch extending out from depressional wetland and the dominance of broomsedge in what is a recent clearcut and bedded landscape.

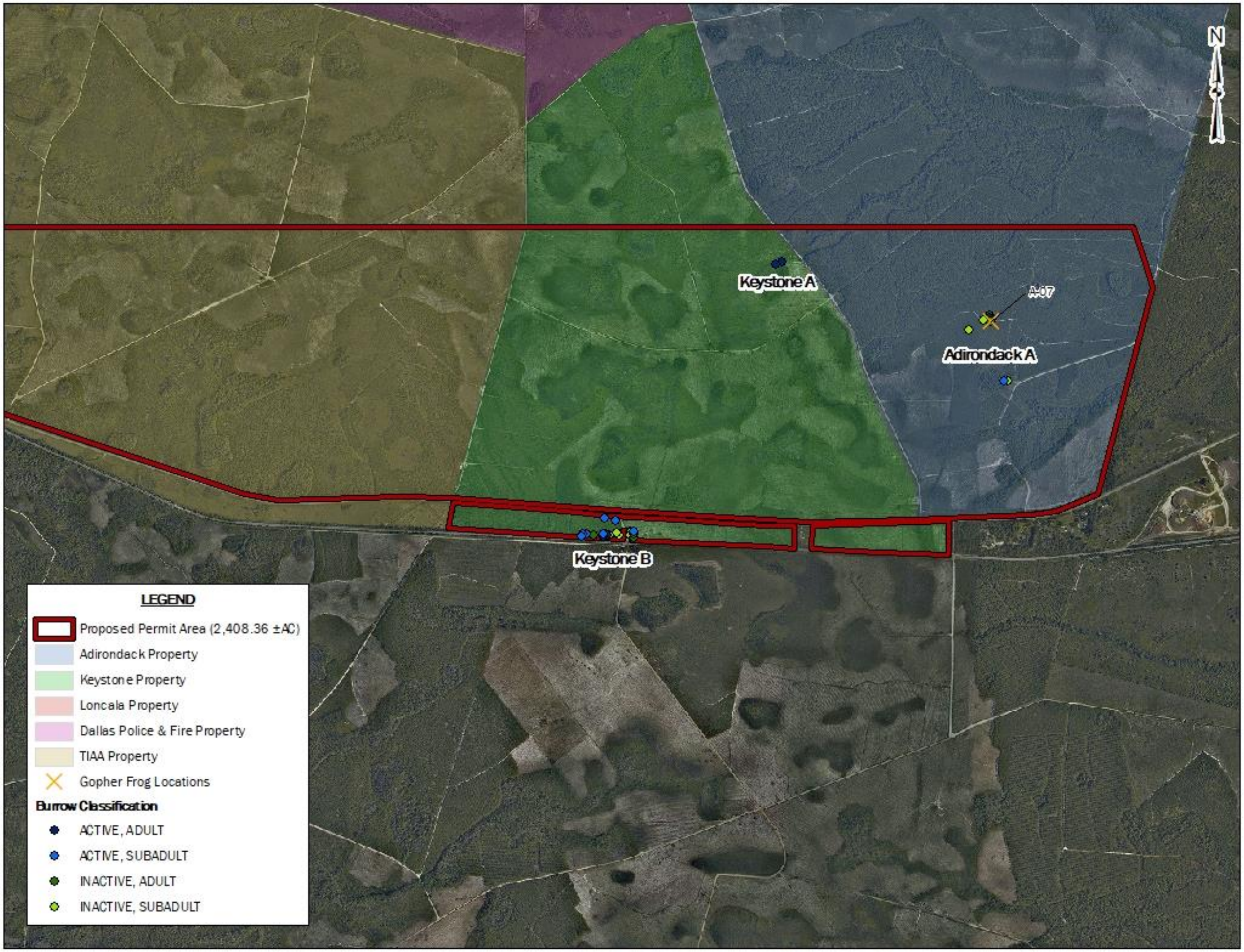


Figure 10. Locations of active/inactive gopher tortoise burrows and gopher frog observations on the Adirondack and Keystone tracts. The tortoise burrows shown on this map were surveyed on multiple dates for eastern indigo snakes.

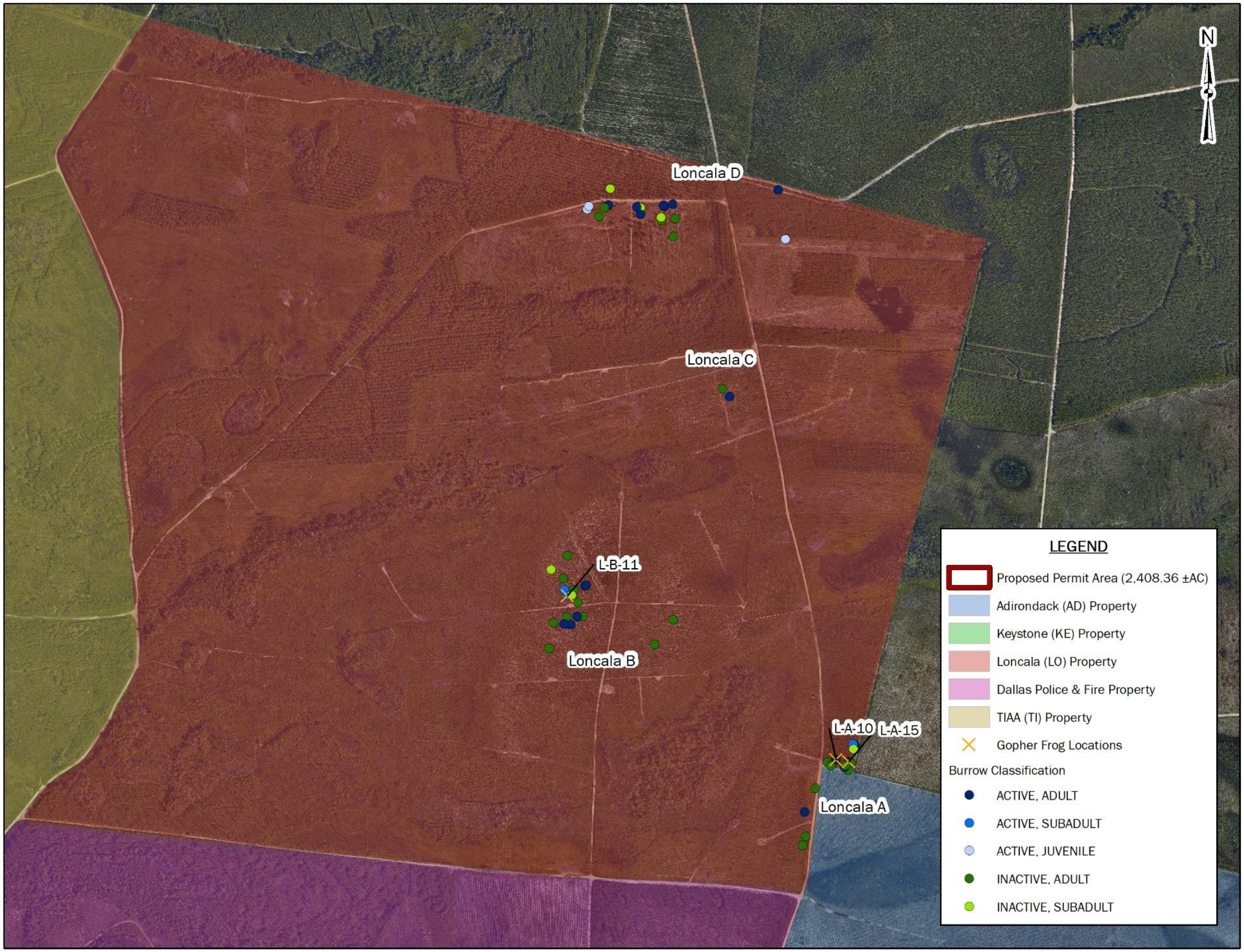


Figure 11. Locations of active/inactive gopher tortoise burrows and gopher frog observations on the Loncala tract. The tortoise burrows shown on this map were surveyed on multiple dates for eastern indigo snakes.

Figure 12. Using a burrow camera to examine the burrow of an adult gopher tortoise.

Figure 13.  An adult gopher frog (*Rana capito*) found in a gopher tortoise burrow on the Twin Pines Site.

# Tables

**Table 1. Habitat Review of Isolated Wetlands on the Twin Pines Site, Charlton County, Georgia**

(*see text for explanation of ranking system*)

| Pond Code | Latitude | Longitude | Hydrology | Vegetation | Fire History | Intact Ground Cover? | Bedded? | Habitat Condition | Upland Habitat | Survey Site? |
|---|---|---|---|---|---|---|---|---|---|---|
| **KEYSTONE** | | | | | | | | | | |
| KE-01 | 30.520979 | 82.109586 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-year planted pine | No |
| KE-02 | 30.518907 | 82.105418 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-year p. pine | Yes |
| KE-03 | 30.526381 | 82.106644 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-year p. pine | No |
| KE-04 | 30.520788 | 82.105337 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-year p. pine | No |
| KE-05 | 30.528737 | 82.110309 | Suitable | 2 | 2,3 | No | Yes | 3 | 2-year p. pine | Yes |
| KE-06 | 30.534172 | 82.113456 | Suitable | 2 | 2,3 | No | Yes | 3 | 2-year p. pine | No |
| KE-07 | 30.539235 | 82.114972 | Suitable | 2 | 2,3 | No | Yes | 3 | planted pine | Yes |
| KE-08 | 30.527284 | 82.11642 | Unsuitable | 3 | 2,3 | No | Yes | 3 | 2-year p. pine | No |
| KE-09 | 30.53016 | 82.117364 | Suitable | 2 | 2,3 | No | Yes | 3 | 8-year p. pine | Yes |
| KE-10 | 30.532728 | 82.11965 | Unsuitable | 3 | 2,3 | No | Yes | 3 | planted pine | No |
| KE-11 | 30.53357 | 82.121489 | Suitable | 2 | 2,3 | No | Yes | 3 | 2-year p. pine | Yes |
| KE-12 | 30.538326 | 82.118573 | Suitable | 2 | 2,3 | No | Yes | 3 | 8-year p. pine | No |
| KE-13 | 30.535922 | 82.11594 | Suitable | 2 | 2,3 | No | Yes | 3 | 8 year p. pine | Yes |
| KE-14 | 30.52835 | 82.120406 | Suitable | 2 | 2,3 | No | Yes | 3 | 2-year p. pine | No |
| KE-15 | 30.522925 | 82.116888 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-year p. pine | No |
| KE-16 | 30.522785 | 82.112462 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-year p. pine | No |
| KE-17 | 30.518872 | 82.121427 | Unsuitable | 3 | 2,3 | No | Yes | 3 | 2-year p. pine | No |
| **LONCALA** | | | | | | | | | | |
| LO-01 | 30.583984 | 82.140291 | Suitable | 2 | 2,3 | No | Yes | 3 | 8-10-year p. pine | Yes |
| LO-02 | 30.585451 | 82.138633 | Suitable | 2 | 2,3 | No | Yes | 3 | 8-10 year p. pine | Yes |
| LO-03 | 30.574639 | 82.117651 | Suitable | 3 | 2,3 | No | Yes | 3 | recent clearcut | No |
| LO-04 | 30.580485 | 82.118042 | Unsuitable | 3 | 3 | No | Yes | 3 | recent clearcut | No |
| LO-05 | 30.576724 | 82.124697 | Suitable | 3 | 2,3 | No | Yes | 3 | recent clearcut | No |
| LO-06 | 30.572041 | 82.132216 | Unsuitable | 3 | 2,3 | No | Yes | 3 | ca. 8-10 p. pine | No |
| LO-07 | 30.576472 | 82.13783 | Suitable | 3 | 2,3 | No | Yes | 3 | recent clearcut | No |
| LO-08 | 30.578002 | 82.135673 | Suitable | 3 | 2,3 | No | Yes | 3 | recent clearcut | No |

**Table 1. Habitat Review of Isolated Wetlands on the Twin Pines Site, Charlton County, Georgia (Continued)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **ADIROND** | | | | | | | | | | |
| AD-01 | 30.522642 | 82.103361 | Suitable | 2 | 2 | No | Yes | 3 | 2-year p. pine | Yes |
| AD-02 | 30.525445 | 82.104549 | Unsuitable | 3 | 3 | No | Yes | 3 | 2-year p. pine | No |
| AD-03 | 30.524073 | 82.098321 | Unsuitable | 3 | 3 | No | Yes | 3 | 12-year slash pine | No |
| AD-04 | 30.525379 | 82.099249 | Suitable | 2 | 3 | No | Yes | 3 | 12-yr slash pine | Yes |
| AD-05 | 30.524052 | 82.101006 | Unsuitable | 3 | 3 | No | Yes | 3 | recent clearcut | No |
| AD-06 | 30.528595 | 82.091191 | Unsuitable | 3 | 3 | No | Yes | 3 | 10-year slash pine | No |
| AD-07 | 30.528172 | 82.095729 | Suitable | 2 | 3 | No | Yes | 3 | 8-15 year slash pine | Yes |
| **TIAA** | | | | | | | | | | |
| TI-01 | 30.526199 | 82.164059 | Unsuitable | 2 | 2,3 | No | Yes | 3 | clearcut | No |
| TI-02 | 30.523727 | 82.148684 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-12 year slash pine | No |
| TI-03 | 30.526854 | 82.14479 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-year slash pine | No |
| TI-04 | 30.52908 | 82.141195 | Unsuitable | 3 | 2,3 | No | Yes | 3 | 2-year slash pine | No |
| TI-05 | 30.532081 | 82.125323 | Suitable | 3 | 2,3 | No | Yes | 3 | 2-year slash pine | No |
| TI-06 | 30.525121 | 82.133605 | Unsuitable | 3 | 2,3 | No | Yes | 3 | planted pine | No |
| TI-07 | 30.519821 | 82.134069 | Unsuitable | 3 | 2,3 | No | Yes | 3 | planted pine | No |
| TI-08 | 30.524865 | 82.157784 | Unsuitable | 3 | 2,3 | No | Yes | 3 | 2-year slash pine | No |
| TI-09 | 30.524101 | 82.155082 | Suitable | 2 | 2,3 | No | Yes | 3 | 2-year slash pine | Yes |

**Table 2. Frosted Flatwoods Salamander Survey Data**

| Pond Code | Survey Dates | Personnel | Dipnet Hours | Trap-Nights | Vegetation Sampled[1] | Amphibians Observed[2] |
|---|---|---|---|---|---|---|
| **KEYSTONE** | | | | | | |
| KE-02 | 2/28-3/1/2019 | ds, jk, ct | 1.5 | 16 | 1 | RSPH (L), AGRY (A), POCU (A), HFEM (A), EQUA (L) |
| KE-05 | 2/26-2/27/2019 | ds, jk, ct | 1.5 | 16 | 1, 2, 3, 4, 5, 6 | RSPH (L), AGRY (A), EQUA (L) |
| KE-07 | 2/26-2/27/2019 | ds, jk, ct | 1.5 | 16 | 1, 2, 3, 4, 5, 6 | RSPH (A, L), AGRY (A), POCU (A), RGRY (A) |
| KE-09 | 2/27-2/28/2019 | ds, jk, ct | 1.5 | 24 | 1, 4, 5, 6 | RSPH (L) |
| KE-11 | 2/27-2/28/2019 | ds, jk, ct | 2 | 12 | 1, 2, 3, 4, 5, 6 | RSPH (L), AGRY (A), EQUA (L), ATER (A), AQUE (A) |
| KE-13 | 2/27/2019 | ds, jk, ct | 1.5 | 0 | 5 | RSPH (L), POCU (L) |
| **LONCALA** | | | | | | |
| LO-01 | 2/28-3/1/2019 | ds, jk, ct | 1 | 12 | 1, 5 | RSPH (L), HFEM (A) |
| LO-02 | 2/28-3/1/2019 | ds, jk, ct | 1 | 12 | 1 | RSPH (L), EQUA (L) |
| **ADIROND** | | | | | | |
| AD-01 | 3/7-3/8/2019 | ds, jk, cs | 1.5 | 12 | 2, 4, 5, 6 | RSPH (E, L), AGRY (A), EQUA (L) |
| AD-04 | 3/7-3/8/2019 | ds, jk, cs | 1.5 | 12 | 2, 3, 4, 5, 6 | POCU (L) |
| AD-07 | 3/7-3/8/2019 | ds, jk, cs | 1.25 | 14 | 1, 2, 4, 5 | RSPH (A, L), EQUA (L) |
| **TIAA** | | | | | | |
| TI-09 | 3/8-3/9/2019 | ds, jk, cs | 1.5 | 29 | 1 | RSPH (L), HCIN (A), EQUA (L), SINT (A) |

[1]1=Carex; 2=Panicum; 3=Rhynchospora; 4=Eriocaulon; 5=Sphagnum; 6=Xyris

[2]E=Egg mass; L=Larva; A=Adult
AGRY (Acris gryllis); EQUA (Eurycea quadrigitata); HCIN (Hyla cinerea); HFEM (Hyla femoralis); POCU (Pseudacris ocularis); RGRY (Rana grylio); RSPH (Rana sphenocephala); SINT (Siren intermedia); ATER (Anaxyrus terrestris); AQUE (Anaxyrus quercicus)

**Table 3: Amphibians, Reptiles and Fishes Observed at Frosted Flatwoods Salamander Survey Sites**

| Wetland Site Code | K-02 | K-05 | K-07 | K-09 | K-11 | K-13 | L-01 | L-02 | A-01 | A-04 | A-07 | T-09 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SALAMANDERS** | | | | | | | | | | | | |
| dwarf salamander (*Eurycea quadridigitata*) | L | L | | | L | | | L | L | | L | L |
| lesser siren (*Siren intermedia*) | | | | | | | | | | | | A |
| **ANURANS**[1] | | | | | | | | | | | | |
| southern toad (*Anaxyrus terrestris*) | | | | | A | | | | | | | |
| oak toad (*Anaxyrus quercicus*) | | | | | A | | | | | | | |
| southern cricket frog (*Acris gryllus*) | A | A | A | | A | | | | A | | A | |
| little grass frog (*Pseudacris ocularis*) | A | | A | | | L | | | | L | | |
| pinewoods treefrog (*Hyla femoralis*) | A | | | | | | A | | | | | |
| green treefrog (*Hyla cinerea*) | | | | | | | | | | | | A |
| pig frog (*Rana grylio*) | | | A | | | | | | | | | |
| southern leopard frog (*Rana sphenocephala*) | L | L | A, L | L | L | L | L | L | E, L | | A, L | L |
| **SNAKES** | | | | | | | | | | | | |
| banded watersnake (*Nerodia fasciata*) | | | | | | | | | X | | | X |
| black swampsnake (*Liodytes pygaea*) | | | | | | | X | | | | | |
| eastern ribbonsnake (*Thamnophis sauritus*) | | | | X | | | | | X | | | |
| cottonmouth (*Agkistrodon piscivorus*) | | | | | | | | | | | X | |
| **FISHES** | | | | | | | | | | | | |
| eastern mudminnow (*Umbra pygmaea*) | | | | | | | X | X | | | | |
| redfin pickerel (*Esox americanus*) | X | | X | X | | | X | | | | | X |
| redface topminnow (*Fundulus rubrifrons*) | X | X | | | X | | | | | | | X |
| pygmy killifish (*Leptolucania ommata*) | | | | | | | | | | | | X |
| eastern mosquitofish (*Gambusia holbrooki*) | X | X | X | X | X | | X | X | | | X | X |
| warmouth (*Lepomis gulosus*) | | | | | | | | | | | X | |

**Table 3: Amphibians, Reptiles and Fishes Observed at Frosted Flatwoods Salamander Survey Sites (Continued)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| banded sunfish (*Enneacanthus obesus*) | X | X | X | | | X | X | | | X | X |
| pygmy sunfish (*Elassoma* sp.) | X | | | | | | | | | | X |
| mud sunfish (*Acantharcus pomotis*) | | | | | | | | | | | X |

[1]E = Eggs; L = Larvae; A = Adult, X=Species observed

**Table 4. Eastern Indigo Snake Survey Data: Twin Pines Site, Charlton County, Georgia**

| Site | Survey # | Date | Time | Tortoise Burrows Surveyed | Weather | Results |
|---|---|---|---|---|---|---|
| **ADIROND** | | | | | | |
| Adirondack | 1 | 3/6-3/7/2019 | 1000-1600 | 8 | sunny, clear 70 F | no indigo snakes found |
| Adirondack | 2 | 3/19/2019 | 1550-1630 | 8 | very cloudy, 62 F | no indigo snakes found |
| **KEYSTONE** | | | | | | |
| Keystone A | 1 | 12/17/2018 | 1140-1255 | 5 | calm, partly cloudy, 57-60 F | no indigo snakes found, pigmy rattlesnake, burrow 01 |
| Keystone A | 2 | 1/18/2019 | 1030-1055 | 5 | calm, mostly sunny, 64 F | no indigo snakes found |
| Keystone A | 3 | 2/26/2019 | 1130-1200 | 5 | cloudy, warm 68 F | no indigo snakes found |
| Keystone B | 1 | 12/17/2018 | 1415-1636 | 40 | calm, mostly cloudy, 61-64 F | no indigo snakes found, gopher frog, burrow 03; e. coachwhip shed, burrow 04 |
| Keystone B | 2 | 1/18/2019 | 1130-1340 | 40 | calm, mostly sunny, 70 F | no indigo snakes found |
| Keystone B | 3 | 2/26/2019 | 1500-1630 | 40 | cloudy, warm 74 F | no indigo snakes found, gopher frog, burrow 02 |
| **LONCALA** | | | | | | |
| Loncala A | 1 | 12/18/2018 | 1022-1142 | 22 | calm, mostly sunny, 62-64 F | no indigo snakes found |
| Loncala A | 2 | 1/17/2019 | 1500-1600 | 22 | calm, sunny, 67 F | no indigo snakes found |
| Loncala A | 3 | 2/26/2019 | 1230-1300 | 22 | cloudy, warm 70 F | no indigo snakes found |
| Loncala B | 1 | 12/18/2018 | 1216-1408 | 19 | calm, mostly sunny, 67 F | no indigo snakes found |
| Loncala B | 2 | 1/17/2019 | 1145-1420 | 19 | calm, mostly sunny, 63 F | no indigo snakes found |
| Loncala B | 3 | 2/26/2019 | 1310-1340 | 19 | cloudy, warm 70 F | no indigo snakes found |
| Loncala C | 1 | 12/18/2018 | 1452-1503 | 3 | calm, mostly sunny, 68 F | no indigo snakes found |
| Loncala C | 2 | 1/17/2019 | 1430-1450 | 3 | calm, mostly sunny, 65 F | no indigo snakes found |
| Loncala C | 3 | 2/26/2019 | 1345-1400 | 3 | cloudy, warm 72 F | no indigo snakes found |
| Loncala D | 1 | 2/26/2019 | 1405-1435 | 21 | cloudy, warm 72 F | no indigo snakes found |
| Loncala D | 2 | 3/19/2019 | 1430-1530 | 21 | very cloudy, 62 F | no indigo snakes found |

Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA

| Date | Site-No. | Latitude, Longitude | Activity Status Active/Inact/Ab[1] | Burrow Width (cm) | Size Class | Tortoise Observed (Yes/No/Undet.) | Commensal Species Observed |
|---|---|---|---|---|---|---|---|
| **ADIRON** | | | | | | | |
| 4/3/2019 | A-01 | 30.524019°N, 82.097257°W | INACTIVE | 21 | SUBADULT | No | |
| 4/3/2019 | A-02 | 30.524032°N, 82.097501°W | ACTIVE | 25 | SUBADULT | Yes | pine snake |
| 4/3/2019 | A-03 | 30.526448°N, 82.099388°W | INACTIVE | 21 | SUBADULT | Yes | |
| 4/3/2019 | A-04 | 30.527119°N, 82.098285°W | INACTIVE | 31.5 | ADULT | No | |
| 4/3/2019 | A-05 | 30.526959°N, 82.098139°W | ACTIVE | 11.5 | SUBADULT | Undet. | |
| 4/3/2019 | A-06 | 30.527028°N, 82.098256°W | ACTIVE | 33 | ADULT | Yes | |
| 4/3/2019 | A-07 | 30.526818°N, 82.098197°W | INACTIVE | 27.5 | ADULT | No | gopher frog |
| 4/3/2019 | A-08 | 30.526869°N, 82.098624°W | INACTIVE | 11 | SUBADULT | Undet. | |
| **KEYSTONE** | | | | | | | |
| 4/3/2019 | K-A-01 | 30.529655°N, 82.109575°W | ACTIVE | 32.5 | ADULT | No | |
| 4/3/2019 | K-A-02 | 30.529535°N, 82.109940°W | ACTIVE | 35 | ADULT | No | |
| 4/3/2019 | K-A-03 | 30.529522°N, 82.109943°W | ACTIVE | 35.5 | ADULT | Yes | |
| 4/3/2019 | K-A-04 | 30.529890°N, 82.109420°W | ABAN (INA) | N/A | ADULT | No | |
| 4/3/2019 | K-A-05 | 30.530050°N, 82.109950°W | ABAN (INA) | N/A | ADULT | No | |
| 4/4/2019 | K-B-01 | 30.516932°N, 82.117889°W | INACTIVE | 30 | ADULT | Yes | |
| 4/4/2019 | K-B-02 | 30.516924N, 82.117859°W | ACTIVE | 19.5 | SUBADULT | No | |
| 4/4/2019 | K-B-03 | 30.516866°N, 82.117834°W | INACTIVE | 9 | SUBADULT | Undet. | |
| 4/4/2019 | K-B-04 | 30.516786°N, 82.117861°W | INACTIVE | 9 | SUBADULT | Undet. | |
| 4/4/2019 | K-B-05 | 30.516661°N, 82.117679°W | INACTIVE | 26 | ADULT | No | |
| 4/4/2019 | K-B-06 | 30.516624°N, 82.117662°W | ABAN (INA) | N/A | ADULT | No | |
| 4/4/2019 | K-B-07 | 30.516813°N, 82.117682°W | INACTIVE | 26 | ADULT | Yes | |
| 4/4/2019 | K-B-08 | 30.516937°N, 82.117685°W | ACTIVE | 13 | SUBADULT | Yes | |
| 4/4/2019 | K-B-09 | 30.516909°N, 82.117596°W | ABAN (INA) | N/A | JUVENILE | No | |
| 4/4/2019 | K-B-10 | 30.516693°N, 82.118407°W | ABAN (ACT) | N/A | JUVENILE | No | |

Table 5. **Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA**

| Date | Site-No. | Latitude, Longitude | Activity Status Active/Inact/Ab[1] | Burrow Width (cm) | Size Class | Tortoise Observed (Yes/No/Undet.) | Commensal Species Observed |
|---|---|---|---|---|---|---|---|
| 4/4/2019 | K-B-11 | 30.516781°N, 82.118489°W | INACTIVE | 22 | SUBADULT | No | |
| 4/4/2019 | K-B-12 | 30.516715°N, 82.118419°W | ABAN (INA) | N/A | ADULT | No | |
| 4/4/2019 | K-B-13a | 30.516781°N, 82.118489°W | INACTIVE | 37 | ADULT | Yes | |
| 4/4/2019 | K-B-13b | 30.516781°N, 82.118489°W | INACTIVE | 22 | SUBADULT | No | |
| 4/4/2019 | K-B-14 | 30.516826°N, 82.118559°W | ABAN (INA) | N/A | JUVENILE | No | |
| 4/4/2019 | K-B-15 | 30.516849°N, 82.118558°W | INACTIVE | 13.5 | SUBADULT | Yes | |
| 4/4/2019 | K-B-16 | 30.516778°N, 82.118957°W | INACTIVE | 24 | SUBADULT | No | |
| 4/4/2019 | K-B-17 | 30.516835°N, 82.119183°W | ACTIVE | 33 | ADULT | Yes | |
| 4/4/2019 | K-B-18 | 30.516802°N, 82.119119°W | ABAN (INA) | N/A | SUBADULT | No | |
| 4/4/2019 | K-B-19 | 30.516786°N, 82.119124°W | ACTIVE | 31 | ADULT | No | |
| 4/4/2019 | K-B-20 | 30.516730°N, 82.119288°W | ACTIVE | 30 | ADULT | Yes | |
| 4/4/2019 | K-B-21 | 30.516800°N, 82.119323°W | ACTIVE | 13 | SUBADULT | Yes | |
| 4/4/2019 | K-B-22 | 30.516915°N, 82.119692°W | ABAN (INA) | N/A | ADULT | No | |
| 4/4/2019 | K-B-23 | 30.516750°N, 82.119825°W | INACTIVE | 32 | ADULT | No | |
| 4/4/2019 | K-B-24 | 30.516883°N, 82.119894°W | ABAN (INA) | N/A | SUBADULT | No | |
| 4/4/2019 | K-B-25 | 30.516813°N, 82.120248°W | ACTIVE | 16.5 | SUBADULT | Yes | |
| 4/4/2019 | K-B-26 | 30.516801°N, 82.120424°W | ACTIVE | 12 | SUBADULT | Yes | |
| 4/4/2019 | K-B-27 | 30.516832°N, 82.120449°W | ACTIVE | 12 | SUBADULT | Undet. | |
| 4/4/2019 | K-B-28 | 30.516722°N, 82.120482°W | ACTIVE | 25.5 | SUBADULT | Yes | |
| 4/4/2019 | K-B-35 | 30.517612°N, 82.119058°W | INACTIVE | 12 | SUBADULT | Undet. | |
| 4/4/2019 | K-B-36 | 30.517587°N, 82.119131°W | ABAN (INA) | N/A | JUVENILE | No | |
| 4/4/2019 | K-B-37 | 30.517568°N, 82.119173°W | ABAN (INA) | N/A | SUBADULT | No | |
| 4/4/2019 | K-B-38 | 30.517567°N, 82.119232°W | ACTIVE | 12 | SUBADULT | Undet. | |
| 4/4/2019 | K-B-39 | 30.517439°N, 82.118669°W | ACTIVE | 12 | SUBADULT | Undet. | |
| **LONCALA** | | | | | | | |
| 4/2/2019 | L-A-01 | 30.568645°N, 82.120398°W | ACTIVE | 36 | ADULT | Yes | |

**Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA**

| Date | Site-No. | Latitude, Longitude | Activity Status Active/Inact/Ab[1] | Burrow Width (cm) | Size Class | Tortoise Observed (Yes/No/Undet.) | Commensal Species Observed |
|---|---|---|---|---|---|---|---|
| 4/2/2019 | L-A-02 | 30.568065°N, 82.120363°W | INACTIVE | 26 | ADULT | No | |
| 4/2/2019 | L-A-03 | 30.567858°N, 82.120446°W | INACTIVE | 35 | ADULT | No | |
| 4/2/2019 | L-A-04 | 30.569200°N, 82.120101°W | INACTIVE | 32 | ADULT | No | |
| 4/2/2019 | L-A-05 | 30.569848°N, 82.119892°W | ABAN (INA) | N/A | JUVENILE | No | |
| 4/2/2019 | L-A-06 | 30.569819°N, 82.119773°W | INACTIVE | 29.5 | ADULT | No | |
| 4/2/2019 | L-A-07 | 30.569884°N, 82.119772°W | ACTIVE | 11.2 | SUBADULT | Undet. | |
| 4/2/2019 | L-A-08 | 30.569774°N, 82.119646°W | INACTIVE | 29.6 | ADULT | No | |
| 4/2/2019 | L-A-09 | 30.569731°N, 82.119676°W | INACTIVE | 34 | ADULT | No | |
| 4/2/2019 | L-A-10 | 30.569880°N, 82.119536°W | ACTIVE | 40.2 | ADULT | Yes | gopher frog |
| 4/2/2019 | L-A-11 | 30.570100°N, 82.119250°W | ABAN (INA) | N/A | ADULT | No | |
| 4/2/2019 | L-A-12 | 30.570215°N, 82.119014W | ACTIVE | 34.2 | ADULT | Yes | |
| 4/2/2019 | L-A-13 | 30.570249°N, 82.119065°W | ACTIVE | 13 | SUBADULT | Undet. | |
| 4/2/2019 | L-A-14 | 30.570124°N, 82.119064°W | INACTIVE | 22 | SUBADULT | No | |
| 4/2/2019 | L-A-15 | 30.569835°N, 82.119189°W | ACTIVE | 33 | ADULT | Yes | gopher frog |
| 4/2/2019 | L-A-16 | 30.569792°N, 82.119152°W | INACTIVE | 26.5 | ADULT | No | |
| 4/2/2019 | L-A-17 | 30.569799°N, 82.119118°W | INACTIVE | 29.7 | ADULT | No | |
| 4/2/2019 | L-A-18 | 30.569621°N, 82.119207°W | INACTIVE | 30.5 | ADULT | No | |
| 4/2/2019 | L-A-19 | 30.569692°N, 82.119306°W | ACTIVE | 34 | ADULT | Yes | |
| 4/2/2019 | L-A-20 | 30.569696°N, 82.119308°W | ABAN (INA) | N/A | SUBADULT | No | |
| 4/2/2019 | L-A-21 | 30.569743°N, 82.119279°W | INACTIVE | 29.2 | ADULT | No | |
| 4/2/2019 | L-A-22 | 30.570552°N, 82.118916°W | ABAN (INA) | N/A | ADULT | No | |
| 4/3/2019 | L-B-01 | 30.573181°N, 82.123975°W | INACTIVE | 31.5 | ADULT | No | |
| 4/3/2019 | L-B-02 | 30.572592°N, 82.124486°W | INACTIVE | 28 | ADULT | No | |
| 4/3/2019 | L-B-03 | 30.574680°N, 82.126850°W | INACTIVE | 33 | ADULT | No | |
| 4/3/2019 | L-B-04 | 30.574364°N, 82.127295°W | INACTIVE | 24 | SUBADULT | No | |
| 4/3/2019 | L-B-05 | 30.574151°N, 82.126971°W | INACTIVE | 33.5 | ADULT | No | |
| 4/3/2019 | L-B-06 | 30.573883°N, 82.126677°W | INACTIVE | 32 | ADULT | No | |

Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA

| Date | Site-No. | Latitude, Longitude | Activity Status Active/Inact/Ab[1] | Burrow Width (cm) | Size Class | Tortoise Observed (Yes/No/Undet.) | Commensal Species Observed |
|---|---|---|---|---|---|---|---|
| 4/3/2019 | L-B-07 | 30.573982°N, 82.126377°W | ACTIVE | 34.5 | ADULT | Yes | |
| 4/3/2019 | L-B-08 | 30.57400°N, 82.126340°W | ACTIVE | 35 | ADULT | No | |
| 4/3/2019 | L-B-09 | 30.573589°N, 82.126571°W | INACTIVE | 37.5 | ADULT | No | |
| 4/3/2019 | L-B-10 | 30.573884°N, 82.126939°W | ACTIVE | 13 | SUBADULT | Undet. | |
| 4/3/2019 | L-B-11 | 30.573746°N, 82.126855°W | ACTIVE | 11 | SUBADULT | Undet. | gopher frog |
| 4/3/2019 | L-B-12 | 30.573251°N, 82.126441°W | INACTIVE | 35 | ADULT | No | |
| 4/3/2019 | L-B-13 | 30.573251°N, 82.126591°W | ACTIVE | 35 | ADULT | Yes | |
| 4/3/2019 | L-B-14 | 30.573063°N, 82.126757°W | ACTIVE | 30.5 | ADULT | Yes | |
| 4/3/2019 | L-B-15 | 30.573244°N, 82.126875°W | INACTIVE | 29.5 | ADULT | No | |
| 4/3/2019 | L-B-16 | 30.573112°N, 82.127239°W | INACTIVE | 32 | ADULT | No | |
| 4/3/2019 | L-B-17 | 30.572507°N, 82.127354°W | INACTIVE | 33 | ADULT | No | |
| 4/3/2019 | L-B-18 | 30.573081°N, 82.126946°W | ACTIVE | 32 | ADULT | Yes | |
| 4/3/2019 | L-B-19 | 30.573755°N, 82.126735°W | INACTIVE | 15.5 | SUBADULT | Undet. | |
| 4/3/2019 | L-C-01 | 30.579251°N, 82.121553°W | ABAN (INA) | N/A | JUVENILE | No | |
| 4/3/2019 | L-C-02 | 30.578621°N, 82.122628°W | INACTIVE | 29 | ADULT | No | |
| 4/3/2019 | L-C-03 | 30.578438°N, 82.122431°W | ACTIVE | 38.5 | ADULT | Yes | |
| 4/2/2019 | L-D-01 | 30.582978°N, 82.123975°W | ACTIVE | 30 | ADULT | Yes | |
| 4/2/2019 | L-D-02 | 30.582636°N, 82.123911°W | INACTIVE | 28 | ADULT | No | |
| 4/2/2019 | L-D-03 | 30.582222°N, 82.123969°W | INACTIVE | 43 | ADULT | No | |
| 4/2/2019 | L-D-04 | 30.582603°N, 82.124289°W | INACTIVE | 28 | ADULT | No | |
| 4/2/2019 | L-D-05 | 30.582669°N, 82.124294°W | INACTIVE | 24 | SUBADULT | No | |
| 4/2/2019 | L-D-06 | 30.582925°N, 82.124217°W | ACTIVE | 32.5 | ADULT | Yes | |
| 4/2/2019 | L-D-07 | 30.582953°N, 82.124230°W | ACTIVE | 23 | SUBADULT | Yes | |
| 4/2/2019 | L-D-08 | 30.582952°N, 82.124231°W | ACTIVE | 29 | ADULT | Yes | |
| 4/2/2019 | L-D-09 | 30.582893°N, 82.124861°W | INACTIVE | 20 | SUBADULT | Undet. | |
| 4/2/2019 | L-D-10 | 30.582738°N, 82.124859°W | ACTIVE | 33.5 | ADULT | Yes | |
| 4/2/2019 | L-D-11 | 30.582555°N, 82.124848°W | ACTIVE | 14 | SUBADULT | Yes | |

**Table 5. Gopher Tortoise Survey Data, Twin Pines Site, Charlton Co., GA**

| Date | Site-No. | Latitude, Longitude | Activity Status Active/Inact/Ab[1] | Burrow Width (cm) | Size Class | Tortoise Observed (Yes/No/Undet.) | Commensal Species Observed |
|---|---|---|---|---|---|---|---|
| 4/2/2019 | L-D-12 | 30.582919°N, 82.124967°W | ACTIVE | 31 | ADULT | Yes | |
| 4/2/2019 | L-D-13 | 30.583345°N, 82.125689°W | INACTIVE | 25 | SUBADULT | Yes | |
| 4/2/2019 | L-D-14 | 30.582959°N, 82.125734°W | ACTIVE | 35.5 | ADULT | No | |
| 4/2/2019 | L-D-15 | 30.582895°N, 82.125845°W | INACTIVE | 41.5 | ADULT | No | |
| 4/3/2019 | L-D-16 | 30.582688°N, 82.125988°W | INACTIVE | 32.5 | ADULT | No | |
| 4/3/2019 | L-D-17 | 30.582864°N, 82.126309°W | INACTIVE | 37.5 | ADULT | Undet. | |
| 4/3/2019 | L-D-18 | 30.582864°N, 82.126309°W | ACTIVE | 6 | JUVENILE | Yes | |
| 4/3/2019 | L-D-19 | 30.582929°N, 82.126268°W | ACTIVE | 6 | JUVENILE | Undet. | |
| 4/3/2019 | L-D-20 | 30.582149°N, 82.120903°W | ACTIVE | 7.5 | JUVENILE | Undet. | |
| 4/3/2019 | L-D-21 | 30.583321°N, 82.121103°W | ACTIVE | 43.5 | ADULT | Yes | |

[1]ABA (ACT) and ABA (INA) indicate burrows that were abandoned when visited in April 2019 but had been classifies as Active (ACT) or Inactive (INA) in November 2018.

Appendix 1: Amphibian/Reptile Species List for Twin Pines, Charlton County, Georgia
A= Adirondack, K = Keystone, L = Loncala, T = Tia Tract

*Reptiles*

| | | |
|---|---|---|
| American Alligator | *Alligator mississippiensis* | L, T |
| Gopher Tortoise | *Gopherus polyphemus* | A, K, L |
| Coastal Plain Cooter | *Pseudemys floridana* | L |
| Eastern Box Turtle | *Terrapene carolina* | A |
| Eastern Glass Lizard | *Ophisaurus ventralis* | T |
| Green Anole | *Anolis carolinensis* | A, K, L, T |
| Fence Lizard | *Sceloporus undulatus* | A, K |
| Southeastern Five-lined Skink | *Plestiodon inexpectatus* | K |
| Broadhead Skink | *Plestiodon laticeps* | K, L |
| Ground Skink | *Scincella lateralis* | K, L |
| Six-lined Racerunner | *Aspidoscelis sexlineata* | A, L |
| Eastern Garter Snake | *Thamnophis sirtalis* | K, L |
| Eastern Ribbon Snake | *Thamnophis sauritus* | A, K, T |
| Banded Watersnake | *Nerodia fasciata* | A, T |
| Black Swampsnake | *Liodytes pygaea* | L |
| Black Racer | *Coluber constrictor* | A, K, L, T |
| Eastern Coachwhip | *Coluber flagellum* | K |
| Rough Greensnake | *Opheodrys aestivus* | A, T |
| Florida Pine Snake | *Pituophis melanoleucus* | A, K |
| Corn Snake | *Pantherophis guttatus* | A, K |
| Scarlet Kingsnake | *Lampropeltis elapsoides* | K, L |
| Cottonmouth | *Agkistrodon piscivorous* | A, L, T |
| Pygmy Rattlesnake | *Sistrurus miliarius* | A, K, L, T |
| Timber Rattlesnake | *Crotalus horridus* | A |

*Amphibians*

| | | |
|---|---|---|
| Dwarf Salamander | *Eurycea quadridigitata* | A, K, L, T |
| Lesser Siren | *Siren intermedia* | T |
| Two-toed Amphiuma | *Amphiuma means* | A |
| Southern Toad | *Anaxyrus terrestris* | A, K, L |
| Oak Toad | *Anaxyrus quercicus* | K, L |
| Southern Cricket Frog | *Acris gryllus* | A, K, L, T |
| Little Grass Frog | *Pseudacris ocularis* | A, K |
| Pinewoods Treefrog | *Hyla femoralis* | A, K, L, T |
| Green Treefrog | *Hyla cinerea* | K, T |
| Gopher Frog | *Rana capito* | A, K, L |
| Southern Leopard Frog | *Rana sphenocephala* | A, K, L, T |
| Bronze Frog | *Rana clamitans* | K |
| Bullfrog | *Rana catesbeiana* | K |
| Pig Frog | *Rana grylio* | K, L |

Altamaha Environmental Consulting

414 Club Drive
Hinesville, Georgia 31313
912.255.2003

# Results of Eastern Indigo Snake Surveys on the Twin Pines Site, Charlton County, Georgia: Year 2

DIRK J. STEVENSON

dstevenson@altamahaec.com

# Results of Eastern Indigo Snake Surveys on the Twin Pines Site, Charlton County, Georgia: Year 2

In November-December 2019, I again conducted eastern indigo snake (*Drymarchon couperi*) surveys on the Twin Pines Site, Charlton County, Georgia.

Similar to my first round of indigo snake surveys (conducted December, 2018 – March, 2019 [see Stevenson, 2019]), these surveys followed the field methods described by Stevenson et al. (2003) and Bauder et al. (2017). Specifically, I conducted visual encounter surveys for indigo snakes overwintering in gopher tortoise colonies. I surveyed for basking indigo snakes, and for indigo snake shed skins, at/near all active/inactive gopher tortoise burrows on-site ($n$ = 106 burrows) on three dates from 19 November – 18 December 2019. Approximately two weeks separated each survey event for each respective site. Maps of indigo snake survey areas and gopher tortoise burrow locations are provided.

On each indigo snake survey, each tortoise burrow was carefully examined for the presence of fresh snake tracks (if found, burrows with tracks are scoped with a gopher tortoise burrow camera in an effort to locate snakes resting deep inside the burrow). From 1-4 TTL biologists assisted me on these surveys.

No eastern indigo snakes or eastern indigo snake shed skins were found by my visual encounter surveys at the Twin Pines site, and no fresh snake tracks were located at burrows. A single pygmy rattlesnake (*Sistrurus miliarius*) and the shed skin of a Florida pinesnake (*Pituophis melanoleucus*) were observed (Table 1). No gopher frogs (*Rana capito*) were observed during these surveys.

A lack of indigo snake observations during focused surveys doesn't demonstrate that the species is never present or transient on the Twin Pines site (even if the species doesn't winter on-site it is possible that snakes from adjacent tracts, if present that is, may occasionally visit the Twins Pines site to forage). However, there are no recent credible sightings known for the property (i.e., from TTL and other staff who have spent considerable field time on-site) and my dedicated surveys during two consecutive years failed to locate the species.

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**Education, Experience, Integrity in Applied Ecology and Conservation**

Joyce Marie Klaus, Ph.D.
4684 GA Highway 83 South, Culloden, GA 31016
478-538-8495 (mobile) or 478-994-3380 (office)
JoyceMarieKlaus@gmail.com

# 2019 Survey for Rare, Threatened and Endangered Plants

# Twin Pines Mining Block 1

# Charlton County, Georgia

# FINAL REPORT

Joyce Marie Klaus, Ph.D.
Conservation Biologist
Terra-Ignea Enterprises, LLC
DBA J.M. Klaus Conservation Services

# 2019 Survey for Rare, Threatened and Endangered Plants

## Executive Summary

From January 2019 – December 2019 I conducted surveys for rare plants on approximately 2,424 acres of land in Charlton County, GA proposed for heavy mineral sands mining by Twin Pines Minerals, LLC (U.S. Army Corps of Engineers permit application # SAS-2018-00554). These surveys targeted plants listed or proposed to be listed under the federal Endangered Species Act as threatened or endangered, as well as plants listed under the Wildflower Preservation Act of Georgia as unusual, rare, threatened or endangered, and plants that are tracked by the state of GA Department of Natural Resources (GA DNR, Wildlife Resources Division, Wildlife Conservation Section). Uplands and wetlands on site were degraded by former silvicultural activity so I concentrated survey efforts in areas where habitat was most likely to harbor rare species (e.g. graminaceous wetlands, open sphagnum bogs, bayheads containing hardwood species, uplands where planting beds were eroded to some degree, uplands consisting of gopher tortoise-appropriate soils and uplands with minimal midstory density).

I detected six plant species that are tracked by GA DNR (*Asclepius pedicillata, Asimina pygmaea, Fuirena scirpoidea, Quercus chapmanii, Rhexia nuttallii, Tillandsia bartramii*), two species that are listed under the GA Wildflower Preservation Act (*Sarracenia minor, Sarracenia psitticina*), and no species that are federally listed or proposed to be listed under the Endangered Species Act. Of these, three tracked species (*Asimina pygmaea, Fuirena scirpoidea, Rhexia nuttallii*) were numerous and widespread where appropriate habitat was present.

## Introduction

In 2018 Twin Pines Minerals LLC and TTL inc. (agent) consulted with federal and state agencies (U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Georgia Department of Natural Resources, and U.S. Environmental Protection Agency) as part of a preliminary planning process for a proposed 2,424 acre heavy mineral sands mining project on Trail Ridge east of Okefenokee National Wildlife Refuge in Charlton County, Georgia [U.S. Army Corps of Engineers permit application # SAS-2018-00554]. One outcome of the consultation was a request that threatened and endangered species surveys be conducted on the site prior to permit approvals.  As an experienced botanist and ecologist with Terra-Ignea Enterprises LLC, I was subcontracted by TTL to conduct surveys for target plant species beginning January 2019 and concluding by December 2019.

## Methods

U.S. Fish and Wildlife Service and Georgia Department of Natural Resources provided TTL with a list of target plant species with ranges overlapping the proposed mining tracts and for which habitat was likely to occur on the tracts. These included three candidate plant species proposed for listing under the Endangered Species Act (*Hartwrightia floridana, Coreopsis integrifolia, Balduina atropurpurea*). An additional 24 species of plants, either listed under the GA Wildflower Preservation Act or state-tracked, were added to the list by GA DNR botanists (Table 1), for a total of 27 target plant species that agencies requested be considered.

I assessed target plant species habitat availability and quality on the proposed mining area using satellite imagery, National Wetlands Inventory maps, topographic maps and soils maps followed by ground-truthing. Although the entire proposed project site has been severely impacted by prior silvicultural activity, I selected 450 acres of highest quality flatwoods available (uplands where planting beds were eroded to some degree, uplands consisting of gopher tortoise-appropriate soils and uplands with minimal midstory density, Figures 1-4) and surveyed all of that area despite habitat being marginal at best (pine planting beds up to 0.5 m high, obvious intensive prior herbicide treatment, severe 2017 wildfire effects and subsequent salvage logging, Figures 5-8). I walked on parallel transects that were approximately 50 m apart, with a TTL staff approximately 10 m to each side of me (three of us total), throughout the selected flatwoods habitat during four separate survey periods to catch peak bloom time for all target plant species; survey periods were April 15-26, May 29-June 5, July 15-22 and October 7-14.

I identified 45 wetlands totaling approximately 472 acres for plant surveys using primarily satellite imagery. Three people (myself and two TTL staff) walked approximately 10 m apart around wetland ecotones to survey all 45 wetlands for target wetland plant species from April 15-26. Because many of the wetlands were in extremely degraded condition (mechanical site preparation for silviculture, planted with *Pinus elliotii*, disturbed by feral swine and severely impacted by wildfire as a result of long-term fire suppression, Figures 9-11), during the first survey I scored wetland characteristics (hydrology, fire, graminoids, midstory, canopy, surrounding upland) on a scale of 1-3, 1 being intact and 3 being severely degraded (Table 2). In subsequent survey periods, I only surveyed the 32 wetlands (329 acres) with a cumulative score < 12 and/or that had target species occurrences in the first survey. Subsequent survey periods for wetlands remaining in the survey were May 29-June 5, July 15-22 and October 7-14.

I recorded all plant locations using a Trimble R1 GNSS receiver with sub-meter accuracy and a Trimble Nomad 1050 handheld data collection device. If I could not identify species with 100% certainty in the field, I collected specimens and identified them with a dissecting microscope, using 'Flora of the Southern and Mid-Atlantic States' (Weakley 2015) as the authoritative reference.

I used geospatial software (ArcGIS) to map precise locations of all observed occurrences of target plant species (Figures 1-4) and summarized findings in an Excel database (Table 1). I shared all Excel database files, maps and GIS files with TTL staff.

## Results

Within the proposed mining project boundary, as of August 2019, I documented a total of 1000 occurrences of target plants, with some of those occurrences representing single plants and some representing clusters of plants. I detected four target plant species that are tracked by GA DNR: *Asimina pygmaea, Fuirena scirpoidea, Quercus chapmanii* and *Tillandsia bartramii* (Table 1). Of these, *Asimina pygmaea* and *Fuirena scirpoidea* were abundant and widespread. I also encountered two additional species that are state-tracked that were not on the original target species list: *Asclepius pedicillata* and *Rhexia nuttallii* (Table 1), with *Rhexia nuttallii* being abundant and widespread. I documented two species that are listed and under the GA Wildflower Preservation Act: *Sarracenia minor* and *Sarracenia psitticina* (Table 1 and Figures 1-4). I failed to detect any plant species protected or proposed for protection under the federal Endangered Species Act. Because there were records of four other state-tracked species near to the proposed project site, I added them to the target species list: *Epidendrum magnolia*, *Platanthera chapmanii*, *Platanthera integra*, and *Platanthera nivea*. I did not observe any of those species within the proposed project area.

Although not exhaustive, I compiled a general list of plant species encountered on site as I opportunistically observed them (Table 3.) The list includes 104 species, mostly forbs that I was able to identify in the field or that I identified using a scope and 'Weakley's Flora.'

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Table 1. Target plant species 2019. # occurrences = documented on proposed mine site. Protection status: GA tracked = not listed; U.S. petitioned/under review = candidate species for protection under U.S. Endangered Species Act; GA unusual, threatened or rare = listed under GA Wildflower Preservation Act. Added by (entity who added the species to the target species list): JMK = J.M. Klaus Conservation Services/Terra-Ignea Enterprises; GA DNR = Georgia Department of Natural Resources; US FWS = U.S. Fish and Wildlife Service.

| Scientific name | Common name | # occurrences | Protection status | Flower/fruit time | Added by |
|---|---|---|---|---|---|
| *Asclepias pedicellata* | Savannah Milkweed | 9 | GA tracked | July-August | JMK |
| *Asimina pygmaea* | Dwarf Pawpaw | 413 | GA tracked | April-July | GA DNR |
| *Balduina atropurpurea* | Purple honeycomb-head | 0 | U.S. petitioned/under review | August-November | US FWS |
| *Coreopsis integrifolia* | Floodplain tickseed | 0 | U.S. petitioned/under review | August-November | US FWS |
| *Ctenium floridanum* | Florida Orange-grass | 0 | GA tracked | June-October | GA DNR |
| *Epidendrum magnoliae* | Green-fly orchid | 0 | GA unusual | June-July | JMK |
| *Fuirena scirpoidea* | Southern Umbrella-sedge | 206 | GA tracked | July-November | GA DNR |
| *Galactia floridana* | Florida Milk-pea | 0 | GA tracked | June-September | GA DNR |
| *Gymnopogon chapmanianus* | Chapman's Skeleton Grass | 0 | GA tracked | August-November | GA DNR |
| *Hartwrightia floridana* | Hartwrightia | 0 | U.S. petitioned/under review | July-December | US FWS |
| *Justicia angusta* | Narrowleaf Water-willow | 0 | GA tracked | March-November | GA DNR |
| *Lachnocaulon beyrichianum* | Southern Bog-button | 0 | GA tracked | May-October | GA DNR |
| *Litsea aestivalis* | Pond Spice | 0 | GA rare | March-May | GA DNR |
| *Palafoxia integrifolia* | Palafoxia | 0 | GA tracked | August-November | GA DNR |
| *Peltandra sagittifolia* | Arrow Arum | 0 | GA tracked | July-September | GA DNR |
| *Piloblephis rigida* | Pennyroyal | 0 | GA tracked | January-December | GA DNR |
| *Platanthera chapmanii* | Chapman's fringed orchid | 0 | GA tracked | July-September | JMK |
| *Platanthera integra* | Yellow fringeless orchid | 0 | GA tracked | July-September | JMK |
| *Platanthera nivea* | Snowy orchid | 0 | GA tracked | June | JMK |
| *Pteroglossaspis ecristata* | Wild Coco | 0 | GA threatened | June-October | GA DNR |
| *Quercus chapmanii* | Chapman Oak | 4 | GA tracked | September-December | GA DNR |
| *Rhexia nuttallii* | Nutall meadowbeauty | 253 | GA tracked | June | JMK |
| *Rhynchospora fernaldii* | Fernald's Beakrush | 0 | GA tracked | June-January | GA DNR |
| *Sarracenia minor var. minor* | Hooded Pitcherplant | 78 | GA unusual | April-June | GA DNR |
| *Sarracenia psittacina* | Parrot Pitcherplant | 8 | GA threatened | March-July | GA DNR |
| *Schoenolirion albiflorum* | White Sunnybell | 0 | GA tracked | May-June | GA DNR |
| *Scutellaria arenicola* | Sandhill Skullcap | 0 | GA tracked | May-September | GA DNR |
| *Spiranthes floridana* | Florida Ladies-tresses | 0 | GA tracked | April-June | GA DNR |
| *Sporobolus teretifolius* | Wireleaf dropseed | 0 | GA tracked | July-October | GA DNR |
| *Stokesia laevis* | Stokes Aster | 0 | GA tracked | June-September | GA DNR |
| *Tephrosia chrysophylla* | Sprawling Goats Rue | 0 | GA tracked | April-November | GA DNR |
| *Tillandsia bartramii* | Bartram's Air-plant | 29 | GA tracked | June-September | GA DNR |
| *Verbesina heterophylla* | Diverse-leaf Crownbeard | 0 | GA tracked | April-July | GA DNR |

Table 2. Scoring system for wetlands.

| | 1 | 2 | 3 |
|---|---|---|---|
| Hydrology | Intact | Some degradation, easily restored | Severely degraded, restoration difficult |
| Fire | Frequent | Evidence of some past fire suppression | Evidence of severe fire suppression |
| Graminoids | Abundant | Some | Sparse or none |
| Midstory | Sparse | Patchy | Dense throughout basin |
| Canopy | < 50% closed | > 50% closed | Complete closure |
| Upland | Intact | Ditched & bedded, low groundcover quality | Severely degraded, low groundcover quality |

Table 3. All plants identified during 2019 surveys (not an exhaustive plant list).

| **Scientific name** | **Scientific name** | **Scientific name** | **Scientific name** | **Scientific name** |
|---|---|---|---|---|
| *Acer rubrum* | *Crotalaria maritima* | *Lachnanthes caroliniana* | *Polygala lutea* | *Scutellaria integrifolia* |
| *Aletris lutea* | *Cyrilla racemosa* | *Lachnocaulon anceps* | *Polygala nana* | *Serenoa repens* |
| *Anchistia virginica* | *Eleocharis sp.* | *Leucothoe axillaris* | *Pteridium aquilinum* | *Seymeria cassoides* |
| *Andropogon virginicus* | *Erigeron philadelphicus* | *Liatris tennuifolia* | *Pterocaulon pycnostachyum* | *Smilax auriculata* |
| *Aristida spiciformis* | *Eryngium integrifolium* | *Lobelia glandulosa* | *Quercus chapmanii* | *Smilax bona-nox* |
| *Asclepius cinerea* | *Eupatorium capillifoloium* | *Lyonia ferruginea* | *Quercus laurifolia* | *Smilax glauca* |
| *Asclepius connivens* | *Euthamia caroliniana* | *Lyonia fruticosa* | *Quercus myrtifolia* | *Smilax laurifolia* |
| *Asclepius pedicellata* | *Fuirena scirpoidea* | *Lyonia lucida* | *Quercus virginiana* | *Solidago sp.* |
| *Asimina incana* | *Galactia regularis* | *Magnolia virginica* | *Rhexia nuttallii* | *Sophronanthe hispida* |
| *Asimina pygmaea* | *Gelsemium sempervirens* | *Mikania scandens* | *Rhexia sp.* | *Stipulicida setacea* |
| *Baccharis halimifolia* | *Gordonia lasianthus* | *Myrica caroliniensis* | *Rhododenron canescens* | *Tephrosia spicata* |
| *Balduina angustifolia* | *Helenium vernale* | *Nyssa biflora* | *Rhododenron viscosum* | *Tillandsia bartramii* |
| *Balduina uniflora* | *Hypericum brachyphyllum* | *Onoclea sensibilis* | *Rhus copellinum* | *Trichostema sp.* |
| *Bejaria racemosa* | *Hypericum sp.* | *Panicum hemitomon* | *Rhynchospora latifolia* | *Trilisa ordoratissima* |
| *Bidens mitis* | *Hypericum tetrapetalum* | *Persea palustris* | *Sabatia brachiata* | *Typha sp.* |
| *Calopogon pallidus* | *Hypoxis sp.* | *Physostegia virginiana* | *Sabatia dodecandra* | *Vaccinium arboreum* |
| *Carphephorus corymbosus* | *Ilex coriacea* | *Pinguicula cerulea* | *Sabatia macrophylla* | *Vaccinium myrsinites* |
| *Cleistesiopsis divaricata* | *Ilex glabra* | *Pinus elliotii* | *Sagittaria sp.* | *Vaccinium stamineum* |
| *Clethra alnifolia* | *Iris virginica* | *Pinus pallustris* | *Salix sp.* | *Vitis sp.* |
| *Cliftonia monophylla* | *Juncus polycephalos* | *Pluchea odorata* | *Sarracenia minor* | *Wisteria frutescens* |
| *Acer rubrum* | *Kalmia hirsuta* | *Polygala cruciata* | *Sarracenia psitticina* | |


Figure 1. Twin Pines 2019 proposed mining project area with select flatwoods, wetlands and target plant locations. Degraded flatwoods areas were only surveyed opportunistically. Degraded wetlands are those that scored > 12 using the wetland scoring system (Table 2) and were not surveyed after the first survey period.

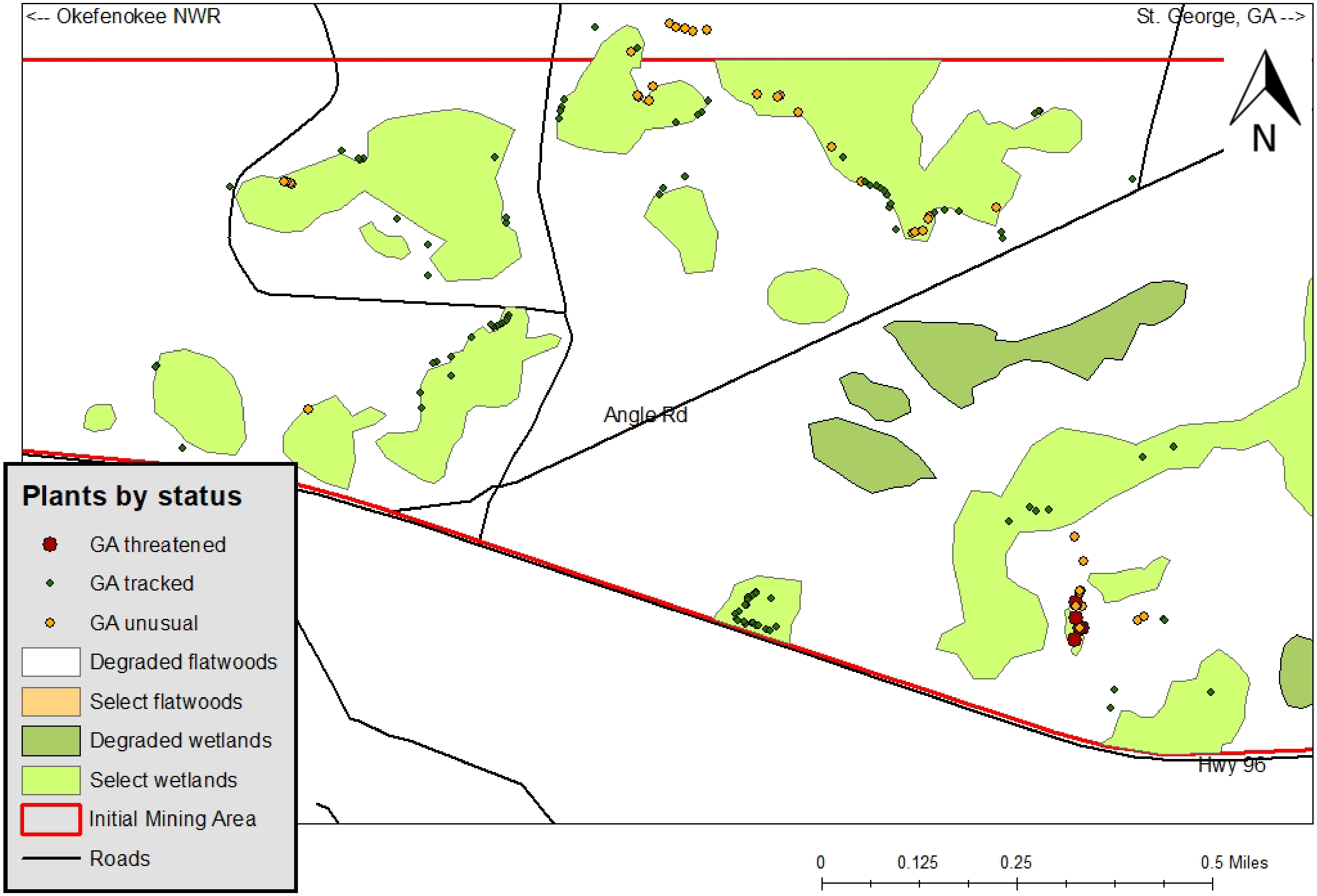


Figure 2. Twin Pines 2019 proposed mining project area, western section with select flatwoods, wetlands and target plant locations. Degraded flatwoods areas were only surveyed opportunistically. Degraded wetlands are those that scored > 12 using the wetland scoring system (Table 2) and were not surveyed after the first survey period.


Figure 3. Twin Pines 2019 proposed mining project area central section with select flatwoods, wetlands and target plant locations. Degraded flatwoods areas were only surveyed opportunistically. Degraded wetlands are those that scored > 12 using the wetland scoring system (Table 2) and were not surveyed after the first survey period.

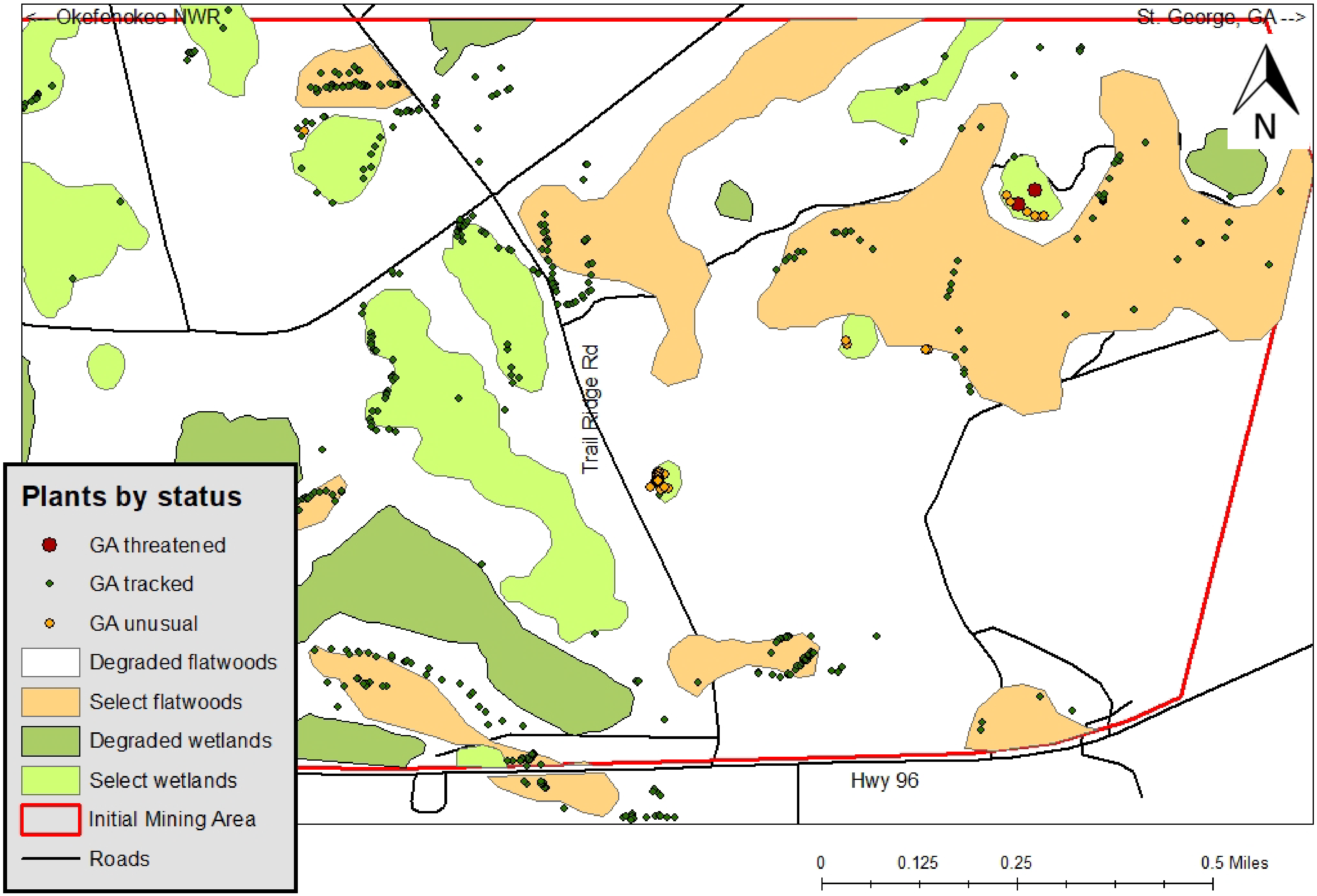


Figure 4. Twin Pines 2019 proposed mining project area eastern section with select flatwoods, wetlands and target plant locations. Degraded flatwoods areas were only surveyed opportunistically. Degraded wetlands are those that scored > 12 using the wetland scoring system (Table 2) and were not surveyed after the first survey period.

Figure 5. Typical post-wildfire salvage-logged upland habitat. Dominant groundcover is dense *Andropogon virginicus*, a species common on agricultural sites (i.e. ‘old fields’) and a symptom of past intensive silvicultural activity.

Figure 6. Typical upland habitat that escaped wildfire and has not been recently logged. This was likely the condition of most of the proposed project site before the 2017 wildfire. The dominant midstory/groundcover is *Serenoa repens*, a symptom of long-term fire suppression and intense herbicide use. This density of midstory structure precludes establishment or persistence of herbaceous species.

Figure 7. Fresh mechanical site preparation showing disturbance to soil and groundcover.

Figure 8. Young planted *Pinus elliotii* and rank *Andropogon sp.* in uplands/flatwoods precludes establishment or persistence of other herbaceous groundcover.

Figure 9. Typical degraded wetland habitat impacted by silviculture and wildfire, and dominated by dense shrubs, especially *Lyonia sp.* and *Cyrilla racemifolora*, with few herbaceous areas.

Figure 10. Many of the more herbaceous wetlands were impacted by feral swine. This image is typical of the damage caused by these pests that are abundant in the project area.

Figure 11. Every wetland in the proposed project area was impacted by intensive silvicultural activity. This is typical of the hydrologic impacts caused by mechanical site preparation (ditching and bedding) and planting pines. The area in the center is a planting bed and more open water areas on either side are ditches up to 0.5 m deep.

# THREATENED & ENDANGERED SPECIES HABITAT ASSESSMENT REPORT

## APPROXIMATELY 53.095-ACRE CHIP MILL PROPERTY
## SAINT GEORGE, CHARLTON COUNTY, GEORGIA

Submitted to:

Twin Pines Minerals, LLC

Attn: Mr. Steve Ingle, P.E.
2100 Southbridge Parkway
Birmingham, Alabama 35209

SAS-2018-00554
TTL Project No. 000180200804.00

June 19, 2020

TTL

# SIGNATURE OF ENVIRONMENTAL PROFESSIONALS

TTL, Inc. has performed a Threatened and Endangered Species Survey within the project site. Environmental professionals with specialized understanding of the listed species and the habitats of concern conducted the survey and developed this report.

| | |
|---|---|
| Chris Stanford<br>Project Professional | June 19, 2020<br>Date |
| Chris Terrell<br>Project Professional | June 19, 2020<br>Date |
| Cindy House-Pearson<br>Senior Natural Resources<br>Client Manager | June 19, 2020<br>Date |

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## FIGURES



## APPENDICES

# 1.0 INTRODUCTION

TTL, Inc. (TTL) was contracted by Twin Pines Minerals, LLC (Twin Pines) to perform habitat assessment for federally listed threatened or endangered species within the proposed project area. Twin Pines proposes to convert an existing lumber chip mill into a material processing facility for a proposed heavy mineral mining operation in Saint George, Charlton County, Georgia. TTL conducted the field activities for this project from March 23, 2020 to March 25, 2020. The U.S. Army Corps of Engineers (USACE) project number is SAS-2018-00554.

A list of federally protected species is maintained by the U.S. Fish and Wildlife Service (USFWS) for each county within the U.S. Consultation with the USFWS is required if project activities have the potential to impact listed species. The purpose of the survey is to observe the presence or probable absence of listed species and to evaluate the potential for suitable habitat. Site photographs are included in Appendix A.

# 2.0 SITE DESCRIPTION

The site is an approximately 53.095-acre area depicted on the U.S. Geological Survey (USGS) 7.5-minute Topographic Map of Saint George, Georgia (Figure 1). The center of the site is located near latitude 30.518411 and longitude -82.087495. According to the USGS Topographic Map, the elevation at the site ranges from approximately 120 to 155 feet above mean sea level.

The northern portion of the delineation area is located north of Highway 94. The southern portion of the review area is located between Highway 94 and the railroad right-of-way.

Driving directions to the site are as follows: from the intersection of GA-23 and GA-94 (in St. George, GA), travel west along GA-94 for approximately 2.96 miles and the chip mill is located along the southern portion of GA-94 (Figure 2).

# 3.0 LITERATURE AND RECORDS REVIEW

Prior to conducting the field effort, TTL performed a literature and records review to develop an understanding of the potential for the presence of ecosystems that may support species identified by the USFWS. These data sources and the review findings are described below.

## 3.1 Soils

The Natural Resource Conservation Service (NRCS) maintains a database of soil types (map units) for most areas of the U.S. The map unit descriptions, along with the maps, can be used to determine the composition and properties of the unit which represents a large area dominated by one or more major soil types. Map units are useful for planning purposes to provide an overall understanding of whether the soils that occur in a general area are likely to provide habitat support for listed species. Table 1 presents the soil map unit within the survey area. A map of the onsite and adjacent soils with the hydric rating classification is presented in Figure 3.

Table 1: Soil Map Unit Classification

| Map Symbol | Map Unit Description |
| --- | --- |
| LeA | Leon Fine Sand, 0 to 2 percent slopes |
| LyA | Lynn Haven Fine Sand, 0 to 2 percent slopes |
| MaA | Mandarin Fine Sand, 0 to 2 percent slopes |

## 3.2 Wetlands & Waters

The U.S. Fish and Wildlife Service (USFWS) created and maintains the National Wetland Inventory (NWI) database of information on the characteristics, extent, and status of the wetlands and deepwater habitats within the U.S. This information is useful for planning purposes and provides an overall understanding of the habitats that may be present in or around the site. The NWI classifies habitat types as marine, estuarine, riverine, lacustrine or palustrine with additional modifiers as appropriate to identify the water regime, water chemistry, soil or other characteristics based on *Classification of Wetlands and Deepwater Habitats of the U.S*. (Cowardin, 1979).

TTL reviewed the NWI data for the site using the USFWS NWI Wetlands Mapper web-based tool to determine the potential for wetlands to exist on the site. The USFWS NWI Mapper identified numerous stream features along the locations of constructed roadside and railroad right-of-way within the review area boundary as well as a small area of forested wetland along the southeastern portion of the review area. Figure 4 depicts the NWI Map, and Table 2 summarizes the habitat below.

Table 2: NWI Classifications

| Map Unit Symbol | Description of Habitat |
|---|---|
| R4SBC | Riverine; Intermittent; Streambed; Seasonally flooded. |
| PFO6F | Palustrine; Forested, Deciduous; Semipermanently Flooded |

Furthermore, from March 23, 2020 to March 25, 2020 TTL delineated waters of the United States (WOTUS) on the property. The review area contains one, approximately 3.604-acre, wetland and one, approximately 1.247-acre, constructed storm water basin. The wetland is located on the northwestern portion of the review area (Figure 5). The hydrology for this area is supported by localized stormwater and a shallow water table. The wetland vegetation communities within the delineation area vary from large areas of bedded, planted pine habitat [dominated by slash pine (*Pinus elliottii*) whose growth has been stunted due to hydric conditions, inkberry (*Ilex glabra*), red maple (*Acer rubrum*), Carolina redroot (*Lachnanthes caroliniana*), loblolly bay (*Gordonia* lasianthus), broomsedge (*Andropogon virginicus*) and Virginia chain fern (*Woodwardia virginica*)], to forested bayhead/riparian habitat that exhibited few signs of silvicultural activities [dominated by pond cypress (*Taxodium ascendens*), swamp tupelo (*Nyssa biflora*), large gallberry (*Ilex coriacea*), myrtle leaf holly (*Ilex myrtifolia*), manyhead rush (*Juncus polycephalus*) and Virginia chain fern].

## 3.3 Ecoregion

Areas with generally similar ecosystems, with respect to the type, quality and quantity of environmental resources have been divided into "ecoregions" by the U.S. Environmental Protection Agency (EPA). The U.S. is divided and sub-divided into successively smaller regions: Level I is the coarsest scale and Level IV is the finest scale of division. The project site is located within the Sea Island Flatwoods (75f) Level IV ecoregion within the Southern Coastal Plain Level III ecoregion (Griffith et al., 2001).

The Southern Coastal Plain ecoregion is described below:

> *The Southern Coastal Plain extends from South Carolina and Georgia through much of central Florida, and along the Gulf coast lowlands of the Florida Panhandle, Alabama, and Mississippi. From a national perspective, it appears to be mostly flat plains, but it is a heterogeneous region*

*also containing barrier islands, coastal lagoons, marshes, and swampy lowlands along the Gulf and Atlantic coasts. In Florida, an area of discontinuous highlands contains numerous lakes. This ecoregion is generally lower in elevation with less relief and wetter soils than ecoregion 65. Once covered by a variety of forest communities that included trees of longleaf pine, slash pine, pond pine, beech, sweetgum, southern magnolia, white oak, and laurel oak, land cover in the region is now mostly slash and loblolly pine with oak-gum-cypress forest in some low lying areas, citrus groves, pasture for beef cattle, and urban.* (Griffith et al., 2001)

The Sea Island Flatwoods ecoregion is described below:

*The **Sea Island Flatwoods** are poorly-drained flat plains with lower elevations and less dissection than 65l. Pleistocene sea levels rose and fell several times creating different terraces and shoreline deposits. Spodosols and other wet soils are common, although small areas of better-drained soils add some ecological diversity. Trail Ridge is in this region, forming the boundary with 75g. Loblolly and slash pine plantations cover much of the region. Water oak, willow oak, sweetgum, blackgum and cypress occur in wet areas.* (Griffith et al., 2001)

# 4.0 POTENTIAL SPECIES AND HABITAT DESCRIPTION

## 4.1 Potential Species Overview

According to information maintained by the U.S. Fish & Wildlife Service (USFWS) Environmental Conservation Online System (ECOS) IPaC Species List (**Consultation Code: 04EG1000-2020-SLI-1378**, **Event Code: 04EG1000-2020-E-02535**), four (4) federally-listed species may be located within the project area; there are no critical habitats identified within the project area. A copy of the Official Species List Letter is included as Appendix A. The species list is also provided in the table below:

| Group | Name | Status |
|---|---|---|
| Reptiles | **Eastern Indigo Snake (*Drymarchon coraris couperi*)** | **Threatened** |
| | **Gopher Tortoise (*Gopherus polyphemus*)** | **Candidate** |
| Amphibians | **Frosted Flatwoods Salamander (*Ambystoma cingulatum*)** | **Threatened** |

| Group | Name | Status |
|---|---|---|
| Birds | **Red-cockaded Woodpecker (*Picoides borealis)*** | **Endangered** |

## 4.2 Gopher Tortoise

The Gopher tortoise is a large brownish-gray land turtle. The gopher tortoise grows slowly, with female shells (carapace) reaching at least nine inches in length while male carapaces can be slightly smaller. The gopher tortoise has large flipper-like, heavily scaled front legs and strong toenails for digging while the back legs are muscular. In North America, there are four extant species (desert tortoise, Texas tortoise, Bolson tortoise and the gopher tortoise), all occurring in deep sand habitats.

The largest populations of gopher tortoises occur in deep, dry sandy soils with a moderately open tree canopy such as the longleaf pine-scrub oak-wiregrass sand hills that are frequently burned. This habitat is ideal for digging deep burrows and allows sufficient sunlight to reach the ground to provide thermo-regulation necessary for nesting and incubation of the eggs. This open canopy also allows abundant herbaceous vegetation necessary for their preferred herbivorous diet.

Clear cuts that are created by timber harvesting activities may support a small population for a few years, but as the canopy closes, the tortoises move toward areas with a more open canopy. Dense hardwood and unburned pine/hardwood areas are not suitable habitat. While agricultural fields provide support for a few individuals, it is considered marginal habitat.

Gopher tortoise survey methods closely followed those recommended by Smith et al. (2009). From a review of soil maps and vegetation, combined with initial field reconnaissance, it became apparent that, on-site, gopher tortoise burrows were limited to habitats underlain by the soil type classified as Mandarin Fine Sand (MAA). Mandarin is classified as a suitable soil, but not as a preferred soil, for the tortoise (U.S. Department of Agriculture Natural Resources Conservation Service, 2013).

To locate burrows, TTL walked line transects, with observers spaced approximately 5 meters apart, through all areas of potential habitat. TTL flagged and collected geospatial data for all active (i.e., intact burrows with fresh tortoise tracks) and inactive (i.e., intact burrows, but lacking fresh tracks) tortoise burrows on the Chip Mill property.

TTL identified 31 active and inactive gopher tortoise burrows in close proximity to the railroad spur right-of-way as shown on Figure 6. Site photographs are provided in Appendix A.

## 4.3 Eastern Indigo Snake

Due to known occurrences in the region and gopher tortoise burrows present onsite, wintering habitat may be present for the eastern indigo snake. Although not surveyed for due to the time of year of the field inspection, no specimens, associated fresh snake tracks, or snake shed skins of the eastern indigo snake were observed during the field inspections.

## 4.4 Frosted Flatwoods Salamander

The frosted flatwoods salamander is endemic to mesic longleaf pine-wiregrass flatwoods and savannahs where it breeds in isolated, ephemeral depressional wetlands (Palis 1997; Jensen and Stevenson 2008). Optimal breeding habitats are kept open-canopied by occasional fire events and the basins of these wetlands are typically carpeted with graminaceous vegetation (Bishop and Haas 2005, Palis 1997; US FWS 1999). Adult salamanders spend over 90% of their lives in fire-maintained, mesic longleaf/slash pine–wiregrass flatwoods surrounding breeding sites (Palis and Means 2005). Late winter-early spring surveys for larvae are the most effective and efficient way to document the presence of this salamander (Bishop et al. 2006, Bevelhimer et al. 2008).

TTL reviewed the on-site wetland habitats for their suitability of potential breeding pond habitats for the frosted flatwoods salamander (i.e., isolated depressional wetlands forested with pond cypress (*Taxodium ascendens*), black gum (*Nyssa biflora*), slash pine (*Pinus elliottii*), and myrtle-leaved holly (*Ilex myrtifolia*). The on-site forested wetland was evaluated as to its potential suitability for the frosted flatwoods salamander based on a ranking system developed by Palis (2002). For each wetland; the hydrology, fire history, presence/absence of graminaceous vegetation within the pond basin (including *Carex*, *Rhynchospora*, *Eriocaulon*, *Xyris*, *Panicum* spp.) as well as the condition of pine uplands (e.g., fire history, integrity of ground cover, soil type and disturbance) surrounding the wetland was considered. TTL did not identify any suitable habitat for breeding sites within the review area. The onsite forested wetland appeared riparian in nature and was not an isolated, depressional feature.

## 4.5 Red-cockaded Woodpecker

Red-cockaded woodpecker are residents of the Okefenokee National Wildlife Refuge. Suitable habitat consists of well-drained, sandy areas dominated by old-growth, longleaf pine communities with sparse mid-story vegetation and dense diverse herbaceous groundcover. Pine trees must be of sufficient size and spatial distribution to be inhabited by red-cockaded woodpeckers. Due to the site's current use as a commercial forestry operation (north of Highway 94) and chip mill (south of

Highway 94), this habitat does not exist within the review area. No red-cockaded woodpeckers, cavity trees, or signs were observed during field reconnaissance.

# 5.0 CONCLUSIONS

Within the survey review area, TTL observed 31 gopher tortoise burrows, which are located in close proximity to the railroad rail spur right-of-way. Therefore, potential wintering habitat is present onsite for the eastern indigo snake. No suitable habitat was observed onsite for the frosted flatwoods salamander or the red-cockaded woodpecker.

Due to the historic use of this property as an industrial facility and no proposed construction within burrow areas, this project may affect but is not likely to adversely affect the gopher tortoise or the eastern indigo snake.

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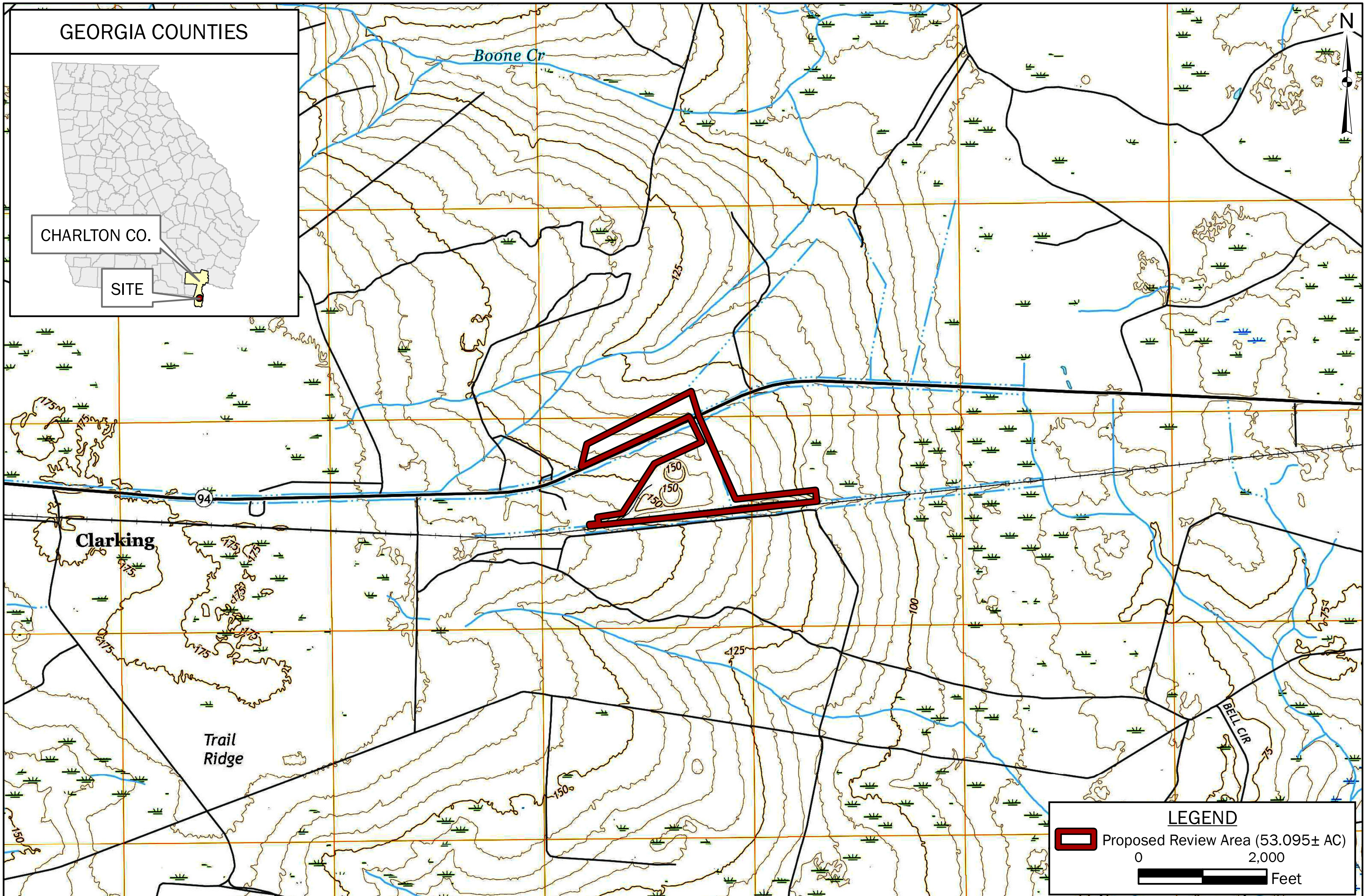
# FIGURES

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# FIGURE 1: SITE LOCATION & TOPOGRAPHIC MAP

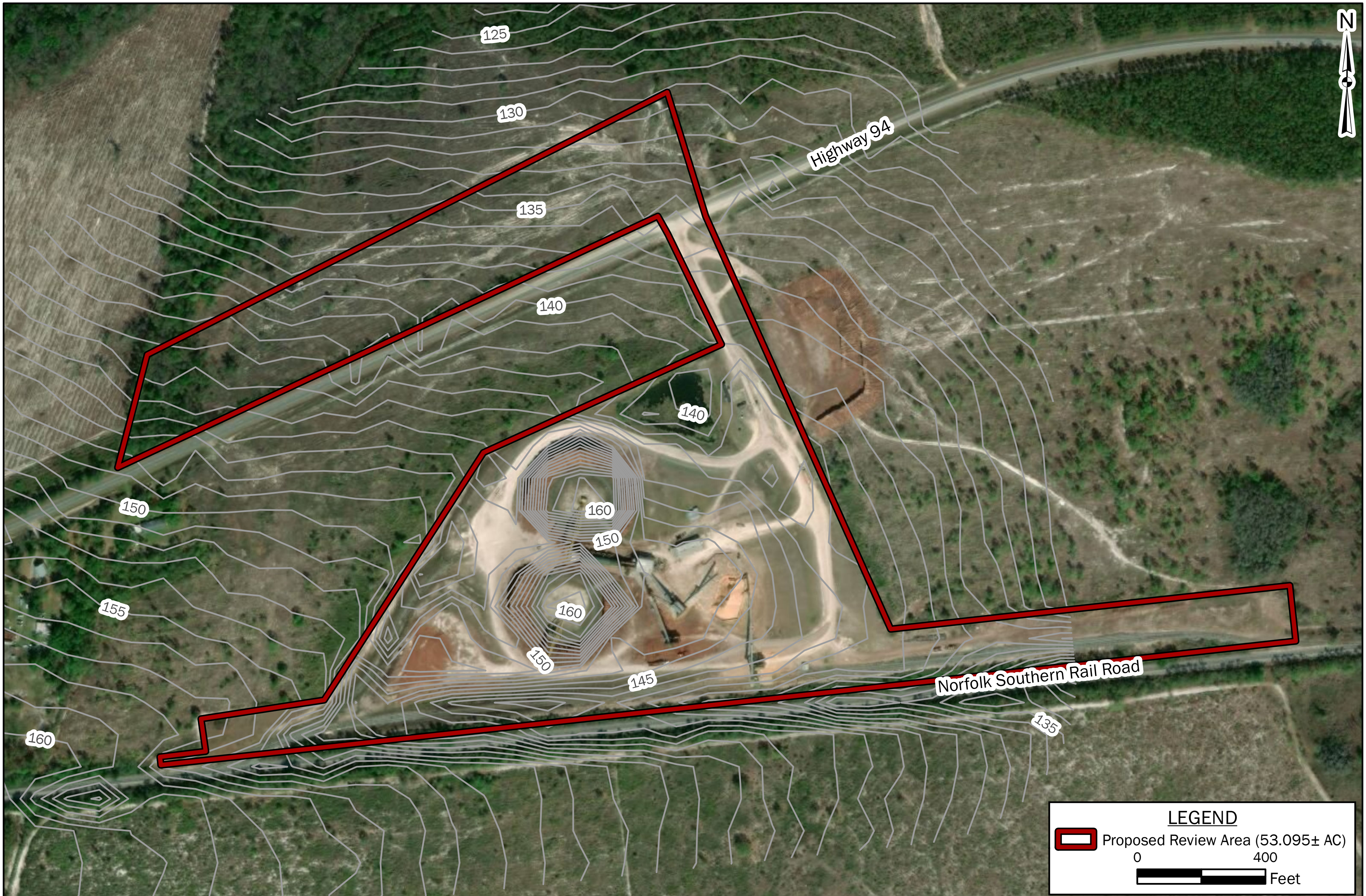
THREATENED & ENDANGERED SPECIES REPORT

TWIN PINES MINERALS

ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Saint George, Georgia USGS 7.5 Minute Quadrangle Map, 2017 (5-ft Contour Interval).

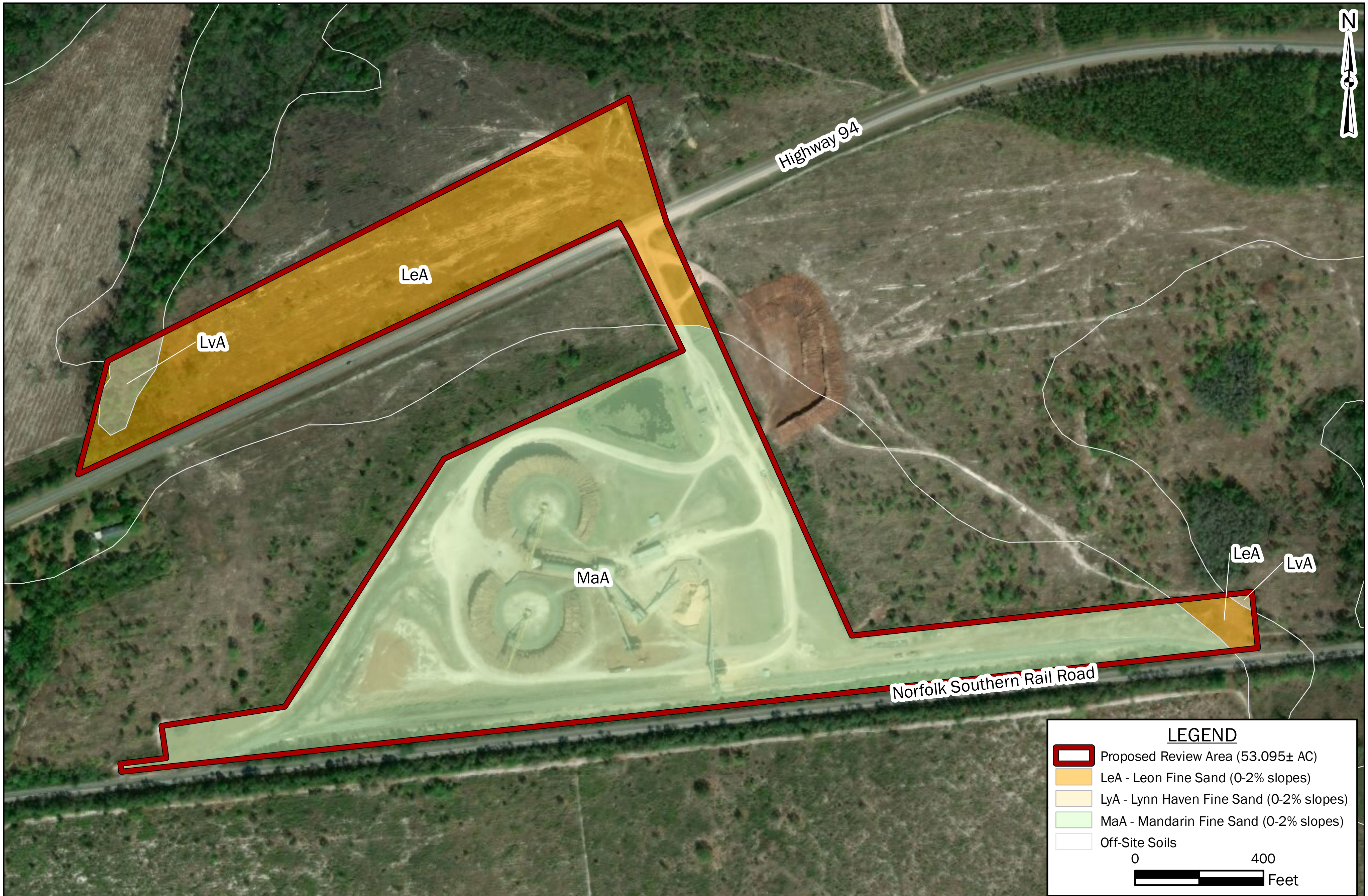
| | |
|---|---|
| DRAWN BY: DEK | |
| CHECKED BY: CMS | |
| DRAWING DATE: 6/17/2020 | |
| REVISION DATE: N/A | |
| TTL JOB NO.: 000180200804.00 | |
| APPROX. SCALE: | 1 in = 2,000 ft |




TTL

FIGURE 2: SITE LOCATION & AERIAL PHOTOGRAPH
THREATENED & ENDANGERED SPECIES REPORT
TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA
BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

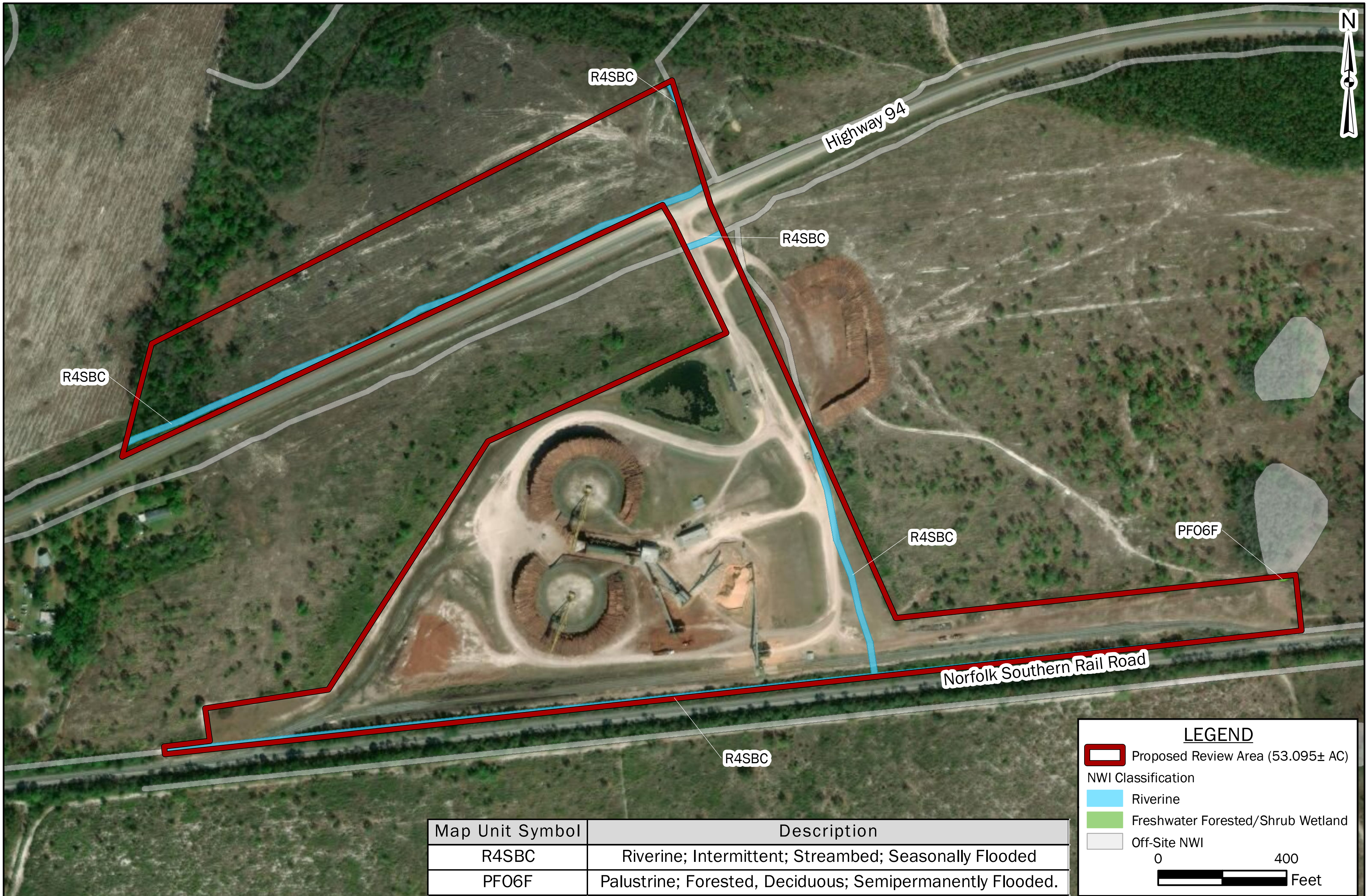
| | |
|---|---|
| DRAWN BY: DEK | |
| CHECKED BY: CMS | |
| DRAWING DATE: 6/17/2020 | |
| REVISION DATE: N/A | |
| TTL JOB NO.: 000180200804.00 | |
| APPROX. SCALE: | 1 in = 400 ft |




TTL

FIGURE 3: NATURAL RESOURCES CONSERVATION SERVICES (NRCS) SOIL MAP
THREATENED & ENDANGERED SPECIES REPORT
TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA
BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

| | |
|---|---|
| DRAWN BY: DEK | |
| CHECKED BY: CMS | |
| DRAWING DATE: 6/17/2020 | |
| REVISION DATE: N/A | |
| TTL JOB NO.: 000180200804.00 | |
| APPROX. SCALE: | 1 in = 400 ft |




| Map Unit Symbol | Description |
|---|---|
| R4SBC | Riverine; Intermittent; Streambed; Seasonally Flooded |
| PF06F | Palustrine; Forested, Deciduous; Semipermanently Flooded. |

TTL

# FIGURE 4: NATIONAL WETLAND INVENTORY (NWI) MAP
## THREATENED & ENDANGERED SPECIES REPORT
## TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

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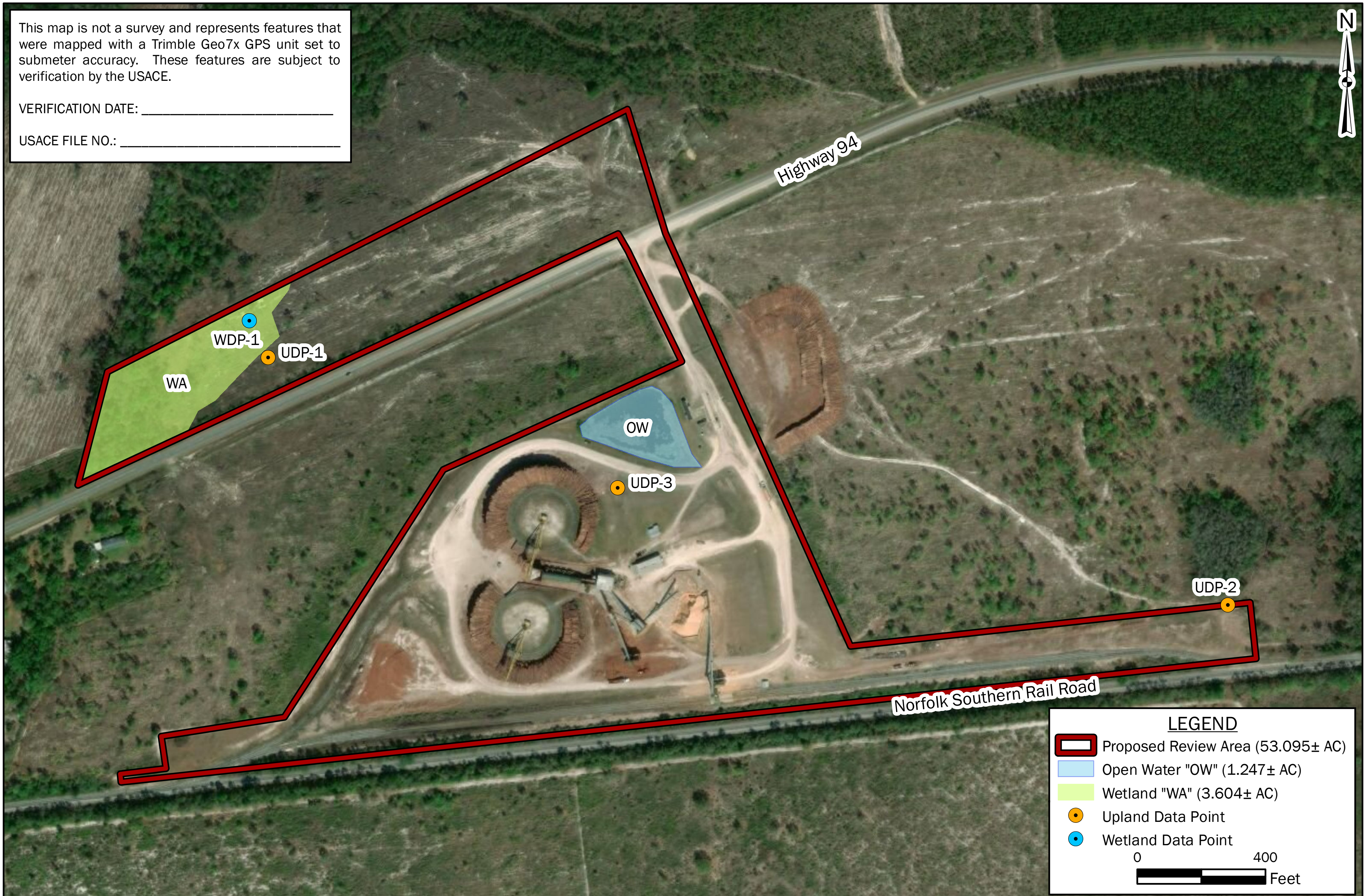
| DRAWN BY: DEK | |
| CHECKED BY: CMS | |
| DRAWING DATE: 6/17/2020 | |
| REVISION DATE: N/A | |
| TTL JOB NO.: 000180200804.00 | |
| APPROX. SCALE: | 1 in = 400 ft |




TTL

# FIGURE 5: WATERS OF THE U.S. DELINEATION MAP

## THREATENED & ENDANGERED SPECIES REPORT

## TWIN PINES MINERALS

ST. GEORGE, CHARLTON COUNTY, GEORGIA

BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

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| DRAWN BY: DEK | |
| CHECKED BY: CMS | |
| DRAWING DATE: 6/17/2020 | |
| REVISION DATE: N/A | |
| TTL JOB NO.: 000180200804.00 | |
| APPROX. SCALE: | 1 in = 400 ft |


TTL

FIGURE 6: GOPHER TORTOISE BURROW LOCATION MAP
THREATENED & ENDANGERED SPECIES REPORT
TWIN PINES MINERALS
ST. GEORGE, CHARLTON COUNTY, GEORGIA
BASEMAP: Maxar, Vivid Imagery, 3/24/2018 (0.46 m Resolution).

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| DRAWN BY: DEK |
| CHECKED BY: CMS |
| DRAWING DATE: 6/17/2020 |
| REVISION DATE: N/A |
| TTL JOB NO.: 000180200804.00 |
| APPROX. SCALE: 1 in = 400 ft |

# APPENDIX A

SITE PHOTOGRAPHS

Photograph 1: View of Wetland Data Point 1 (WDP-1) location.

Photograph 2: View of Upland Data Point 1 (UDP-1) location.

Photograph 3: View westward of the southeastern portion of the delineation area.

Photograph 4: View of Upland Data Point 2 (UDP-2) location.

Photograph 5: View of the constructed recirculation open water located on the central portion of the delineation area.

Photograph 6: View of Upland Data Point 3 (UDP-3) location.

Photograph 7: View of gopher tortoise burrow in close proximity to rail spur along the southeastern portion of the review area.

Photograph 8: View of gopher tortoise burrow in close proximity to rail spur along the southwestern portion of the review area .

**DEPARTMENT OF THE INTERIOR**

**Fish and Wildlife Service**

**50 CFR Part 17**

**[Docket No. FWS–R4–ES–2009–0029; FF09E21000 FXES1111090FEDR 223]**

## Endangered and Threatened Wildlife and Plants; Finding for the Gopher Tortoise Eastern and Western Distinct Population Segments

**AGENCY:** Fish and Wildlife Service, Interior.

**ACTION:** Notification of findings.

**SUMMARY:** We, the U.S. Fish and Wildlife Service (Service), announce findings on the status of the gopher tortoise (*Gopherus polyphemus*) rangewide and in the eastern (east of the Mobile and Tombigbee Rivers) and western (west of the Mobile and Tombigbee Rivers) portions of the range under the Endangered Species Act of 1973, as amended (Act). After a review of the best available scientific and commercial information, we find that listing the gopher tortoise as an endangered or a threatened species rangewide is not warranted. We find that the gopher tortoise in the eastern portion of its range and the gopher tortoise in the western portion of its range meet the criteria of separate distinct population segments (DPS), as defined by our Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act. We determine the Eastern DPS of the gopher tortoise is not warranted for listing at this time. Further, we confirm that the Western DPS of the gopher tortoise meets the definition of a threatened species. Additionally, this notice serves as our completed 5-year review of the Western DPS of the gopher tortoise. We ask the public to submit to us any new information that becomes available concerning the threats to the gopher tortoise or its habitat at any time.

**DATES:** The finding announced in this document was made on October 12, 2022.

**ADDRESSES:** This finding is available on the internet at *https://www.regulations.gov* at Docket No. FWS–R4–ES–2009–0029. Supporting information that we developed for this finding including the species status assessment report, peer review, and future condition modeling, are found in the decision file available at *https://www.regulations.gov* at Docket No. FWS–R4–ES–2009–0029 and on the Service's website at *https://www.fws.gov/office/florida-ecological-services/library,* and is available for public inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Florida Field Office, 7915 Baymeadows Way, Suite 200, Jacksonville, FL 32256. Please submit any new information or materials concerning this finding to the above address.

**FOR FURTHER INFORMATION CONTACT:** Lourdes Mena, Division Manager, Florida Classification and Recovery, U.S. Fish and Wildlife Service, Florida Ecological Services Field Office, 7915 Baymeadows Way, Suite 200, Jacksonville, FL 32256–7517; telephone 904–731–3134; or James Austin, Acting Field Supervisor, Mississippi Ecological Services Field Office, 6578 Dogwood View Parkway, Jackson, MS 39213; telephone 601–321–1129. Individuals in the United States who are deaf, deafblind, hard of hearing, or have a speech disability may dial 711 (TTY, TTDD, or TeleBraille) to access telecommunications relay services. Individuals outside the United States should use the relay services offered within their country to make international calls to the point-of-contact in the United States.

**SUPPLEMENTARY INFORMATION:**

### Previous Federal Actions

On July 7, 1987, the gopher tortoise (*Gopherus polyphemus*) was listed under the Act as a threatened species (52 FR 25376) in the western portion of its range, from the Tombigbee and Mobile Rivers in Alabama west to southeastern Louisiana on the lower Gulf Coastal Plain. On January 18, 2006, we received a petition dated January 13, 2006, from Save Our Big Scrub, Inc. and Wild South requesting that the population of the gopher tortoise in the eastern portion of its range be listed as a threatened species under the Act and critical habitat be designated. On September 9, 2009, we published a 90-day finding (74 FR 46401) that the petition contained substantial information indicating that listing may be warranted for the eastern population of the gopher tortoise. On July 27, 2011, we published a 12-month finding (76 FR 45130) on the petition to list the gopher tortoise in the eastern portion of its range, and, in that finding, we evaluated the status of the gopher tortoise in the western portion of its range. We reaffirmed that the gopher tortoise warranted listing as a threatened species in the western portion of its range. We found the gopher tortoise in the eastern portion of its range was warranted for listing but precluded by higher priority listing actions (warranted but precluded finding).

The species was placed on the candidate list (our list of species that have been found to warrant listing, but which are precluded by higher priority listing actions) and received a listing priority number of 8 based on the magnitude and immediacy of the threats. The eastern population of gopher tortoise was included in subsequent annual candidate notices of review (CNORs) (76 FR 66370, October 26, 2011; 77 FR 69994, November 21, 2012; 78 FR 70104, November 22, 2013; 79 FR 72450, December 5, 2014; 80 FR 80584, December 24, 2015; 81 FR 87246, December 2, 2016; 84 FR 54732, October 10, 2019; 85 FR 73164, November 16, 2020; 87 FR 26152, May 3, 2022).

On April 1, 2021, the Center for Biological Diversity (CBD) filed a complaint alleging our ''warranted but precluded'' finding for the eastern population of the gopher tortoise violated the Act because we were not making ''expeditious progress'' in adding qualified species to the lists of endangered or threatened species and because we had not shown that the immediate proposal of the eastern population of the gopher tortoise was precluded by higher priority actions consistent with 16 U.S.C. 1533(b)(3)(B)(iii). On April 26, 2022, the Service entered into a court-approved settlement agreement with CBD requiring the Service to submit either a warranted or a not warranted finding for the eastern population of gopher tortoise to the **Federal Register** by September 30, 2022.

On June 20, 2019, we initiated a 5-year review for the western population of the gopher tortoise (84 FR 28850), and this document completes our status review under section 4(c)(2) of the Act. See *https://ecos.fws.gov/ecp/species/C044* for the species profile for the gopher tortoise.

### Supporting Documents

A species status assessment (SSA) team prepared an SSA report for the gopher tortoise. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents compilations of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species. In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review of listing actions under the Act, we sought the expert opinions of seven appropriate specialists regarding the gopher tortoise SSA. We received responses from two peer reviewers. We coordinated with the nine Tribal nations in the range of the species early in the SSA process for the gopher tortoise, including the Catawba Nation, the Jena Band of Choctaw Indians, the Tunica-Biloxi Indian Tribe, the Miccosukee Tribe of Indians, the Seminole Tribe of Florida, the Chitimacha Tribe of Louisiana, the Coushatta Tribe of Louisiana, the Mississippi Band of Choctaw Indians, and the Poarch Band of Creek Indians. We sent the draft SSA report for review to 10 Tribes (with the addition of the Cherokee Nation).

**Background**

*Species Information*

In this section, we present an overview of the biological information for gopher tortoise. A more thorough review of the taxonomy, species description, life history, species needs, and ecology of the gopher tortoise is presented in detail in the SSA report (Service 2022, pp. 24–45).

Taxonomy and Species Description

The gopher tortoise is the only tortoise (family Testudinidae) east of the Mississippi River; one of six species in the genus *Gopherus* in North America (Ernst and Lovich 2009, p. 581; Edwards et al. 2016, p. 131). The scientific name, *Gopherus polyphemus,* has remained unchanged since it was first described by F.M. Daudin in 1802. There is no taxonomic distinction between the gopher tortoise in the western and eastern portions of its range or at any level of geographic subdivision. However, genetic differences do occur in populations across the range of the species. Genetic variation across the range is best explained by the geographic features of the Apalachicola-Chattahoochee River system and the Mobile and Tombigbee Rivers in Alabama (Osentoski and Lamb 1995, p. 709; Clostio et al. 2012, pp. 613–625; Ennen et al. 2012, pp. 110–122; Gaillard et al. 2017, p. 497) (see Genetics section below for more information).

The gopher tortoise is larger than any other terrestrial turtle in the Southeast and is characterized by a domed, dark brown to grayish-black carapace (upper shell) and a yellowish plastron (lower shell). Adult gopher tortoises are typically 10 to 12 inches (in) (25.4 to 30.5 centimeters (cm)) long and weigh 9 to 13 pounds (4 to 6 kilograms) (Ernst et al. 1994, p. 466; Ashton and Ashton 2008, p. 17; Bramble and Hutchison 2014, p. 4). Hatchlings are up to 2 in (5 cm) in length, with a somewhat soft, yellow-orange shell. When young, female gopher tortoises may be smaller than males, but, as adults, female tortoises are generally larger than males. Females have a flat plastron, while that of males is more concave. Male gopher tortoises can also be distinguished by a larger gland under the chin and a longer throat projection. As a fossorial species, its hind feet are elephantine or stumpy, and the forelimbs are shovel-like, with claws used for digging.

Range and Distribution

The gopher tortoise occurs in the Southeastern Atlantic and Gulf Coastal Plains from southern South Carolina, west through Georgia, the Florida panhandle, Alabama, and Mississippi to eastern Louisiana, and south through peninsular Florida (Auffenberg and Franz 1982, p. 95). The current range of the gopher tortoise generally aligns with the species' historical range and the historical range of the longleaf pine ecosystem (Auffenberg and Franz 1982, pp. 99–120). The eastern portion of the gopher tortoise's range includes Alabama (east of the Tombigbee and Mobile Rivers), Florida, Georgia, and southern South Carolina. The western portion of the range includes areas west of the Tombigbee River in Alabama, Mississippi, and Louisiana.

The gopher tortoise is more widespread and abundant in the eastern portion of its range, particularly in central and north Florida and eastern and southern Georgia. These areas in Florida and Georgia make up the core of the species' distribution (Tuberville et al. 2009, p. 12). The best available information indicates gopher tortoises occur on approximately 844,812 acres (ac) (341,883 hectares (ha)) across the species' range (areal extent of populations as delineated for our analysis below in Analysis Unit and Population Delineation*).* An additional 16,338,932 ac (6,612,131 ha) of potential habitat has been identified by a species-specific habitat suitability model (Crawford et al. 2020, entire; Service 2022, pp. 122–126). For the SSA assessment, potential habitat is described as suitable habitat with unknown gopher tortoise presence outside delineated local gopher tortoise populations but within the species' current range. Rangewide, approximately 80 percent of potential gopher tortoise habitat occurs in private ownership, with the remainder owned or managed by local, State, Federal, or private conservation entities (Wear and Greis 2013, p. 103; Natural Resources Conservation Service (NRCS) 2018, p. 2).

Life History

The gopher tortoise's life history is characterized by a late age of reproductive maturity, low reproductive output (fecundity), and long lifespan, which make this long-lived species more vulnerable to demographic perturbations and slower to rebound from impacts to populations (Lohoefener and Lohmeier 1984, p. 2; Service 2013, p. 21; Tuberville et al. 2014, p. 1151). Gopher tortoises reach reproductive maturity between 9 and 20 years of age, although reproductive maturity is determined by size rather than age. Growth rates and sizes at sexual maturity vary among populations and habitat quality (Landers et al. 1982, pp. 104–105; Mushinsky et al. 1994, pp. 123–125).

Gopher tortoises generally breed from May through October; however, the gopher tortoise populations in south Florida have an extended reproductive season (Landers et al. 1980, p. 355; McRae et al. 1981, pp. 172–173; Taylor 1982, entire; Diemer 1992a, pp. 282–283; Ott-Eubanks et al. 2003, p. 317; Moore et al. 2009, p. 391). The warmer weather in south Florida is associated with year-round courtship behavior, greater site productivity, and larger clutches leading to production of young over a much longer time period than populations farther north (Ashton et al. 2007, p. 359; Moore et al. 2009, p. 391). Female gopher tortoises usually lay eggs from mid-May through mid-July, and incubation lasts 80–110 days (Diemer 1986, p. 127). Rangewide, average clutch size varies from 4–8 eggs per clutch, with clutches in the western portion of the range averaging lower with 4.8–5.6 eggs per clutch (Seigel and Hurley 1993, p. 6; Seigel and Smith 1996, pp. 10–11; Tuma 1996, pp. 22–23; Epperson and Heise 2003, pp. 318–321; Ashton et al. 2007, p. 357). Sex determination is temperature dependent for gopher tortoises, with lower temperatures producing more males and higher temperatures producing more females. The pivotal temperature for a 1:1 sex ratio has been observed to be 29.3 degrees Celsius (°C) (84.7 degrees Fahrenheit (°F)) (DeMuth 2001, pp. 1612–1613). The lifespan of gopher tortoises is generally estimated at 50–80 years.

The gopher tortoise's diet reflects that of a generalist herbivore (*e.g.,* eating mainly grasses, plants, fallen flowers, fruits, and leaves) and may also include insects and carrion (Auffenberg and Iverson 1979, p. 558; Landers 1980, p. 9; Garner and Landers 1981, p. 123;

Wright 1982, p. 25; Macdonald and Mushinsky 1988, pp. 349–351; Birkhead et al. 2005, pp. 146, 155; Mushinsky et al. 2006, p. 480; Richardson and Stiling 2019, pp. 387–388). Gopher tortoises prefer grassy, open-canopy microhabitats, and their population density directly relates to the density and diversity of herbaceous biomass and a lack of canopy (Auffenberg and Iverson 1979, p. 558; Landers and Speake 1980, p. 522; Wright 1982, p. 22; Stewart et al. 1993, p. 79; Breininger et al. 1994, p. 63; Boglioli et al. 2000, p. 703; Ashton and Ashton 2008, p. 78).

Habitat

Gopher tortoise habitat comprises well-drained, sandy soils (needed for burrowing, sheltering, and nest construction/breeding), with an open canopy, sparsely vegetated midstory, and abundant herbaceous groundcover (for feeding). Soil characteristics are an important component of gopher tortoise habitat and affect burrow density and extent. The soils in the eastern portion of the range are characterized by a higher sand content, although the percentage of sand varies by habitat type (*i.e.,* coastal soils often contain more sand than more inland upland soils) (Auffenberg and Franz 1982, pp. 98–105, 113–118, 120–121). In the western portion of the range, soils are loamy and contain more clay, and xeric (dry) conditions are less common west of the Florida panhandle (Lohoefener and Lohmeier 1981, p. 240; Auffenberg and Franz 1982, pp. 114–115; Mann 1995, pp. 10–11; Craul et al. 2005, pp. 11–13). Higher clay content in soils may contribute to lower abundance and density of tortoises (Means 1982, p. 524; Wright 1982, p. 21; Ultsch and Anderson 1986, p. 790; Estes and Mann 1996, p. 24; Smith et al. 1997, p. 599; Jones and Dorr 2004, p. 461).

Historically, gopher tortoise's habitats were open pine forests, savannahs, and xeric grasslands. Today, upland natural vegetative communities, including longleaf pine (*Pinus palustris*) and other open pine systems, sandhill, xeric (dry) oak (*Quercus* spp.) uplands, xeric hammock, xeric Florida scrub, and maritime scrub coastal habitats, most often provide the conditions necessary (*e.g.,* open canopy and abundant herbaceous groundcover) to support gopher tortoises (Auffenberg and Franz 1982, p. 99; Diemer 1986, p. 126; Diemer 1987, pp. 73–74; Breininger et al. 1994, p. 60). In addition to the upland natural communities, some ruderal (disturbed) habitat may also provide the open canopy or sunny conditions and herbaceous groundcover needed by gopher tortoises (Auffenberg and Franz 1982, p. 99; Howell et al. 2020, p. 1). An open canopy allows sunlight to reach the forest floor to stimulate the growth and development of herbaceous groundcover and provide warmth for basking and egg incubation (Landers 1980, pp. 6, 8; Landers and Speake 1980, p. 522; Lohoefener and Lohmeier 1981, entire; Auffenberg and Franz 1982, pp. 98–99, 104–107, 111, 120; Boglioli et al. 2000, p. 703; Rostal and Jones 2002, p. 485; Jones and Dorr 2004, p. 461; McDearman 2006, p. 2; McIntyre et al. 2019, p. 287). When canopies become too dense in an area, gopher tortoises move into ruderal habitats such as roadsides with more herbaceous ground cover, lower tree cover, and sun exposure (Garner and Landers 1981, p. 122; McCoy et al. 1993, p. 38; Baskaran et al. 2006, p. 346). Ruderal habitats may also include utility rights-of-way, edges, fencerows, pasturelands, and planted pine stands.

Historically, open-canopied southern pine forests were maintained by frequent, lightning-generated fires. Currently, a variety of land management practices including prescribed fire, grazing, mowing, roller chopping, timber harvesting, and selective herbicide application, are used in the restoration, enhancement, and maintenance of gopher tortoise habitats (Cox et al. 2004, p. 10; Ashton and Ashton 2008, p. 78; Georgia Department of Natural Resources (GDNR) 2014, unpaginated; Rautsaw et al. 2018, p. 141). These habitat management activities implemented singularly or in combination (*e.g.,* roller chopping followed by prescribed fire) are used to restore and maintain the open canopy, sparsely vegetated midstory, and abundant herbaceous groundcover conditions needed by gopher tortoises.

Gopher tortoise burrows are central to normal feeding, breeding, and sheltering activity. Gopher tortoises can excavate many burrows over their lifetime and often use several each year. Burrows typically extend 15 to 25 feet (ft; 4.6 to 7.6 meters (m)), can be up to 12 ft (3.7 m) deep, and provide shelter from predators, winter cold, fire, and summer heat (Hansen 1963, p. 359; Landers 1980, p. 6; Wright 1982, p. 50; Diemer 1986, p. 127; Boglioli 2000, p. 699). Tortoises spend most of their time within burrows and emerge during the day to bask, feed, and reproduce (Service 2022, p. 28). During the cool weather dormant season, gopher tortoises throughout most of the range shelter within their burrows, become torpid, do not eat, and rarely emerge, except on warm days to bask in sunlight at the burrow entrance (Service 2013, p. 21).

As a keystone species (which is a species that has a disproportionately large effect on its natural environment relative to its abundance), gopher tortoise burrow systems provide benefits to the landscape and return leached nutrients to the soil surface; increase habitat heterogeneity; shelter seeds from fires; and provide resources and refugia for other species (Auffenberg and Weaver 1969, p. 191; Landers 1980, pp. 2, 515; Kaczor and Hartnett 1990, pp. 107–108). An estimated 60 vertebrates and 302 invertebrates, including the threatened Eastern indigo snake, the gopher mouse, the six-lined roadrunner, the gopher frog, the cave cricket, and casual visitants, such as the tiger beetle, skunk, opossum, and rattlesnakes, share tortoise burrows (Jackson and Milstrey 1989, p. 87).

Genetics

Genetic flow in gopher tortoise populations is known to be influenced by distance, geographic features, and human influence by transporting tortoises across the range. Several studies show genetic assemblages across the geographic range, but these studies have not been entirely congruent in their delineations of western and eastern genetic assemblages (Osentoski and Lamb 1995, p. 713; Clostio et al. 2012, pp. 617–620; Ennen et al. 2012, pp. 113–120; Gaillard et al. 2017, pp. 501–503). Recent microsatellite analysis suggests there are five main genetic groups delineated by the Tombigbee and Mobile Rivers, Apalachicola and Chattahoochee Rivers, and the transitional areas between several physiographic province sections of the Coastal Plains (*i.e.,* Eastern Gulf, Sea Island, and Floridian) (figure 1) (Gaillard et al. 2017, pp. 505–507).

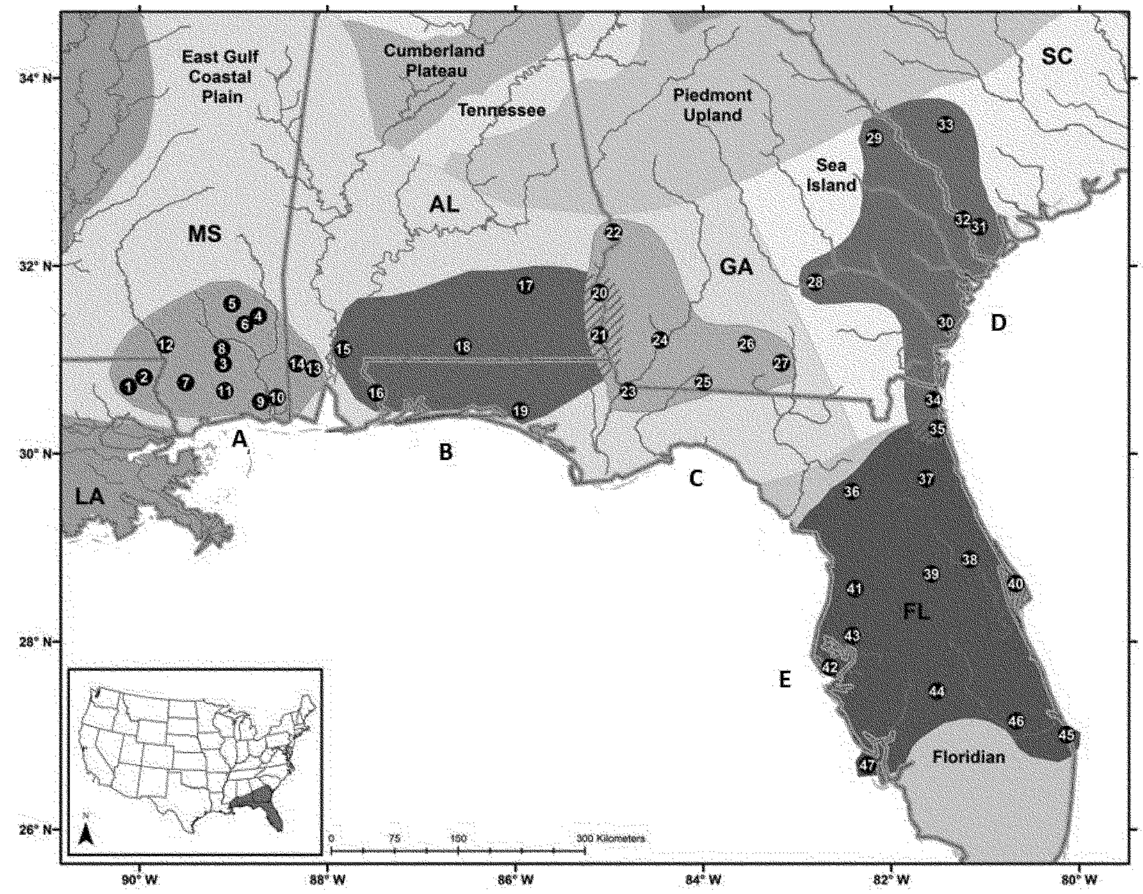


Figure 1. Sampling locations and subsequent genetics units from genetics study of gopher tortoises shown in relation to physiographic province sections of the U.S. Coastal Plains.
The shaded areas around sampling sites represent their assignment to one of the five genetic groups as follows: (A) Western (portions of Louisiana, Mississippi, and western Alabama); (B) Central (portions of Alabama, the panhandle of Florida, and extreme western Georgia); (C) West Georgia (western Georgia); (D) East Georgia (eastern Georgia); and (E) Florida (peninsular Florida). (Figure from Gaillard et al. 2017.)

The last decade of genetic research has shown that genetic diversity exists among individuals in a population, among populations, and across the range (Ennen et al. 2010, entire; Clostio et al. 2012, entire; Gaillard et al. 2017, entire). The most recent rangewide genetic analysis confirmed that the edges (periphery) of the range have lower levels of genetic diversity relative to the core but also showed genetic mixing at the borders between units (Gaillard et al. 2017, p. 507). Evidence of tortoises with ancestry from different genetic sites is most likely due to the decades of tortoises being moved by humans as part of various formal and informal translocation and population augmentation efforts as well as non-conservation, human-mediated movements (see Translocation and Headstarting, below) (Gaillard et al. 2017, pp. 504–505). In addition, contemporary gene flow is asymmetric across the gopher tortoise range as a result of recent migrations affecting changes in genetic diversity. For example, gene flow is higher from the Central to Western genetic regions and from the Florida panhandle to the East Georgia genetic region, while the Florida panhandle area has low genetic flow with the West Georgia genetic region (Gaillard et al. 2017, pp. 504–509). In general, migration rates between genetic regions were low, with the highest proportion of movements and genetic exchange from within the same genetic unit (Gaillard et al. 2017, pp. 505–506).

Home Range and Movement

As mentioned previously, gopher tortoises often use several burrows per year. The burrows of a gopher tortoise represent the general boundaries of a home range, which is the area used for feeding, breeding, and sheltering (McRae et al. 1981, p. 176). Gopher tortoise home ranges tend to vary in size depending on habitat quality, with larger areas in lower quality habitat (Auffenberg and Iverson 1979, pp. 559–561; Castellon et al. 2012, p. 159; Guyer et al. 2012, p. 130). Home ranges are larger in the western portion of the gopher tortoise range than those typically observed for tortoises in Alabama (east of the Tombigbee and Mobile Rivers), Georgia, South Carolina, and Florida, and this variation is most likely due to habitat quality differences (Lohoefener and Lohmeier 1984, pp. 1–25; Epperson and Heise 2003, p. 315; Tuberville et al. 2005, p. 356; Richter et al. 2011, p. 408). Males typically have larger home ranges and tend to travel farther distances than females; this is primarily for breeding opportunities and related to burrow density and social hierarchical behaviors (McRae et al. 1981, p. 175; Guyer et al. 2012, pp. 129–

132; Castellon et al. 2018, pp. 11–12). For example, average home ranges in Mississippi, Alabama, Florida, and Georgia have varied from 0.1 to 39.8 ac (0.04 to 16.1 hectares ha) (McRae et al. 1981, pp. 175–176; Diemer 1992b, pp. 160–161; Tuma 1996, pp. 28–43; Ott-Eubanks et al. 2003, pp. 315–316; Guyer et al. 2012, pp. 128–129; Castellon et al. 2018, p. 17).

Just as gopher tortoise home ranges are larger in lower quality habitat, gopher tortoise movements also increase as herbaceous biomass and habitat quality decrease and tortoises must search farther for adequate resources (Auffenberg and Iverson 1979, p. 558; Auffenberg and Franz 1982, p. 121; Castellon et al. 2018, p. 18). As distances increase between gopher tortoise burrows, isolation among gopher tortoises also increases due to the decreasing rate of visitation and breeding by males to females (Boglioli et al. 2003, p. 848; Guyer et al. 2012, p. 131). Most breeding populations have been found to consist of burrows no greater than about 549 ft (167 m) apart, although males may move up to 1,640 ft (500 m) for mating opportunities (Guyer and Johnson 2002, pp. 6–8; Ott-Eubanks et al. 2003, p. 320; Guyer et al. 2012, p. 131).

Population Dynamics

At the landscape scale, the gopher tortoise requires large swaths of interconnected, high-quality habitat patches to support healthy populations. Large swaths of high-quality habitat provide habitat connectivity for gopher tortoise life-history needs of dispersal (immigration and emigration), breeding, and foraging. Interconnected, high-quality habitat that supports gopher tortoise requirements influences population dynamics and demographics through the carrying capacity of the area and opportunities for genetic exchange.

As long-lived animals, gopher tortoises naturally experience delayed sexual maturity, low reproductive rates, high mortality at young ages and small size-classes, and relatively low adult mortality. Factors affecting population growth, decline, and dynamics include the number or proportion of annually breeding and egg-laying females (breeding population size), clutch size, nest depredation rates, egg hatching success, mortality (hatchling–yearling, juvenile–subadult, adult), the age or size at first reproduction, age- or stage-class population structure, maximum age of reproduction, and immigration and emigration rates.

Gopher tortoise population dynamics are sensitive to demographic changes in adult, hatchling, and juvenile survival (Gibbons 1987, entire; Congdon et al. 1993, entire; Heppell 1998, entire; Epperson and Heise 2001, entire; Miller 2001, entire; Wester 2005, entire; McDearman 2006, p. 7). Hatchling survivorship is the most critical life history stage due to the high mortality in this life stage (Tuberville et al. 2009, p. 33). For example, a simulated 5 percent decrease in hatchling mortality shifted the population growth rate from slowly declining (1.5 percent decrease) to slowly increasing (1.1 percent increase) and eliminated the probability of extinction within 200 years (Tuberville et al. 2009, p. 33). Changes in other vital parameters, including age of first reproduction and average clutch size, also affect population growth, although generally not to the extent of hatchling and juvenile mortality (McDearman 2006, pp. 7, 20).

Demographic factors have been evaluated in population viability analysis (PVA) studies to estimate the probabilities of gopher tortoise population extinction over time and the important factors affecting the species' viability (Cox et al. 1987, pp. 24–34; Lohoefener and Lohmeier 1984, entire; Cox 1989, p. 10; Epperson and Heise 2001, pp. 37–39; Miller 2001, entire; Wester 2005, pp. 16–20; McDearman 2006, entire; Tuberville et al. 2009, entire; Folt et al. 2022, entire). The number of gopher tortoises required for a population to remain on the landscape for 200 years varies from 50 to 200 individuals depending on habitat and management conditions (Cox et al. 1987, pp. 27–29; Cox et al. 1994, p. 29). Although populations as small as 50 tortoises have exhibited positive growth rates and are projected to remain on the landscape in the future in some PVA models, the inclusion of threats such as upper respiratory tract disease (URTD) or fire ant (*Conomyrma* spp., *Solenopsis invicta*) predation led to population decline and eventual extirpation of these smaller populations in these models (Miller 2001, pp. 13, 26–27; McDearman 2006, pp. 6–7). In models that resulted in projected gopher tortoise population declines of 1 to 3 percent per year, the factors that affected gopher tortoise population growth rates included the geographic location of the population and habitat quality (Tuberville et al. 2009, pp. 17–22). Populations of at least 100 gopher tortoises were found to be reasonably resilient to variations in habitat quality; however, larger populations of at least 250 tortoises were needed to remain on the landscape in lower quality habitat (Tuberville et al. 2009, p. 19).

A minimum viable population (MVP) in terms of acceptable benchmarks for the purpose of conservation and recovery efforts of gopher tortoise has been established by the Gopher Tortoise Council (GTC; GTC 2013, entire). Viability, as defined in the MVP, is valuable for conservation planning purposes and differs from the definition of viability used in the SSA (Service 2022, p. 20). The GTC adopted the definition of a viable tortoise population as consisting of at least 250 adult tortoises, at a density of at least 0.4 tortoises per ha, with an even sex ratio, and evidence of all age classes present, on a property with at least 247 ac (100 ha) of high-quality habitat managed for the benefit of the gopher tortoise (GTC 2013, pp. 2–3). Within our SSA report and this document, we use the GTC's definition of a ''viable population.'' A primary support population was defined as consisting of 50–250 adult gopher tortoises. Primary support populations may improve viability through habitat restoration, natural recruitment increases, or population augmentation. A secondary support population was defined as fewer than 50 tortoises that have more constraints to reach sufficient viability, but are important for education, community interest, and augmentation, and can maintain sufficient viability to remain on the landscape in the long term with rigorous habitat management and/or connectivity with other populations (GTC 2014, p. 4). It should be noted that smaller support populations may remain on the landscape for a long period of time under high-quality habitat conditions but are more vulnerable to stochastic events than populations that meet the MVP threshold (Miller 2001, p. 28; GTC 2014, p. 4; Folt et al. 2021, entire). We rely on these defined population benchmarks in our assessment of gopher tortoise viability, as described below in *Current Condition.*

**Regulatory and Analytical Framework**

*Regulatory Framework*

Section 4 of the Act (16 U.S.C. 1533) and the implementing regulations in title 50 of the Code of Federal Regulations set forth the procedures for determining whether a species is an endangered species or a threatened species, issuing protective regulations for threatened species, and designating critical habitat for threatened and endangered species. In 2019, jointly with the National Marine Fisheries Service, the Service issued final rules that revised the regulations in 50 CFR parts 17 and 424 regarding how we add, remove, and reclassify threatened and endangered species and the criteria for designating listed species' critical habitat (84 FR 45020 and 84 FR 44752; August 27, 2019). At the same time the Service also issued final regulations that, for species listed as threatened species after September 26, 2019, eliminated the Service's general protective regulations automatically applying to threatened species the prohibitions that section 9 of the Act applies to endangered species (collectively, the 2019 regulations).

However, on July 5, 2022, the U.S. District Court for the Northern District of California vacated the 2019 regulations (*Center for Biological Diversity* v. *Haaland,* No. 4:19–cv–05206–JST, Doc. 168 (N.D. Cal. July 5, 2022) (*CBD* v. *Haaland*)), reinstating the regulations that were in effect before the effective date of the 2019 regulations as the law governing species classification and critical-habitat decisions. Accordingly, in developing the analysis contained in this finding, we applied the pre-2019 regulations, which may be reviewed in the 2018 edition of the Code of Federal Regulations at 50 CFR 424.11(d). Those pre-2019 regulations did not include provisions clarifying the meaning of ''foreseeable future,'' so we applied a 2009 Department of the Interior Solicitor's opinion (M–37021, ''The Meaning of 'Foreseeable Future' in Section 3(2) of the Endangered Species Act'' (Jan. 16, 2009) (M–37021). Because of the ongoing litigation regarding the court's vacatur of the 2019 regulations, and the resulting uncertainty surrounding the legal status of the regulations, we also undertook an analysis of whether the finding would be different if we were to apply the 2019 regulations. That analysis, which we described in a separate memo in the decisional file and posted on *https://www.regulations.gov,* concluded that we would have reached the same finding if we had applied the 2019 regulations because, based on the modeling and scenarios evaluated, we considered our ability to make reliable predictions in the future and the uncertainty in how and to what degree the gopher tortoise could respond to those risk factors in this timeframe. We determined that this timeframe represents a period of time for which we can reliably predict both the threats to the species and the species' response to those threats under the 2019 regulations. We also find this determination to be ''rooted in the best available data that allow predictions into the future'' and extend as far as those predictions are ''sufficiently reliable to provide a reasonable degree of confidence in the prediction, in light of the conservation purposes of the Act'' in accordance with the 2009 Solicitor's Opinion.

On September 21, 2022, the U.S. Circuit Court of Appeals for the Ninth Circuit stayed the district court's July 5, 2022, order vacating the 2019 regulations until a pending motion for reconsideration before the district court is resolved (*In re: Cattlemen's Ass'n,* No. 22–70194). The effect of the stay is that the 2019 regulations are currently the governing law. Because a court order requires us to submit this finding to the **Federal Register** by September 30, 2022, it is not feasible for us to revise the finding in response to the Ninth Circuit's decision. Instead, we hereby adopt the analysis in the separate memo that applied the 2019 regulations as our primary justification for the finding. However, due to the continued uncertainty resulting from the ongoing litigation, we also retain the analysis in this preamble that applies the pre-2019 regulations and we conclude that, for the reasons stated in our separate memo analyzing the 2019 regulations, this finding would have been the same if we had applied the pre-2019 regulations.

The Act defines an ''endangered species'' as a species that is in danger of extinction throughout all or a significant portion of its range, and a ''threatened species'' as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The Act requires that we determine whether any species is an endangered species or a threatened species because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

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

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term ''threat'' to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term ''threat'' includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term ''threat'' may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an ''endangered species'' or a ''threatened species.'' In determining whether a species meets either definition, we must evaluate all identified threats by considering the species' expected response and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an ''endangered species'' or a ''threatened species'' only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term ''foreseeable future,'' which appears in the statutory definition of ''threatened species.'' Because the decision in *CBD* v. *Haaland* vacated our 2019 regulations regarding the foreseeable future, we refer to a 2009 Department of the Interior Solicitor's opinion entitled ''The Meaning of 'Foreseeable Future' in Section 3(20) of the Endangered Species Act'' (M–37021). That Solicitor's opinion states that the foreseeable future ''must be rooted in the best available data that allow predictions into the future'' and extends as far as those predictions are ''sufficiently reliable to provide a reasonable degree of confidence in the prediction, in light of the conservation purposes of the Act.'' Id. at 13.

It is not always possible or necessary to define the foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

*Analytical Framework*

The SSA report documents the results of our comprehensive biological review of the best scientific and commercial data regarding the status of the species, including an assessment of the potential threats to the species. The SSA report does not represent our decision on whether the species should be proposed for listing as an endangered or threatened species under the Act. However, it does provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found at Docket FWS–R4–ES–2009–0029 on *https://www.regulations.gov* and at *https://www.fws.gov/office/florida-ecological-services/library.*

To assess gopher tortoise viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. The next stage involved an assessment of the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species' responses to positive and negative environmental and anthropogenic influences. Throughout all of these stages, we used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We use this information to inform our regulatory decision.

**Summary of Biological Status and Threats**

In this discussion, we review the biological condition of the species and its resources, and the threats that influence the species' current and future condition, in order to assess the species' overall viability and the risks to that viability. The following discussions include evaluations of the following threats and associated sources influencing the gopher tortoise and its habitat: (1) Habitat loss, degradation, and fragmentation, (2) climate change, and (3) insufficient and/or incompatible habitat management. Other factors influencing gopher tortoise viability include road mortality, disease, harvest and rattlesnake roundups, predation, nonnative invasive species, and conservation measures, including relocation, translocation, and headstarting programs. Conservation of habitat through land acquisition and conservation actions on public and private lands and the retention of private forest lands reduces the severity of some of these threats by providing protection of habitat across the landscape, maintaining connectivity between habitat patches, and increasing the opportunity for beneficial habitat management actions. In this section, we describe the threats that influence the species' current and future conditions and conservation measures that may mitigate those threats. Additional information may be found in the SSA report (Service 2022, pp. 46–102).

*Habitat Loss, Degradation, and Fragmentation*

Habitat loss, degradation, and fragmentation have affected the gopher tortoise and its habitat. The gopher tortoise was historically associated with fire-dependent longleaf pine ecosystems. Longleaf pine communities declined to less than 3 million ac (1.2 million ha) by the 20th century from a historical estimate of 92 million ac (37 million ha) due to forest clearing and conversion for agriculture, conversion from longleaf to other pine species, and development (Frost 1993, p. 20; Ware et al. 1993, p. 447; Landers et al. 1995, p. 39). As a result of fire suppression and exclusion in many areas, approximately two to three percent of longleaf pine ecosystems remain in relatively natural condition (Frost 1993, p. 17; Simberloff 1993, p. 3; Jose et al. 2007, p. ix; Jensen et al. 2008, p. 16; Oswalt et al. 2012, p. 7). Although historically associated with longleaf pine communities, the species currently occurs in open canopy stands of several southern pine species.

Currently, habitat loss, degradation, and fragmentation caused by a variety of sources across the species' range continue to negatively affect gopher tortoise viability. Urbanization and development, major road construction, incompatible and/or insufficient habitat management, and certain types of agriculture negatively impact the gopher tortoise and its habitat (Auffenberg and Franz 1982, pp. 105, 112; Lohoefener and Lohmeier 1984, pp. 2–6; Diemer 1986, p. 128; Diemer 1987, pp. 74–75; Hermann et al. 2002, pp. 294–295; Enge et al. 2006, p. 4). While large-scale development of solar farms may impact the gopher tortoise and its habitat in connection with other threats, we have determined that solar energy development is not a key factor influencing the species' viability at this time (Ong et al. 2013, p. iv; Service 2022, p. 52). Invasive species introduced as a result of habitat fragmentation or urbanization can influence gopher tortoises either through predation or alterations to habitat structure and function (Mann 1995, p. 24; Lippincott 1997, pp. 48–65; Basiotis 2007, p. 24; Engeman et al. 2009, p. 84; Engeman et al. 2011, p. 607; Dziadzio et al. 2016, p. 531; Bartoszek et al. 2018, pp. 353–354). Climate change has the potential to negatively impact habitat through the loss of habitat due to sea level rise, limitations on number of suitable burn days due to changes in temperature, precipitation, increased flooding due to predicted increases in the severity of hurricanes, and human migration from inundated coastal areas to inland areas, with subsequent impacts to gopher tortoises (Ruppert et al. 2008, p. 127; Castellon et al. 2018, pp. 11–14; Hayhoe et al. 2018, entire; Kupfer et al. 2020, entire). Although habitat management and climate change influence gopher tortoise habitat and contribute to habitat loss, fragmentation, and degradation, they are discussed as separate factors, below. In this section, we discuss below the primary sources (Urbanization and Development, Road Effects and Mortality) for habitat loss, fragmentation, and degradation.

Urbanization and Development

At a landscape scale, the gopher tortoise needs large swaths of interconnected, high-quality habitat patches to support viable populations.

Within these large swaths of high-quality habitat on the landscape, gopher tortoises require habitat connectivity for dispersal (immigration and emigration), breeding, and foraging. Urbanization and development of the landscape fragments and replaces natural areas with artificial structures, impervious surfaces, and lawns and gardens containing nonnative plant species; this activity impacts gopher tortoise populations that rely on a mosaic of interconnected uplands (Sutherland 2009, p. 35). Development and urbanization can also impact gopher tortoise populations on conservation lands (lands in public or private ownership managed for conservation under a management plan) by disrupting habitat connectivity across the landscape and disrupting habitat management activities on conservation lands, particularly through the reduction of prescribed fire activities. Urbanization and development impacts to individuals, populations, and habitats have been documented, although not specifically quantified in terms of survival, recruitment, and health of gopher tortoises prior to our SSA. Our modeling for the future condition analysis in the SSA includes urbanization projected by the SLEUTH model as part of the threats scenarios as described in *Future Condition* (Service 2022, pp. 144–175; Folt et al. 2022, entire).

Human population growth is a primary driver of urbanization and subsequent habitat fragmentation that is impacting gopher tortoises rangewide. Rangewide, Alabama, Florida, Georgia, Louisiana, and South Carolina have experienced population growth from 3 to 15 percent since 2010, while Mississippi has experienced a 6 percent decrease in human population. Population growth from 2 to 13.4 percent is projected to occur in each State rangewide from 2020 to 2030 (Blanchard 2007, p. 7; FEDR 2021, unpaginated; Culverhouse College of Business 2021, unpaginated; Georgia Census 2021, unpaginated; Population Projections 2005, unpaginated; U.S. Census Bureau 2021, unpaginated). As the human population continues to grow in the Southeast, development is expected to increase demand for forest resources and lead to habitat fragmentation and degradation of forests through the conversion of high-quality gopher tortoise habitat to lands in forest production that may not be managed in a way compatible with gopher tortoise needs. Forest loss and fragmentation reduce the ecological function and connectivity essential for the dispersal of gopher tortoises across the landscape (Guyer et al. 2012, p. 131; Jones and Dorr 2004, p. 461).

Gopher tortoises can occur in residential areas despite the fact that these areas are typically of lower habitat quality. However, conversion of gopher tortoise habitat to residential areas results in mortality of gopher tortoises when individuals are entombed in burrows during construction activities. In the western portion of the range where the species is federally listed, individual gopher tortoises are translocated from development sites to avoid mortality from land development activities. Since 2007, the Florida Fish and Wildlife Conservation Commission (FWC) requires developers to relocate tortoises out of harm's way, either onsite or at an approved recipient site (FWC 2007, p. 10). Other States (Georgia, Alabama, and South Carolina) have some measure of legal protection for gopher tortoises, though gopher tortoise burrows are not protected uniformly across the range. When notified, these States work with developers to minimize impacts when tortoises occur on development sites.

Human development of the landscape (*i.e.,* urbanization) affects terrestrial wildlife communities in the Southeastern United States, including gopher tortoise populations that often rely on upland habitats that are popular sites for urban development or agriculture. Gopher tortoise populations on protected and managed lands are somewhat buffered from habitat loss as a result of urbanization, but landscape-level connectivity is negatively affected. Urbanization and development have influenced the gopher tortoise and its habitat historically, and we expect these effects to continue in the future. This threat is present across the range of the species, although populations near already urbanized areas and areas of projected development are more affected. For example, in Florida, urban growth and development is identified as one of the primary threats to gopher tortoises (Auffenberg and Franz 1982, p. 112; Diemer 1986, p. 128; Diemer 1987, pp. 74–75; Enge et al. 2006, p. 4). Georgia is also anticipated to experience dramatic human population increases (Georgia Census 2021, unpaginated), leading to subsequent development and potential loss of gopher tortoise habitat.

Road Effects and Mortality

Roads pose a barrier to gopher tortoise movement, fragment habitat, isolate areas of habitat, and increase mortality of gopher tortoises (Andrews and Gibbons 2005, p. 772; Hughson and Darby 2013, pp. 227–228). Roads that bisect habitat pose a hazard to gopher tortoises by forcing individuals into unsuitable areas and onto highways (Diemer 1987, p. 75; Mushinsky et al. 2006, p. 38). Roads occurring within or adjacent to tortoise habitat impact gopher tortoises, because tortoises are attracted to road shoulders where open-canopy, grassy areas are maintained (Steen and Gibbs 2004, entire; Steen et al. 2006, p. 271). Gopher tortoises appear to use roadsides independently of larger habitat patches, treating them as areas for residency as opposed to travel corridors among other habitat patches (Rautsaw et al. 2018, p. 141). Gopher tortoise nests in roadsides are more susceptible to predators, such as raccoons (*Procyon lotor*), which are common in ecological edges and fragmented, suburban landscapes (Hoffman and Gottschang 1977, p. 633; Wilcove 1985, pp. 1213–1214). The installation of wildlife barrier fences along roadways has the potential to minimize gopher tortoise road mortality. While barrier fencing along roads may reduce road mortality, fencing may also further limit the movement of gopher tortoises.

While road mortality occurs in gopher tortoise populations, the extent to which it affects populations or the species is not well documented. There are no current rangewide monitoring efforts for gopher tortoise road mortality. Florida is the only state that has a database for reporting sick, injured, or dead tortoises; of tortoises reported to the Florida FWC as sick, injured, or dead, 41 percent were found injured or dead on roads (CCA 2018, p. 95).

As development and subsequent habitat loss and fragmentation occurs, gopher tortoises will disperse to find better quality habitat, putting individual gopher tortoises at risk of road mortality. Impacts to habitat and road mortality are expected to increase as road densities and traffic volumes increase and habitat patches become more isolated and more difficult to manage (Enge et al. 2006, p. 10). Highway mortality of gopher tortoises will be highest where there are improved roads adjacent to gopher tortoise populations. Increased traffic on new or expanded roads adjacent to a gopher tortoise population will expose individuals to direct mortality from vehicles and potentially to increased predation. In addition, gopher tortoises in the vicinity of urban areas will be particularly vulnerable (Mushinsky et al. 2006, p. 362), especially in areas with heavy traffic patterns or high speed limits. The threat posed by roads is ongoing and is expected to continue, particularly in peninsular Florida and urban centers in coastal portions of Georgia, Alabama, and Mississippi, where human populations are likely to increase as seen in urban modeling projections using SLEUTH (Terando et al. 2014, entire).

Agricultural Lands

Agricultural lands are an important component of land use activities in the gopher tortoise range. Agricultural lands on suitable soils are 6 times less likely to have burrows and contain 20 times fewer gopher tortoise burrows than open pine sites (Hermann et al. 2002, pp. 294–295). Gopher tortoises do not use the poor-quality habitat in annually tilled fields that do not provide necessary forage (Auffenberg and Franz 1982, p. 105). However, adult tortoises will return to abandoned agricultural fields in a few years when the land is dominated by perennial herbaceous species and remain until succession results in closed canopy conditions that do not provide the species' requirements (Auffenberg and Franz 1982, pp. 105, 107–108). Accordingly, habitat that is normally suitable for gopher tortoise but that is cleared for agricultural activities is not suitable for gopher tortoise use while it is in production or until forage and soil conditions provide gopher tortoise requirements for feeding, nesting, and sheltering.

Cropland (*i.e.,* agriculture) in the gopher tortoise range is projected to decline by 19 percent from 1997 to 2060 (Wear and Greis 2013, p. 45). Restoration of abandoned agricultural fields with appropriate soils into potential gopher tortoise habitat is feasible and has been accomplished through the U.S. Department of Agriculture Conservation Reserve Program (CRP). For example, in the eastern portion of the gopher tortoise range, over 10.5 million acres were reported as enrolled in CRP from 2000 to 2019 in counties with gopher tortoise occurrences (USDA 2020, unpaginated). Although not all of these lands are expected to support gopher tortoise or fall into potential habitat, we expect these restoration actions will improve gopher tortoise habitat. However, at this time, we cannot project the extent to which abandoned agricultural fields will be restored to a level of suitability necessary to support gopher tortoise populations.

Solar Farms

As interest in renewable energy increases, the development of solar farms across the gopher tortoise's range in the Southeast is also increasing, particularly in Florida and South Carolina (EIA 2021, unpaginated). A primary concern regarding large-scale deployment of solar energy is the potentially significant land use requirements, habitat fragmentation, possible exclusion of gopher tortoises as a result of fencing, and the need to relocate tortoises from solar farm sites prior to construction (Ong et al. 2013, p. iv). Some solar utility developers and companies recognize the potential to impact the gopher tortoise and its habitats and work with conservation organizations to avoid and minimize impacts via strategic siting assessments (NASA Develop 2018, unpaginated). The best available science indicates it is not a key factor in species viability, although information quantifying the extent and magnitude of the impact of solar farms on the gopher tortoise is limited.

*Climate Change*

The effects of changing climate conditions have influenced and are expected to continue to influence gopher tortoises and their habitat. In the Southeastern United States, the impacts of climate change are currently occurring in the form of sea level rise and extreme weather events (Carter et al. 2018, p. 749). Changes in temperatures are projected to result in more frequent drought, more extreme heat (increases in air and water temperatures), increased heavy precipitation events (*e.g.,* flooding), more intense storms (*e.g.,* frequency of major hurricanes increases), and rising sea level and accompanying storm surge (Intergovernmental Panel on Climate Change (IPCC) 2022, entire). Higher temperatures and an increase in the duration and frequency of droughts are projected to increase the occurrence of wildfires and reduce the effectiveness of prescribed fires (Carter et al. 2018, pp. 773–774).

Predicted increases in temperature across the gopher tortoise's range due to climate change are expected to affect the species' life history characteristics and demography through skewed sex ratios, larger clutch sizes, increased hatchling success, and larger hatchling size (DeMuth 2001, p. 1614; Ashton et al. 2007, pp. 355–362; Hunter et al. 2021, pp. 215, 221–224). Although these life history and demographic effects may not initially appear to have negative impacts, we do not have available modeling to project the effects of these changes on gopher tortoise demography in terms of forage availability, carrying capacity of areas where the gopher tortoise occurs, or other life history and demographic changes. However, the gopher tortoise may ameliorate these effects by selection of cooler nest sites and altering timing of nesting to earlier in the season (Czaja et al. 2020, entire). Some populations of gopher tortoises already exhibit both of these behaviors (Ashton and Ashton 2008, entire; Moore et al. 2009, entire; Craft 2021, pp. 42–45).

Frequency of severe hurricanes is predicted to increase in the future (IPCC 2022, entire; Carter et al. 2018, entire). Gopher tortoise burrows, particularly those in coastal ecosystems, will be impacted by flooding after a hurricane, causing abandonment, though the burrow may become usable again (Waddle et al. 2006, pp. 281–283; Castellon et al. 2018, pp. 11–14; Falk 2018, entire). In addition, overwash of coastal dunes may result in ''salt burn'' and loss of coastal vegetation, temporarily reducing forage availability in coastal natural communities used by gopher tortoises.

Predicted changes in rangewide temperature and precipitation due to climate change will reduce the number of days with suitable conditions for prescribed burns needed to manage gopher tortoise habitat in the future compared to current conditions (Kupfer et al. 2020, entire). This reduction in prescribed fire, combined with the effects of urbanization, will further restrict the ability to manage gopher tortoise habitat with prescribed fire. In addition to the constrained ability to implement prescribed fire in the future, modeling for the Southeastern United States projects an increased wildfire risk and a longer fire season, with at least a 30 percent increase in lightning-ignited wildfire from 2011 to 2060 (Vose et al. 2018, p. 239).

Sea level rise associated with climate change is expected to affect coastal populations of gopher tortoises through subsequent inundation and loss of habitat in coastal areas. As sea levels continue to rise, coastal water levels—from the mean to the extreme—are growing deeper and reaching farther inland along most U.S. coastlines (Sweet et al. 2022, p. 28). Global mean sea level has risen 7 to 8 in (16 to 21 cm) since 1900, with about half of that rise occurring since 1993 (Hayhoe et al. 2018, p. 85). In areas of the Southeastern United States, tide gauge analysis reveals as much as 1 to 3 ft (0.30 to 0.91 m) of local relative sea level rise in the past 100 years (Carter et al. 2018, p. 757). The future estimated amount that sea level will rise varies based on the responses of the climate system to warming and human-caused emissions (Hayhoe et al. 2018, p. 85). The amount of gopher tortoise habitat predicted to be lost within a given population due to sea level rise depends on the location of the population and site-specific characteristics. Populations affected by habitat loss and degradation due to saltwater inundation and vegetation changes are expected to experience reduced abundance and resiliency. In addition, impacts to gopher tortoises and their habitat are expected due to the relocation of people from flood-prone coastal areas to inland areas, including the relocation of millions of people to currently undeveloped interior natural areas (Stanton and Ackerman 2007, p. 15; Ruppert et al. 2008, p. 127).

The effects of climate change are projected to impact the gopher tortoise and its habitat. These impacts will be direct through loss of individuals and indirect through the loss of habitat due to sea level rise, lack of habitat management due to reduction in burn days, increased flooding, and human migration from inundated coastal areas to inland areas (Ruppert et al. 2008, p. 127; Castellon et al. 2018, pp. 11–14; Hayhoe et al. 2018, entire; Kupfer et al. 2020, entire). Despite the recognition of climate effects on ecosystem processes, there is some uncertainty about the timing of these effects for the Southeastern United States and how the gopher tortoise will respond to these changes. Factors associated with a changing climate may act as risk multipliers by increasing the risk and severity of other threats, as described in *Synergistic and Cumulative Effects,* below.

*Habitat Management*

As mentioned previously, the gopher tortoise needs large swaths of interconnected, high-quality habitat patches with open canopy and abundant herbaceous groundcover to support viable populations, and a variety of land management practices are used in the restoration, enhancement, and maintenance of gopher tortoise habitats. Insufficient habitat management (*e.g.,* no prescribed fire program) has been identified as a major threat to the gopher tortoise (Smith et al. 2006, pp. 326–327). High-quality gopher tortoise habitat will require prescribed fire only at regular intervals, while areas of degraded or low-quality gopher tortoise habitat will require more active habitat management (*e.g.,* multiple habitat management tools including mechanical and chemical treatments in conjunction with the reintroduction of prescribed fire to restore natural conditions). However, not all habitat management activities are uniformly beneficial to the gopher tortoise. In general, management actions that minimize soil disturbance, protect burrows, and maintain a diversity of groundcover plants, to ensure that sufficient sunlight reaches the ground, are beneficial to the gopher tortoise. Conversely, actions that cause significant soil disturbances or result in the loss of diverse groundcover are detrimental to the species. A variety of habitat management methods are implemented rangewide at varying degrees across land ownership and use types (*e.g.,* conservation land, commercial forestry, family-owned lands, etc.). Prescribed fire, selective use of herbicide, mechanical vegetation management (*e.g.,* roller chopping and mowing), and timber harvest are valuable management techniques in the restoration, management, and maintenance of gopher tortoise habitat and are frequently used in combination to achieve habitat condition goals.

The regular application of prescribed fire is important for the maintenance of habitat conditions required by the gopher tortoise. When applied at appropriate intervals, prescribed fire reduces shrub and hardwood encroachment, and stimulates growth of forage plants such as grasses, forbs, and legumes, particularly when applied during the growing season (Thaxton and Platt 2006, p. 1336; FWC 2007, p. 32; Iglay et al. 2014, pp. 39–40; Fill et al. 2017, pp. 156–157). In addition, a more open canopy and midstory created with the use of prescribed fire allows for proper incubation of eggs and thermal regulation (basking) of tortoises. Without habitat management including fire management, gopher tortoises may abandon an area of previously suitable habitat after as little as 20 years of fire exclusion (Ashton et al. 2008, p. 528). In the future, reduced habitat management is expected to result in habitat degradation or loss, negatively impacting the gopher tortoise.

Mechanical or chemical (herbicide) management techniques may be needed to reduce hardwood competition to levels where prescribed fire can be effective and are increasingly important for areas where prescribed fire use is not a viable option, such as habitat in urbanized areas (Ashton and Ashton 2008, p. 78; Miller and Chamberlain 2008, pp. 776–777; Jones et al. 2009, p. 1168; Iglay et al. 2014, p. 40; Platt et al. 2015, p. 913; Greene et al. 2020, p. 50). Habitat management using mechanical means can be effective in reducing shrub and tree density to promote conditions favorable to herbaceous vegetation. Mechanical treatments are used in habitat restoration, site preparation to promote pine seedling survival and growth, maintenance, and in other agricultural and forestry endeavors. Mechanical vegetation management examples include mulching/chipping, subsoiling, shearing, stumping, root raking into piles or windrows, roller chopping, discing, and bedding. Depending on management objectives and treatment type, mechanical site preparation may result in substantial soil disturbance affecting soil structure and chemistry and may increase invasive species on a site (Hobbs and Huenneke 1992, pp. 324–325; Jack and McIntyre 2017, p. 189). Heavy equipment used to manage gopher tortoise habitat may also cause impacts to gopher tortoise through crushing or damage to burrows (Landers and Buckner 1981, pp. 1–7; Greene et al. 2020, p. 54). Some land managers incorporate best management practices for gopher tortoise habitat into their management plans, including a buffer distance around burrows to minimize disturbance and hazards (Smith et al. 2015, pp. 459–460).

Mechanical vegetation management followed by herbicide application is used as a short-term option to maintain habitat in areas where fire use is restricted. Herbicide can reduce midstory vegetation growth resulting in more sunlight reaching the ground. Although mechanical vegetation management is effective in reducing the vertical structure and overgrowth in the mid- and overstories, mechanical treatments alone do not replicate the stimulation of plant growth, flowering, and seed release, and soil nutrient cycling provided by fire (Dean et al. 2015, pp. 55–56). Best conservation practices for mechanical and herbicide management practices in gopher tortoise habitat are available for landowners and managers and are increasingly implemented (FWC 2013, entire; Service 2013, entire; GDNR 2014, entire; Florida Department of Agriculture and Consumer Services (FDACS) 2014, entire; FDACS 2015, entire; Jack and McIntyre 2017, p. 200).

Forest (Timber) Management

Management of forests, either public or private, influences habitat where gopher tortoises occur or habitat that may be suitable for gopher tortoises. Although specific forest or timber management techniques vary by site, management goals, and ownership, we summarize the influence of forest or timber management in general on gopher tortoise below. More details and information on this influence may be found in the SSA section 3.8.4 Timber Management (Service 2022, pp. 76–79).

Not all forested lands provide appropriate conditions for gopher tortoises. However, forests on lands with suitable soils and compatible forest management objectives in the gopher tortoise range can be managed in such a way as to provide the open canopy and the dense herbaceous groundcover conditions needed for gopher tortoise viability. Some types of timber and gopher tortoise habitat management include the reduction of hardwood competition. This activity results in reduced tree density and increased sunlight, promoting herbaceous forage proliferation and suitable conditions for gopher tortoise basking and egg incubation (NRCS 2020, entire). Several management practices associated with working forests, such as planting densities, rotation length, and time until first and subsequent thinning(s), have a direct influence on whether these lands provide and maintain habitat for the species. Gopher tortoises occur in production pine forests with suitable conditions, although at lower densities than reported in other cover types, and densities may be below the threshold necessary to sustain a viable population (Diemer-Berish et al. 2012, pp. 51–52; Wigley et al. 2012, p. 42; Greene et al. 2019, p. 51). In pine forests managed for timber or pulp (typically slash or loblolly pine) where suitable conditions are not maintained, gopher tortoises more frequently abandoned burrows and emigrated from low-quality habitat conditions associated with closed canopy pine plantations (Diemer 1992a, p. 288; Aresco and Guyer 1999, p. 32). Most modern forests managed more intensely for traditional wood products (*i.e.,* timber, pulp) incorporate management strategies to maintain open canopy conditions for much of the life of a commercial stand (Weatherford et al. 2020, p. 4). For private lands, programs such as forest certifications (*e.g.,* Sustainable Forestry Initiative (SFI) or Forest Stewardship Council) and the development of diversified markets for forest products have increased forest management practices that benefit gopher tortoises (Greene et al. 2019, p. 201; Greene et al. 2020, p. 55).

Public lands managed for multiple use or conservation objectives that include timber production employ some of the same habitat management techniques and additionally may be guided by land management plans or forest plans. The Forest and Rangeland Renewable Resources Planning Act (16 U.S.C. 36), as amended by the National Forest Management Act of 1976 (16 U.S.C. 1600–1614), requires that each National Forest (NF) be managed under a forest plan that is revised every 10 years. Forest plans provide an integrated framework for analyzing and approving projects and programs, including conservation of listed species. Several National Forests (*e.g.,* Ocala NF, Desoto NF, Conecuh NF, Apalachicola NF, etc.) occur within the current range of the gopher tortoise, providing important habitat conservation for the species. Identification and implementation of land management and conservation measures to benefit gopher tortoises vary among National Forests, but generally include habitat restoration and management objectives and maintaining buffers around gopher tortoise burrows during various forest management activities.

However, not all public or private lands are managed to these standards, and incompatible practices and insufficient management continue to affect gopher tortoise habitat and influence gopher tortoise viability. Reductions in required groundcover forage may be caused by nearly complete groundcover weed control, high seedling stocking rates, or short timber rotations with a minimal proportion of the rotation being open canopied. In addition, exclusion of prescribed fire and dense hardwood midstory encroachment within open canopied forests degrade habitat through suppression of groundcover and loss of open areas for burrowing and movement.

Historical declines of longleaf forests are well established, with estimates of 95 percent loss from the historical estimate of 88 million ac (35.6 million ha) (Oswalt et al. 2012, p. 13). However, the magnitude and extent of insufficient and incompatible forestry and timber management currently occurring on the landscape and impacting gopher tortoise populations and habitat has not been quantified. Rangewide, approximately 80 percent of potential gopher tortoise habitat occurs in private ownership, with the remainder owned or managed by local, State, Federal, or private conservation entities (Wear and Greis 2013, p. 103; Natural Resources Conservation Service (NRCS) 2018, p. 2). Private landowners hold more than 86 percent of forests in the South and produce nearly all of the forest investment and timber harvesting in the region (Most of the potential gopher tortoise habitat is privately held, and much of this is in silviculture. Rangewide conservation and management efforts between private landowners and conservation agencies, such as best conservation practices for gopher tortoises developed by States and conservation incentive programs and partnerships, promote compatibility between timber and gopher tortoise management; these are further described in *Conservation Efforts and Regulatory Mechanisms,* below. We have included the best available information regarding gopher tortoises in timber production pine forests in our SSA; however, to date, systematic surveys in pine forests intensively managed for timber and pulp products across the range of the gopher tortoise have not been conducted.

*Other Factors—Disease, Predation, Harvest and Roundups, Nonnative Invasive Species*

Disease

A number of diseases, including fungal, viral, bacterial, and parasitic diseases, have been documented in gopher tortoises (Ashton and Ashton 2008, pp. 39–41; Johnson et al. 2008, entire; Myers et al. 2009, p. 582; Desiderio et al. 2021, entire). Upper Respiratory Tract Disease (URTD) resulting from two bacterial species (*Mycoplasma agassizii* and *M. testudineum*) has been documented throughout much of the tortoise's range (McLaughlin 1997, p. 6; Gates et al. 2002, entire; Rabatsky and Blihovde 2002, entire; Dziadzio et al. 2018, entire; Goessling et al. 2019, pp. 5–6). While large-scale die-offs due to URTD appear to be rare, correlations between exposure to *Mycoplasma* spp. and population declines are variable among populations (McCoy et al. 2007, p. 173). URTD has been linked to several large mortality events (defined as the loss of greater than 3 percent of adults in 1 year) in Florida with an estimated loss of 25–50 percent of the adult population in one event and 35 to 125 adults in other events (McLaughlin 1997, p. 6; Gates et al. 2002, entire; Rabatsky and Blihovde 2002, entire; Dziadzio et al. 2018, entire). However, tortoises have natural antibodies to *Mycoplasma* spp., and these natural immune mechanisms may explain why die-offs are less prevalent rangewide than may be expected from the degree of seroprevalence in gopher tortoise populations (Hunter et al. 2008, p. 464; Gonynor and Yabsley 2009, pp. 1–2; Sandmeier et al. 2009, pp. 1261–1262). In addition, URTD may result in altered movement (*e.g.,* increased dispersal) and behavior (*e.g.,* changes to basking) among gopher tortoises (McGuire et al. 2014, pp. 750–754; Goessling et al. 2017, p. 488). Tortoises dispersing long distances increase their likelihood of encountering a road (*i.e.,* a barrier), potentially limiting spread of disease but increasing risk of road mortality. The magnitude of threat that URTD poses to gopher tortoise populations and tortoise demographics is currently unknown, but the best available science indicates it is not a key factor in species viability (Karlin 2008, p. 145).

Predation

Gopher tortoise nest predation varies annually and across sites, ranging from approximately 45 to 90 percent in a given year (Landers et al. 1980, p. 358; Wright 1982, p. 59; Marshall 1987, pp. 29–32). Gopher tortoises are most susceptible to predation within their first year of life, primarily within 30 days of hatching (Pike and Seigel 2006, p. 128; Smith et al. 2013, pp. 4–5). Overall annual hatchling survival has been estimated to be approximately 13 percent (Perez-Heydrich et al. 2012, p. 342). Raccoons (*P. lotor*) are the most frequently reported predator of nests and juvenile gopher tortoises (Landers et al. 1980, p. 358; Butler and Sowell 1996, p. 456). However, 25 species—12 mammals, 5 birds, 6 reptiles, and 2 invertebrates—are known to be predators of eggs, emerging neonates, hatchlings, and older tortoises (Ashton and Ashton 2008, p. 27). Adult gopher tortoises are less likely to experience predation compared to hatchlings and eggs, but predation by canines (*e.g.,* domestic dogs, coyotes, foxes) and humans has occurred (Causey and Cude 1978, pp. 94–95; Taylor 1982, p. 79; Hawkins and Burke 1989, p. 99, Mann 1995, p. 24). Some predation can be attributed to habitat fragmentation and edge effects, roads and infrastructure, increased availability of food for predators in proximity to human-inhabited areas, reduction or elimination of top canid carnivores, ecological perturbations allowing predator range expansion, and domestic animals associated with humans (Stiles and Jones 1998, p. 343; Crooks and Soule 1999, entire; Wetterer and Moore 2005, pp. 352–353).

As mentioned previously, the gopher tortoise is a long-lived species that naturally experiences high levels of mortality in early life stages. However, as urbanization increases in the future, we expect that higher levels of hatchling and juvenile mortality associated with increased predation near anthropogenic sites will have a negative impact on gopher tortoise recruitment in affected populations.

Harvest and Rattlesnake Roundups

Historical harvest of gopher tortoises for consumption has influenced gopher tortoise populations in the past, particularly in portions of the Florida panhandle (Lohoefener and Lohmeier 1984, pp. 1–30; Mann 1995, p. 18; Estes and Mann 1996, p. 21; Tuma and Sanford 2014, pp. 145–146). Although this practice is now uncommon, localized harvest still occurs in some rural areas (Rostal et al. 2014, p. 146). Although loss of individuals may impact affected populations, we have determined that harvest is not a significant species-level threat to the gopher tortoise (Service 2022, p. 63).

Historically, multiple rattlesnake roundups were held throughout the Southeast (Means 2009, p. 132). Snakes were collected by blowing fumes of noxious liquids (‘‘gassing’’) in gopher tortoise burrows to collect snakes for these roundups. Gassing of inhabited burrows negatively impacts the resident tortoise, though research that quantifies mortality associated with this practice is limited (Means 2009, p. 139). The practice of gassing tortoise burrows is now prohibited across the species' range. Gopher tortoise mortality due to rattlesnake collection is primarily historical and is not likely a significant current influence on populations, as only one roundup still takes place in Alabama and the use of gasoline or other chemical or gaseous substances to drive snakes from burrows is now prohibited across the Southeast (Alabama Regulation 220–2–.11, Georgia codes sections 27–1–130 and 27–3–130, Florida Administrative Code 68A–4.001(2), and Mississippi Code R 5–2.2 B). Therefore, harvest and take resulting from rattlesnake roundups are considered historical threats to the species, and the best available science indicates these are not current threats to the species.

Nonnative Invasive Species—Flora and Fauna

The spread of nonnative invasive plant species alters and degrades gopher tortoise habitat by reducing forage quality and quantity and the availability of burrowing and nesting locations, and ultimately influences gopher tortoise viability. Some species postulated to impact tortoise habitat include kudzu (*Pueraria montana*), Chinese privet (*Ligustrum sinense*), Callery pear (*Pyrus calleryana*), natal grass (*Melinis repens*), and Japanese climbing fern (*Lygodium japonicum*), though quantified impacts of these species on tortoises are unknown. One species known to impact gopher tortoise use of habitat is cogongrass (*Imperata cylindrica*), a prolific invasive that occurs throughout much of the gopher tortoise's range. Unlike other invasive plant species in upland communities, cogongrass can rapidly spread following disturbances including prescribed fire (Yager et al. 2010, entire; Holzmueller and Jose 2011, pp. 436–437). It can quickly form a tall, dense ground cover with a dense rhizome layer and can outcompete native vegetation (Dozier et al. 1998, pp. 737–740; Mushinsky et al. 2006, p. 360; Minogue et al. 2018, pp. 1–4). Widespread areas of dense cogongrass could result in habitat loss as gopher tortoises do not use these areas, nor do they consume cogongrass (Basiotis 2007, p. 21). Cogongrass can also decrease gopher tortoise habitat quality by reducing forage quality and quantity and the availability of burrowing and nesting locations (Lippincott 1997, pp. 48–65; Basiotis 2007, p. 24).

Nonnative invasive fauna can also negatively influence the gopher tortoise and its habitat. Throughout the gopher tortoise's range, the red imported fire ant (*Solenopsis invicta*) occurs in disturbed soil in upland habitats (Wetterer and Moore 2005, p. 352; Shearin 2011, pp. 22, 30; USDA 2017, unpaginated). Fire ants are not able to breach gopher tortoise eggs, but the ants will depredate hatchlings (Mann 1995, p. 24; Butler and Hull 1996, p. 17; Epperson and Heise 2003, p. 320; Diffie et al. 2010, p. 295; Dziadzio et al. 2016, pp. 531, 536). Fire ants are aggressive, and their stings can result in direct mortality and reduced survival by limiting growth, altering behavior, and changing foraging patterns of hatchlings (Wilcox and Giuliano 2014, pp. 3–4; Dziadzio et al. 2016, pp. 532–533). In the western portion of the range, gopher tortoise conservation banks and other related sites must include fire ant monitoring and control as part of their management plan to reduce the effects of predation on tortoise eggs and hatchlings (74 FR 46401, September 9, 2009).

The nine-banded armadillo (*Dasypus novemcinctus*), Argentine black and white tegu (*Salvator merianae*), Burmese python (*Python bivittatus*), and black spiny-tailed iguana (*Ctenosaura similis*) use gopher tortoise burrows and are known predators of tortoise eggs (Service 2022, pp. 68–69). Frequent damage to gopher tortoise burrows by wild pigs (*Sus scrofa*), domestic dogs (*Canis lupus familiaris*), and possibly domestic cats (*Felis catus*) may impact some gopher tortoises as well.

The current impact of these nonnative invasive floral and faunal species on gopher tortoise appears low at the species level. Although impacts to individuals and populations have been documented to occur, we did not find nonnative invasive species to be a key factor in gopher tortoise viability.

*Conservation Efforts and Regulatory Mechanisms*

In this section, we describe key protections and conservation efforts provided by various Federal and State entities, private landowners, and nongovernmental organizations. Additional information regarding conservation efforts and Federal and State protections may be found is the SSA report (Service 2022, pp. 79–102).

Federal and State Protections

In addition to the protections provided to the gopher tortoise in the listed portion of the range under sections 7 and 10 of the Act, we implement conservation delivery tools and programs that aid in the conservation of listed and at-risk species, such as the gopher tortoise, on non-Federal lands. Cooperative conservation programs such as the Partners for Fish and Wildlife Program provide technical and financial assistance to private landowners and others for the conservation of wildlife and associated habitat. Between 2010 and 2019, under the Partners for Fish and Wildlife Program, approximately 65,000 ac (26,305 ha) of restoration and enhancement activities were implemented in gopher tortoise habitat on private lands in Alabama, Florida, Georgia, and Mississippi (Service 2020, unpaginated).

The Gopher Tortoise Conservation and Crediting Strategy (Strategy) is a conservation initiative designed to balance military mission activities and gopher tortoise conservation on Department of Defense (DoD) lands in the Southeast (Service 2017, entire); see below under Conservation Lands for further discussion about DoD lands. The Service-approved Strategy establishes the framework for determining credit for DoD conservation actions and is intended to achieve a net conservation benefit to the species. It focuses on identification, prioritization, management, and protection of viable gopher tortoise populations and the best remaining habitat. It provides guidelines designed to result in an increase in the size and/or carrying capacity of populations while promoting the establishment of new populations through increased habitat connectivity or translocation of gopher tortoises (Service 2017, entire).

The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) offers technical and financial assistance to help agricultural producers voluntarily implement conservation activities and practices that benefit the gopher tortoise. The gopher tortoise is identified as a target species eligible for conservation funding in the national Working Lands for Wildlife partnership, which is a collaborative approach to conserving habitat on working lands. In addition, the NRCS works to restore longleaf pine across its historical range through the Longleaf Pine Initiative. Between 2012 and 2021, private landowners across the range of the species have received assistance to implement management practices that benefit gopher tortoises and gopher tortoise habitat on 943,740ac (381,918ha) through NRCS programs.

Each State within the range of the gopher tortoise provides some measure of protection for the species. The States of Florida, Georgia, and South Carolina provide protection for the gopher tortoise through the requirement of land management plans for State lands. The gopher tortoise is protected by regulation as a non-game species in Alabama, is State-listed as threatened in Florida, Georgia, and Louisiana, and is State-listed as endangered in Mississippi and South Carolina. Gopher tortoise protections vary by State; however, laws within most States in the range focus on prohibitions against the take, possession, export/sale, and killing of gopher tortoises. States in the gopher tortoise range also implement conservation programs in partnership with private landowners. For example, Florida's Landowner Assistance Program assists private landowners with plans to improve their wildlife habitat through the development of 10-year management plans on an estimated 44,000 ac (17,806 ha) of gopher tortoise habitat per year (FWC 2020b, p. 6). Florida has also developed the Gopher Tortoise Management and Gopher Tortoise Permitting Guidelines to guide gopher tortoise recovery efforts and regulatory actions (FWC 2007, revised 2012, entire; FWC 2008, revised July 2020; entire). Florida regulations also require that construction or other activities that disturb gopher tortoise burrows must obtain a relocation permit and that the impacts be considered and mitigated.

Translocation and Headstarting

Gopher tortoises have been considered one of the most translocated species in the Southeast, and translocation is commonly used as a conservation strategy to mitigate the loss of tortoises from land under development (Dodd and Seigel 1991, p. 340). Displaced tortoises are often translocated to suitable habitat to reestablish extirpated populations or augment existing populations (Griffith et al. 1989, p. 477). Numerous studies have attempted to evaluate the success of gopher tortoise translocation and improve its efficacy. However, gopher tortoise life history characteristics (*e.g.,* long-lived, slow-growing, and slow to reach maturity) make it difficult to determine if translocations result in sufficiently viable tortoise populations since the typical monitoring periods are shorter than the generation time for the species. Gopher tortoises disperse at a high rate in the year following translocation; however, soft-releases, or the temporary penning of gopher tortoises within a recipient area, are highly effective at limiting dispersal post-translocation (Tuberville et al. 2005, pp. 353–354; Tuberville et al. 2008, pp. 2694–2695; Bauder et al. 2014, pp. 1449–1450). Translocation is successful at removing tortoises from immediate danger due to development (Tuberville et al. 2005, p. 356; Tuberville et al. 2008, p. 2695).

Gopher tortoise relocation and translocation practices are being implemented and included as guidance across the range of the species (Service 2022, pp. 85–87). The primary goals for recipient sites are to prevent the loss of tortoises and retain the existing tortoises; and while habitat is lost on the development site, recipient sites can contribute to habitat conservation if sites receive long-term protection and subsequent habitat management. These sites can provide high conservation value by restocking tortoises to appropriately suitable lands where populations have previously been depleted. However, this practice could result in an overall net loss of habitat if not implemented in conjunction with acquisition and additional protection of habitat when needed. Additional information regarding specific translocation efforts in each State may be found in the SSA report (Service 2022, pp. 83–87).

Headstarting, or the process of hatching and/or rearing juvenile turtles in captivity through their most vulnerable period, has shown success as a technique to boost depleted gopher tortoise populations (Holbrook et al. 2015, pp. 542–543; Tuberville et al. 2015, pp. 467–468; Spencer et al. 2017, p. 1341; Quinn et al. 2018, p. 1552; Tuberville et al. 2021, p. 92). Headstarting has been explored as a management tool for the gopher tortoise with increasing recognition of its potential role, particularly when used in concert with other management actions (Spencer et al. 2017, entire; Quinn et al. 2018, pp. 1552–1553). For example, the gopher tortoise headstarting program at Camp Shelby in Forrest County, Mississippi (funded by the Mississippi Army National Guard and in partnership with The Nature Conservancy) has been ongoing since 2013 and has shown initial success with headstarted juveniles surviving at a much higher rate than their wild counterparts (70–80 percent versus 30 percent for wild 2- to 3-year-old tortoises). Similar survival rates were noted in post-release monitoring of headstarted yearling gopher tortoises in Georgia and South Carolina (Tuberville et al. 2015, entire).

Other Conservation Mechanisms

In the eastern portion of the range, the gopher tortoise is included in a candidate conservation agreement (CCA) (revised 2018) with State, nongovernmental and private organizations and in a candidate conservation agreement with assurances (CCAA) (2017) with Camp Blanding Joint Training in Florida. These Service-approved agreements outline management actions that landowners implement to benefit the gopher tortoise and its habitat across the candidate range. We developed the 2013 Rangewide Conservation Strategy for the Gopher Tortoise to guide conservation of the gopher tortoise by our partners, including States within gopher tortoise range, the Service, and other public and private entities to collect and share information on gopher tortoise threats, outline highest priority conservation actions, and identify organizations best suited to undertake those conservation actions (Service 2013, entire).

In Florida, where the greatest number of tortoises have been identified, several additional conservation efforts are ongoing. The Forestry Wildlife Best Management Practices for State Imperiled Species and the Agriculture Wildlife Best Management Practices for State Imperiled Species were developed in 2014 and 2015, respectively, to enhance silviculture's contribution to the conservation of wildlife, provide guidance to landowners who chose to implement these voluntary practices, and reduce take of gopher tortoises (FDACS 2015, entire). By 2021, landowners provided notice of intention to FWC to implement forestry best management practices (BMPs) on more than 3.7 million ac (1.5 million ha) and conservation practices on approximately 425,031 ac (172,004 ha) of agricultural lands in Florida (FWC 2020a, unpaginated; FWC 2021, p. 1). FWC also provides technical assistance to private and industry landowners to implement beneficial management and/or mitigation activities across 40 counties through other programs and agreements (FWC 2020b, p. 2; FWC 2021, p. 1).

There are numerous other gopher tortoise conservation tools and guides, including several in the core of the species' range in Georgia. For example, the Best Conservation Practices for Gopher Tortoise Habitat on Working Forest Landscapes was developed to assist in best conservation practices for the creation and maintenance of gopher tortoise habitat in the candidate portion of the range (GDNR et al. 2018, entire). Additionally, Forest Management Practices to Enhance Habitat for the Gopher Tortoise details the essentials of managing habitat for gopher tortoises, including prescribed fire, timber harvest, and selective herbicide use (GDNR 2014, unpaginated). Further, the Georgia Gopher Tortoise Initiative is an extension of the Georgia Department of Natural Resource's long-standing effort in conserving longleaf pine systems. The initiative is a collaborative effort between several public and private entities and is geared towards the protection, restoration, and long-term management of gopher tortoise habitat.

Implemented rangewide, America's Longleaf Restoration Initiative is a collaborative effort involving multiple public and private partners actively supporting efforts to restore and conserve longleaf pine ecosystems with a goal to increase longleaf coverage on the landscape to 8.0 million ac (3.2 million ha) (ALRI 2021, unpaginated). Several local implementation teams work across the gopher tortoise range to help restore longleaf pine on habitat where gopher tortoises occur.

Conservation Lands

The conservation of multiple large, contiguous tracts of habitat provides the connectivity and landscape heterogeneity requirements to support gopher tortoise viability. Gopher tortoise habitat occurs across a wide range of lands in public ownership with varying levels of management. An estimated 1.7 million ac (688,000 ha) of potential gopher tortoise habitat occurs on protected lands including lands in Federal, State, and local government, nongovernmental organization, and private ownership (*e.g.,* conservation easements) throughout the species' range.

Managing publicly owned lands in a way that benefits the gopher tortoise is an important mechanism for reducing the effects of habitat loss, fragmentation, and degradation on the species. Habitat management occurring on public conservation lands is often accomplished via natural resource planning instruments (*e.g.,* land management plans, comprehensive conservation plans, resource management plans, etc.). Each State in the gopher tortoise's range has statutory authority to acquire land for conservation purposes. Since publication of the 12-month finding (76 FR 45130, July 27, 2011), all States within the species' range have made concerted efforts to protect gopher tortoise habitat and potential gopher tortoise habitat via strategic land acquisition. Between 2011 and 2019, Alabama, Florida, Georgia, and South Carolina have reported fee-simple acquisition of approximately 42,000 ac (16,996 ha) of potential gopher tortoise habitat with an additional approximately 78,000 ac (31,565 ha) acquired in conservation easements (CCA 2019, pp. 52–73). Federal entities including the U.S. Air Force, the U.S. Forest Service, and the Service recorded an additional 2,740 ac (1,109 ha) of potential gopher tortoise habitat acquired and approximately 24,000 ac (9,712 ha) of conservation easements acquired (CCA 2019, pp. 52–73).

Several National Wildlife Refuges (NWRs) (*e.g.,* Merritt Island NWR, Lake Wales Ridge NWR, Lower Suwannee NWR, St. Marks NWR) occur within the range of the gopher tortoise, providing important habitat conservation for the species. Management activities included in NWR Comprehensive Conservation Plans that influence gopher tortoises include habitat restoration activities such as prescribed fire, pine thinning, and other mechanical vegetation management for restoring desired vegetative conditions in pine and scrub systems, and tortoise management and monitoring actions based on priorities of the refuge and available resources.

Rangewide, the gopher tortoise occurs on 31 DoD installations, with potential habitat on additional installations (DoD 2022, p. 4). Many of these installations specifically include gopher tortoise habitat and population management prescriptions and goals within their individual integrated natural resources management plans (INRMPs) prepared in conjunction with the Service. Most INRMPs also include land management for other upland species that benefit gopher tortoise habitat (and gopher tortoises) as well. Rangewide, approximately 830,000 ac (335,889 ha) of potential gopher tortoise habitat occur on military installations. Limited information is currently available regarding the condition of this potential habitat and the extent to which these areas are occupied by gopher tortoises.

National Forest (NF) plans provide an integrated framework for analyzing and approving projects and programs, including conservation of listed species. Several National Forests (*e.g.,* Ocala NF, Desoto NF, Conecuh NF, Apalachicola NF, etc.) occur within the range of the gopher tortoise and provide important habitat conservation for the species. Identification and implementation of land management and conservation measures to benefit gopher tortoises vary among NFs, but generally include habitat restoration and management objectives and maintaining buffers around gopher tortoise burrows during various forest management activities. For example, the Desoto NF recently completed a 10-year Collaborative Forest Landscape Restoration Program, during which actions to restore longleaf pine were implemented on 374,000 ac (151,352 ha) of NF lands. In addition, the Desoto NF has prioritized any management treatment that contributes to improvement of gopher tortoise, as set forth in their Mission, Vision, and Operational Strategy (USFS 2020, entire).

Private Lands Conservation Efforts

Most forested land within the gopher tortoise range is privately owned. Privately owned lands account for approximately 80 percent of potential gopher tortoise habitat, of which approximately half are managed for forest production (NRCS 2018, p. 2; Greene et al. 2019, p. 201). Across the gopher tortoise range, large working forests account for over 6 million ac (2.4 million ha) of forest land, representing a significant land use with the potential to influence gopher tortoise resiliency and viability (Weatherford et al. 2020, p. 3). While not all working forest lands include appropriate habitat conditions for gopher tortoises, approximately 2.78 million ac (1.12 million ha) of suitable soil types and 2.98 million ac (1.21 million ha) of open pine conditions are estimated to occur on private forest lands (NCASI 2021, p. 1). We included the best available data on gopher tortoise observations between 1977 and 2019 on private forest lands in our SSA (Weatherford et al. 2020, pp. 9–11; Service 2022, pp. 95–99). These observations occur on Member Company lands that are part of the National Council for Air and Stream Improvement and landowners may implement conservation measures including those outlined in the Sustainable Forestry Initiative guidelines.

While working to meet a range of objectives, including timber production, many larger private working forests also accomplish conservation within a broad network of collaboration with Federal, State, and local government agencies, universities, and nongovernmental organizations. For example, forest landowners may create and maintain areas of open pine conditions, conduct gopher tortoise burrow surveys, conduct research, and implement BMPs that benefit the gopher tortoise. In addition, forest certification programs, such as the Sustainable Forestry Initiative (SFI) and Forest Stewardship Council, require participants to adhere to a set of principles including providing wildlife habitat to conserve biological diversity (Weatherford et al. 2020, p. 11). Adhering to these principles likely provides a benefit to maintaining suitable gopher tortoise habitat in private working forests. An estimated 13.7 million ac (5.5 million ha) within the gopher tortoise's range are certified through SFI, although the proportion of certified acres that include gopher tortoise populations or their current habitat is unknown (SFI 2021, unpaginated). Other forest certifications, including the American Tree Farm System, are authorized by the Program for the Endorsement of Forest Certification, a third-party audited certification system.

The largest forest landowner group in the United States is the family forest landowners, controlling approximately 87 percent of forest land in the South (Oswalt et al. 2014, p. 6). The American Forest Foundation works with smaller, family forest landowners and has partnered with the Service's Partners for Fish and Wildlife Program to develop habitat improvement plans as part of a 10-year agreement. Since 2017, the partnership has implemented habitat management activities on more than 3,500 ac (1,416 ha) and identified 762 gopher tortoises, including 2 populations that meet the MVP criteria (AFF 2021, unpaginated).

Additionally, The Longleaf Alliance works with private landowners and other partners across the range of the gopher tortoise to restore and maintain habitat as an essential part of their larger focus in restoring the longleaf pine ecosystem. Through The Longleaf Alliance, in 2019, landowners implemented more than 55,000 ac (22,258 ha) of prescribed fire within gopher tortoise habitat, in addition to longleaf pine plantings, groundcover restoration, and invasive plant management efforts (SERPPAS 2020, p. 17).

Other private conservation efforts include several privately owned tracts of land managed as mitigation/conservation areas for gopher tortoises in both Mississippi and Alabama, which provide suitable habitat, protection, and habitat management. Four conservation areas in Alabama are managed through Service-approved habitat conservation plans, while the Mississippi conservation bank follows national mitigation banking guidelines for maintaining optimal habitat, including aggressive prescribed fire and longleaf restoration programs.

*Synergistic and Cumulative Effects*

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. To assess the current and future condition of the species, we undertake an iterative analysis that encompasses and incorporates the threats individually and then accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Several factors influencing gopher tortoise viability are synergistic and related. Urbanization and development results in habitat loss, fragmentation, and degradation through land use change and increased road infrastructure. The anthropogenic changes associated with urbanization and development also affect the gopher tortoise through the introduction of nonnative invasive species and predators. Climate change is expected to influence the gopher tortoise through several changes as described in *Climate Change,* above. Sea level rise is expected to result in an inland migration of the human population away from inundated areas, resulting in increased urbanization and developed inland areas that are currently undeveloped and potentially suitable upland habitat for gopher tortoise. In addition, changes in precipitation and temperature are expected to result in a decrease in the number of suitable burn days in gopher tortoise habitat, leading to reduced habitat management (another threat to gopher tortoise viability). Urbanization and development also limit the implementation of prescribed burns as a habitat management tool due to safety concerns and proximity to inhabited areas.

Influences on the gopher tortoise that are not considered key factors influencing the species' status may exacerbate the effects of urbanization, climate change, and habitat management in affected gopher tortoise populations. Conservation of habitat through land acquisition and conservation actions on public and private lands and the retention of private forest lands reduces the severity of some of these threats by providing protection of habitat across the landscape, maintaining connectivity between habitat patches, and increasing the opportunity for beneficial habitat management actions now and into the future.

*Summary of Factors Influencing the Species*

The best available information regarding the gopher tortoise and its habitat indicates that habitat loss, degradation, and fragmentation (due to land use changes from urbanization), climate change, insufficient and/or incompatible habitat management, and conservation actions are the most significant factors influencing gopher tortoise viability. Urbanization results in a range of impacts that either remove, degrade, or fragment remaining habitat, or impact gopher tortoises directly through development. Urbanization brings road construction and expansion, which may cause direct mortality of gopher tortoises and fragment remaining habitats. In addition, this type of development may also create conditions that prove to be beneficial to invasive species, serve to increase predators, and establish inadequate conditions for fire management. Temperature increases associated with long-term climate change are likely to further constrain use of prescribed fire through a decrease in the number of suitable burn days.

Habitat loss resulting from sea level rise associated with climate change is a risk for coastal populations of gopher tortoise. Habitat management through prescribed fire and other methods is important to maintaining suitable habitat conditions, and insufficient and/ or incompatible habitat management now and in the future, especially based on projections in reduction of prescribed fire, impacts the viability of gopher tortoise populations. Conservation efforts to benefit the gopher tortoise and its habitat implemented by Federal, State, and private partners occur across the species' range and influence the gopher tortoise condition. These factors are considered to have population-level effects and were evaluated further in the current condition and future condition analysis.

*Current Condition*

We describe the current condition of the gopher tortoise in terms of population resiliency and species redundancy and representation. The analysis of these conservation principles to understand the species' current viability is described in more detail in the gopher tortoise SSA report (Service 2022, pp. 103–143).

Data Sources

To inform the gopher tortoise SSA, we requested, received, and reviewed a variety of data including information from State and Federal agencies, local governments, and private lands. Data received included two general types of information: spatially explicit data with location information (typically from conservation lands) and private lands data without location information. These data represent a subset of gopher tortoises likely to occur on the landscape due to the lack of a comprehensive private lands data set from systematic surveys. Data were collected using burrow surveys of various methodologies and included burrow surveys with and without burrow scoping, and line transect distance sampling (Buckland et al. 1993, entire; Thomas et al. 2010, entire); some burrow data were submitted with unknown methodology. Because data were provided by a variety of sources, contained disparate levels of data resolution, and were collected in various ways, we could not reliably determine abundance, density, habitat availability, or other metrics for all populations.

All population data provided were integral to evaluating the current condition of the gopher tortoise, although different data types come with different assumptions and limitations. Data that come from standardized and systematic surveys result in spatially explicit burrow locations and subsequent population estimates. The use of these spatially explicit data allowed us to make more reliable estimates of population size; use spatial buffering to delineate populations based on species biology; tie site-specific habitat and management factors to locations of gopher tortoises; and estimate future parameters, such as estimated future abundance of gopher tortoise populations. Most spatially explicit data (*e.g.,* burrow locations and subsequent population estimates) in our analyses came from assessments of populations on lands managed for the conservation of biodiversity or natural resources.

A large percentage of potential gopher tortoise habitat occurs on lands in private ownership. To best assess the current and future condition of the gopher tortoise, including populations on private lands, we developed a landowner questionnaire and used responses to estimate population, habitat, and management factors at a county scale to ensure privacy for respondents (Service 2022, appendix A). The vast majority of the private lands data obtained for the SSA lack a spatial component because of issues associated with confidentiality of location data; however, this concern does not preclude the use and importance of these data in the SSA. Responses represent a small percentage of private lands that currently support gopher tortoises, as many private landowners express reluctance to share gopher tortoise occurrence data. We also included information from a subsequent Florida Forestry Association questionnaire in our analyses; however, no population estimates were available for these lands, and we were unable to estimate current resiliency for populations on these properties.

Because data received from these questionnaires are not spatially explicit, there are limitations to the applicability of the data as it relates to delineation of populations, assessment of site-specific factors such as habitat quality and quantity and management regimes, and use of abundance data in projections of future scenarios. We include data from private landowners in the current condition analysis as county-level data and also categorize habitat condition based on landowner responses. The additional data we received on gopher tortoise populations on private lands when developing the SSA informed our current condition analysis of gopher tortoise viability and contributed to the understanding of species' viability.

In this finding, we present results of the current and future condition analyses for delineated spatially explicit populations as described below for clarity and comparison purposes. However, the SSA report also presents results for current conditions for county-level data following the same analysis methodology (Service 2022, pp. 130–142). We used spatially explicit data to inform the population model used to forecast future scenarios for the gopher tortoise, as described below. We did not use county-level data in our future analysis because most information in this category lacks abundance data and we could not apply spatially based modeling used in future analysis to the default county center point. We note that the data included in our current and future condition analyses represent a subset of gopher tortoises likely to occur on the landscape, as data from private lands were lacking (Service 2022, pp. 103–107). Thus, population estimates do not represent an assessment of all populations of gopher tortoises, but rather represent information that was provided by partners through much of the species' range. Given we were able to use only a subset of populations that likely occur on the landscape, our future projections are likely an underestimate of gopher tortoises on the landscape.

Analysis Unit and Population Delineation

To assess rangewide representation for gopher tortoise, we delineated five analysis units based on genetic differences (identified in Gaillard et al. 2017, entire), physiographic regions, and the input of species experts (figure 2). The Tombigbee and Mobile Rivers act as a boundary between Unit 1 (Western) and Unit 2 (Central) analysis units, and the Apalachicola-Chattahoochee Rivers act as a boundary between Unit 2 (Central) and Unit 3 (West Georgia) analysis units. Because of the high degree of admixture and lack of well-defined boundaries found within transitional zones of physiographic regions, we used other biogeographic barriers and expert input to delineate boundaries of the following units: Unit 3, Unit 4 (East Georgia), and Unit 5 (Florida) analysis units. We used U.S. Environmental Protection Agency Level IV ecoregions to delineate the boundaries between Units 3 and 4, and Units 4 and 5 (EPA 2013, unpaginated). We used the Suwanee River to separate Units 3 and 5, as this river represents a significant barrier to dispersal, and gene flow between these two units is known to be low (Gaillard et al. 2017, p. 509). Additional details regarding the delineation of analysis units used to analyze the current and future condition of the gopher tortoise may be found in the SSA report (Service 2022, pp. 111–114).

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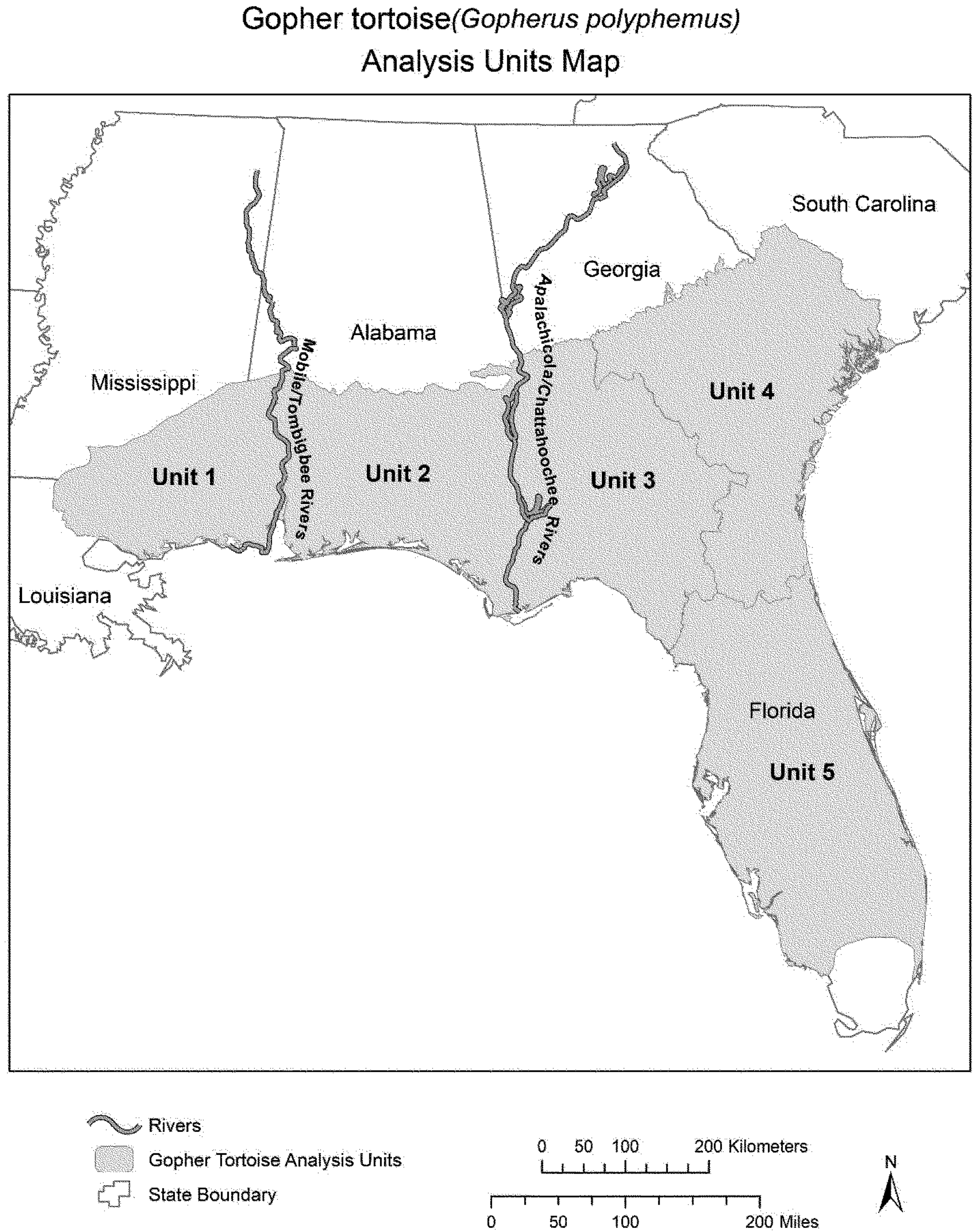


Figure 2. Analysis units used as units of representation for the gopher tortoise (Service 2022, p. 114). Analysis units include Western (Unit 1), Central (Unit 2), West Georgia (Unit 3), East Georgia (Unit 4), and Florida (Unit 5).

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In order to analyze gopher tortoise population resiliency, we defined populations for the species as contiguous areas surrounding known gopher tortoise burrows with habitat conducive to survival, movement, and interbreeding among individuals within the area. Using survey data from across the range of the gopher tortoise, we delineated populations at two spatial scales: local populations and landscape populations, as defined below.

Local populations are geographic aggregations of individuals that interact significantly with one another in social contexts making reproduction significantly greater between individuals within the aggregation than with individuals outside of the aggregation (sensu Smallwood 1999, pp. 103, 108). We operationally delineated local populations by identifying aggregations of individuals or burrows where individuals were clustered together within a 1,968-ft (600-m) buffer to the exclusion of other adjacent individuals or burrows. Gopher tortoise habitat and demography vary across the range; therefore, the 1,968-ft (600-m) buffer represents an average and best estimate across geography and habitat variations based on a thorough literature search and species expert input (Diemer 1992b, p. 161; Guyer et al. 2012, pp. 122, 125, 132, Castellon et al. 2018, p. 17; Service 2019, entire; Greene et al. 2020, pp. 52–53). We delineated 656 local gopher tortoise populations with available spatially explicit data (table 1). We assumed that some areas were unsuitable for gopher tortoise movement or survival and considered those barriers to movement when delimiting local populations. These barriers included interstates, freeways, and expressways; major rivers and lakes; wetlands; and highly urbanized areas (USDOT 2016, unpaginated; ESRI imagery 2021, unpaginated).

Landscape populations are a series of local populations that are connected by some form of movement; individuals within a landscape population are significantly more likely to interact with other individuals within the landscape population than individuals outside of the landscape population. Gopher tortoises have been shown to move more than 4,921 feet (1,500 m) throughout multiple years, with distances as large as 8,802–15,220 feet (2,683–4,639 m) (McRae et al. 1981, p. 172; Ott-Eubanks et al. 2003, p. 317; Diemer-Berish et al. 2012, p. 52; Guyer et al. 2012, entire; Castellon et al. 2018, entire). We operationally delineated landscape populations by identifying local populations connected by habitat within an 8,202-ft (2.5-km) buffer around each local population. To be most inclusive of local populations, we selected a landscape-population buffer consistent with the longer gopher tortoise movements observed (McRae et al. 1981, p, 173; Diemer 1992b, p. 163; Bauder et al. 2014, pp. 1448–1449; Service 2019, entire). We delineated 253 landscape populations with available spatial data (table 1).

TABLE 1—SPATIALLY DELINEATED LOCAL AND LANDSCAPE POPULATIONS OF GOPHER TORTOISES BY STATE IN 2021

| | Spatially delineated populations | |
|---|---|---|
| | Local | Landscape |
| Florida | 316 | 161 |
| Georgia | 151 | 63 |
| Mississippi | 99 | 7 |
| Alabama | 77 | 14 |
| Louisiana | 7 | 5 |
| South Carolina | 6 | 4 |
| Total: | 656 | * 254 |

* One delineated landscape population falls in both Georgia and Florida and is reflected in both States' landscape population total.

Resiliency

Resiliency describes the ability of a species to withstand stochastic events and is associated with population size, growth rate, and habitat quality. Highly resilient populations are more likely to withstand disturbances such as random fluctuations in fecundity (demographic stochasticity), variation in mean annual temperature (environmental stochasticity), or the effects of anthropogenic activities, such as local development projects. Viability denotes a species' ability to sustain populations over a determined timeframe and is closely tied with population resiliency and species-level representation and redundancy. For gopher tortoise populations to have sufficient viability over the long term, they must have an adequate number of individuals (population size), be above a particular density (population density), and have sufficient genetic exchange between local populations to maintain genetic diversity. There must also be sufficient habitat that is beneficially managed for gopher tortoise in order to support individual and population needs. Population size and density are driven by a variety of underlying demographic parameters, including fecundity, sex ratio, and survival at various life history stages (egg, nest, hatchling, juvenile, and adult survival). Genetic diversity is primarily driven by rates of emigration and immigration between local populations.

We relied on the MVP criteria adopted by the Gopher Tortoise Council for abundance, area of managed high-quality habitat, sex ratio, evidence of recruitment, variability in size and age classes, and no major constraints to gopher tortoise movement as described above (GTC 2013, pp. 2–3). As previously mentioned, the best available data contain disparate levels of data resolution, thus we could not reliably determine abundance, density, or other metrics for all populations. Therefore, we used a burrow conversion factor for properties that provided burrow counts and locations, but did not have a corresponding abundance estimate. Although there is no single burrow conversion factor that would be appropriate for all populations across the range of the species, we selected the representative burrow conversion factor of 0.4 individuals per burrow to calculate an estimated current population size described in gopher tortoise literature (Guyer et al. 2012, pp. 127, 129–131). The burrow-to-tortoise conversion factor allows the burrow count information to give an estimate of tortoises on the landscape, although we recognize that variance in burrow abundance is related to factors other than the number of tortoises (Burke 1989, p. entire; Breininger et al. 1991, pp. 319–320; McCoy and Mushinsky 1992, pp. 402, 406).

We used estimated abundance of adult gopher tortoises in a local population as a metric for categorical levels of resiliency: high (greater than or equal to 250), moderate (51 to 249), and low (fewer than 50). These resiliency levels align with the GTC working group's categories for viable (high resiliency), primary support (moderate resiliency), and secondary support (low resiliency) populations (GTC 2014, p. 4).

Current condition abundance estimates are based only on data from spatially delineated populations (*i.e.,* do not contain county-level data or gopher tortoises that are present but not reported), and these estimates substantially underestimate the true number of gopher tortoises present across the species' range. Based on available data, there are an estimated 149,152 gopher tortoises from 656 spatially delineated local populations across the range of the species, with local populations categorized as follows: 360 in low condition, 169 in moderate condition, and 127 in high condition.

Resiliency of populations by analysis unit are described below and in table 2. Most gopher tortoises are found in the eastern portion of the range with Unit 5 (Florida) supporting 47 percent of the estimated rangewide population total, and Units 3 (West Georgia) and 4 (East Georgia) supporting 26 percent and 19 percent, respectively. Units 1 (Western) and 2 (Central) support much smaller numbers of gopher tortoises, with 2 percent and 6 percent of the estimated rangewide population total, respectively, likely driven by differences in soils, as discussed earlier in Habitat.

TABLE 2—SITE-SPECIFIC DATA POPULATION FACTORS AND CURRENT RESILIENCY FOR SPATIALLY DELINEATED LOCAL POPULATIONS OF GOPHER TORTOISE

| Analysis unit | Burrows | Landscape populations | Local populations | Abundance | Current resiliency |
|---|---|---|---|---|---|
| 1 | 8,815 | 13 | 106 | 3,100 | Low (94), Moderate (10), High (2). |
| 2 | 5,809 | 30 | 106 | 8,642 | Low (71), Moderate (27), High (8). |
| 3 | 17,867 | 55 | 109 | 38,947 | Low (42), Moderate (24), High (43). |
| 4 | 20,216 | 46 | 124 | 28,408 | Low (35), Moderate (58), High (31). |
| 5 | 24,783 | 109 | 211 | 70,055 | Low (118), Moderate (50), High (43). |
| Rangewide | 77,490 | 253 | 656 | 149,152 | Low (360), Moderate (169), High (127). |

We relied on gopher tortoise abundance to assess resiliency of populations as the abundance of individuals strongly reflects the condition of the habitat and implementation of beneficial management actions. We summarize our assessment of habitat condition and management actions below and provide more details regarding information used and analysis unit results in the SSA report (Service 2022, pp. 122–130). The influence of habitat size, quality, and management on the resiliency and viability of gopher tortoise populations was also described in the MVP criteria (GTC 2013, p. 2).

Habitat data were provided by a variety of sources and contain disparate levels of data resolution; thus, we could not reliably determine estimates of habitat within all populations across the range of the gopher tortoise. Estimates of habitat with known gopher tortoise occurrences (local populations) and potential habitat (outside local populations, but within the species' range) are derived from the species-specific Habitat Suitability Index (HSI) and suitable soils (Crawford et al. 2020, entire). Rangewide, we determined using the HSI that approximately 844,912 ac (341,923 ha) of suitable habitat occur within spatially explicit local populations with gopher tortoise occurrences and approximately 16,338,932 ac (6,612,131 ha) of potential habitat (suitable habitat with unknown gopher tortoise presence) occur outside delineated populations within the range of the species. Additionally, information from the landowner questionnaire was used to estimate the condition of potential habitat in each analysis unit with 24 percent of the 447,340 ac (181,032 ha) characterized as low condition, 42 percent as moderate condition, and 34 percent as high condition (Service 2022, p. 126). Estimates of habitat were not used to assess resiliency of gopher tortoise populations; only abundance was used to assess resiliency. However, estimates of potential habitat and potential habitat quality on private lands give some information regarding the extent of habitat where gopher tortoises could occur compared to the extent of habitat where occurrences are known.

To assess management of gopher tortoise habitat, we used several data sets available from multiple sources and at multiple spatial scales, and these data may include some overlap. Again, we did not use any management metrics in our resiliency assessment; only abundance was used to assess population resiliency. We determined an estimate of acres burned (prescribed fire and wildfire) using Tall Timbers Southeast fire history dataset, derived from the U.S. Geological Survey Burned Area (v2) Products (Hawbaker et al. 2020, entire) representing years 1994–2019 (Hawbaker et al. 2020, entire). Acres burned across all units have generally increased over time, with significantly more burning occurring in Unit 5 (Florida).

We also used summary data for prescribed fire and other midstory maintenance activities available from America's Longleaf Restoration Initiative (ALRI) FY2019 annual report (ALRI 2019). Florida reported by far the most acres of habitat managed for longleaf by fire and other methods, with nearly 600,000 ac (242,811 ha) treated between October 2018 and September 2019. Much of the management implemented by partners under the ALRI umbrella is likely to benefit gopher tortoise.

Next, we summarized management practices as detailed in the gopher tortoise CCA 2021 annual report, which covers management actions implemented between October 2020 and September 2021. CCA management data have the advantages of being specific to sites known to support gopher tortoises and include both prescribed fire and other beneficial practices such as chemical and mechanical treatments and invasive species control. Unfortunately, the CCA data are limited to the eastern portion of the range, and thus do not include information for the western portion. Finally, we summarized the responses to the landowner questionnaire regarding acres of prescribed fire, burn frequency, and other management practices to benefit the gopher tortoise. Most prescribed burns occurred in Units 3 (West Georgia) and 5 (Florida); burn frequency is often on a 1- to 3-year cycle; and many landowners implement additional beneficial practices (Service 2022, pp. 129–130, 133–139).

We describe the results of our analysis of the abundance (resiliency), habitat, and management metrics for each analysis unit, below. Populations described are those delineated using spatially explicit data and may underestimate the number of gopher tortoises and populations on the landscape.

Analysis Unit 1 (Western)

Based on available data, Unit 1 is composed of many small, disconnected populations and very few larger populations (106 local populations; 13 landscape populations), spread across private and public land. Abundance estimates indicate there are 94 low-, 10 moderate-, and 2 high-resiliency local populations within this unit. Camp Shelby, a DoD property, is the stronghold of Unit 1 with a population estimate of 1,003 individual gopher tortoises. Based on responses to the landowner survey, 17 properties on private lands in the unit support gopher tortoise populations, with 7 properties reporting signs of reproduction.

More than 103,000 ac (41,682 ha) of habitat occurs within gopher tortoise populations in Unit 1, with an additional 2 million ac (809,371 ha) of potential gopher tortoise habitat where gopher tortoise occurrence is unknown. The current estimates for prescribed fire implementation show that over 35,795 ac (14,485 ha) were burned within this unit in 2019, double the area burned since 1994. Over 90 percent of landowners who responded to the questionnaire report implementing prescribed fire on a 1- to 3-year rotation, with all respondents reporting implementation of additional beneficial practices for gopher tortoises.

Analysis Unit 2 (Central)

Based on available data, Unit 2 has 106 local populations and 30 landscape populations. Based on current abundance estimates, this unit is composed of 71 low-, 27 moderate-, and 8 high-resiliency local populations. The eight highly resilient populations are found on conservation lands including Fort Rucker, Conecuh NF, Apalachee Wildlife Management Area (WMA), Perdido WMA, Geneva State Forest, and an unnamed private property. Based on responses to the landowner survey, 32 properties on private lands in the unit support gopher tortoise populations with 17 properties reporting signs of reproduction.

More than 68,000 ac (27,518 ha) of habitat occurs within gopher tortoise populations in Unit 2, with an additional 3.4 million ac (1.37 million ha) of potential gopher tortoise habitat where gopher tortoise occurrence is unknown. The current estimates for prescribed fire implementation show that approximately 106,000 ac (42,896 ha) were burned in 2019, triple the area burned since 1994. Sixty percent of landowners who responded to the questionnaire report implementing prescribed fire on a 1- to 3-year rotation, with 72 percent of respondents reporting implementation of additional beneficial practices for gopher tortoises.

Analysis Unit 3 (West Georgia)

Based on available data, Unit 3 has 109 local populations and 55 landscape populations. Based on current abundance estimates, Unit 3 is composed of 42 low-, 24 moderate-, and 43 high-resiliency local populations. Of the 43 highly resilient populations, 7 populations have estimates exceeding 1,000 individuals, including Twin Rivers State Forest, Chattahoochee Fall Line WMA, River Bend WMA, Alapaha River WMA, Apalachicola NF, and the Jones Center at Ichauway. Based on responses to the landowner survey, 48 properties on private land in Unit 3 support gopher tortoise populations with 21 properties reporting signs of reproduction.

More than 220,000 ac (89,030 ha) of habitat occurs within gopher tortoise populations in Unit 3, with an additional 2.9 million ac (1.17 million ha) of potential gopher tortoise habitat where gopher tortoise occurrence is unknown. The current estimates for prescribed fire implementation show that more than 194,000 ac (78,509 ha) were burned in 2019, almost a 10-fold increase since 1994. Sixty-seven percent of landowners who responded to the questionnaire report implementing prescribed fire on a 1- to 3-year rotation, with 44 percent of respondents reporting implementing additional beneficial practices for gopher tortoises.

Analysis Unit 4 (East Georgia)

Based on available data, Unit 4 has 124 local populations and 46 landscape populations. Based on current abundance estimates, Unit 4 is composed of 35 low-, 58 moderate-, and 31 high-resiliency local populations. Of the 31 highly resilient populations, 5 populations have estimates exceeding 1,000 individuals, including Ohoopee Dunes WMA, Ralph E. Simmons State Forest, Jennings State Forest, and Fort Stewart. Based on responses to the landowner survey, 22 properties on private land in the unit support gopher tortoise populations with 11 properties reporting signs of reproduction.

More than 149,000 ac (60,298 ha) of habitat occurs within the gopher tortoise population in Unit 4, with an additional 2.7 million ac (1.09 million ha) of potential gopher tortoise habitat where gopher tortoise occurrence is unknown. The current estimates for prescribed fire implementation show that more than 161,000 ac (65,154 ha) were burned in 2019, over a 7 times increase since 1994. Fifty-three percent of landowners who responded to the questionnaire report implementing prescribed fire on a 1- to 3-year rotation, with 77 percent of respondents reporting implementing additional beneficial practices for gopher tortoises.

Analysis Unit 5 (Florida)

Based on available data, Unit 5 has 211 spatially explicit local populations and 109 landscape populations. Based on current abundance estimates, Unit 5 is composed of 118 low-, 50 moderate-, and 43 high-resiliency local populations. Of the 43 highly resilient populations, 12 populations have estimates exceeding 1,000 individuals, including Camp Blanding and Goldhead Branch State Park, Ocala NF, Chassahowitzka WMA, Ichetucknee Springs State Park, Bell Ridge Wildlife and Environmental Area, Etoniah Creek State Forest, Halpata Tastanaki and Cross Florida Greenway, Lake Louisa State Park, Kissimmee Prairie Preserve State Park, Green Swamp West Unit WMA, Withlacoochee State Forest's Citrus Tract, and Perry Oldenburg Wildlife and Environmental Area and Withlachoochee State Forest's Croom Tract. Based on responses to the landowner survey, 48 properties on private land in the unit support gopher tortoise populations with 35 properties reporting signs of reproduction.

More than 300,000 ac (121,405 ha) of habitat occurs within gopher tortoise populations in Unit 5, with an additional 5.3 million ac (2.14 million ha) of potential gopher tortoise habitat where gopher tortoise occurrence is unknown. The current estimates for prescribed fire implementation show that more than 582,368 ac (235,675 ha) were burned in 2019, a nearly 14 times increase over time since 1994. Twenty-three percent of landowners who responded to the questionnaire report implementing prescribed fire on a 1- to 3-year rotation, with 83 percent of respondents reporting implementing additional beneficial practices for gopher tortoises.

Representation and Redundancy

We evaluated current representation by examining the genetic and environmental diversity within and among populations across the species' range (Gaillard et al. 2017, entire). We report redundancy for gopher tortoise as the number and resiliency of gopher tortoise populations and their distribution within and among analysis units. Current representation and redundancy have likely decreased relative to the historical condition of the species due to loss of open pine conditions and substantial reduction in longleaf pine ecosystems in the species' range.

The five delineated analysis units are based primarily on genetic variation in gopher tortoises across the range of the species. We expect this genetic variation to be generally indicative of the inherent adaptive capacity of the gopher tortoise as a species (Thurman et al. 2020, p. 522). In addition, the variety of environmental conditions across the species' range, particularly soil characteristics and associated life history characteristics differences between the western and eastern portions of the range, may be used as an indication of adaptive capacity for the gopher tortoise, allowing the species to withstand changing conditions (Thurman et al. 2020, p. 522). Gopher tortoise populations are distributed within and among analysis units across the species' range, contributing to potential adaptive capacity and current representation.

Currently, multiple local and landscape populations occur in all five analysis units. Although the resiliency of these populations varies across the range, all analysis units contain populations in high and moderate resiliency. Rangewide, 45 percent of spatially explicit local populations exhibit moderate or high resiliency. These populations are distributed across the range of the species, contributing to future adaptive capacity (representation) and buffering against the potential of future catastrophic events (redundancy). Because the species is widely distributed across its range, it is highly unlikely any single event would put the species as a whole at risk, although the westernmost portions of the range are likely more vulnerable to such catastrophes given that a greater percentage of the populations present in this unit are of low resiliency compared to other analysis units.

*Future Condition*

Future Condition Modeling

To assess future viability for the gopher tortoise, we developed an analytical framework that integrates projections from multiple models of future anthropogenic and climatic change to project future trajectories or trends of gopher tortoise populations and identify stressors with the greatest influence on future populations. The modeling framework estimates the change in population growth and number of populations while accounting for geographic variation in life history. The model links intrinsic factors (demographic vital rates) to four extrinsic anthropogenic factors that are expected to impact gopher tortoise population viability (climate warming, sea level rise, urbanization, and shifts in habitat management). We used published models describing extrinsic factors in the future to project gopher tortoise demographics under six future scenarios varying in threat magnitude and presence at three timesteps—40, 60, and 80 years in the future. A regression analysis of model outputs was used to identify threats that are predicted to have the greatest impact on gopher tortoise populations. We summarize the model framework below; additional information is available in the SSA report (Service 2022, pp. 144–159, appendix B; Folt et al. 2022, entire).

We developed a population viability analysis (PVA) framework to predict population growth and extinction risk for the gopher tortoise. For the PVA, the demography of spatially explicit local gopher tortoise populations was brought into a multi-stage, female-only model with two discrete life stages: juveniles and adults. Recruitment into the adult stage by immigration was also modeled. Specific demographic parameters including recruitment, maturity age, survival, immigration, and initial population size were modeled based on values in gopher tortoise literature (Landers et al. 1980, p. 359; Mushinsky et al. 1994, p. 123; Rostal and Jones 2002, p. 7; Ott-Eubanks et al. 2003, p. 319; Ashton et al. 2007, p. 360; Guyer et al. 2012, p. 130; Perez-Heydrich et al. 2012, p. 342; Smith et al. 2013, p. 355; Tuberville et al. 2014, p. 1155; Meshaka Jr. et al. 2019, pp. 105–106; Howell et al. 2020, entire; Folt et al. 2021, pp. 624–625, 627; Hunter and Rostal 2021, p. 661; E. Hunter unpubl. data, 2021; J. Goessling 2021, p. 141). For the demographic parameters (*e.g.,* recruitment, maturity age, survival) that vary substantially by temperature among populations, we determined the relationships between demographic rates and mean annual temperature (MAT) sourced from the WorldClim database (Hijmans 2020, entire).

We initialized the model with estimates of population size from spatially delineated populations (as described in *Current Condition*). In the future condition analysis in the SSA, we did not model local populations with fewer than three adult individuals as part of the future condition analysis as these populations do not have sufficient viability to remain on the landscape during the timeframes modeled (40, 60, and 80 years) (*i.e., these populations have reached the quasi-extinction threshold*). The process of delineating spatially explicit local populations and landscape populations for the future condition model resulted in a dataset of 626 local populations that formed 244 landscape populations with 70,600 individual (female) gopher tortoises that are included in our analysis of future conditions (Service 2022, p. 149).

A recently published peer-reviewed model uses a very similar methodology to the future condition analysis in the SSA (Folt et al. 2022, entire). The published model varied slightly from that in the SSA and did not model populations across the range with current abundance of fewer than eight individuals or fewer than three adult females. Populations with seven or fewer tortoises likely lack sufficient genetic diversity to support sufficient long-term viability (Chesser et al. 1980, entire; Frankham et al. 2011, p. 466; Folt et al. 2022, p. e02143). Both the recently published and the future condition analysis runs of the model assumed a 1:1 sex ratio and a 3:1 adult:juvenile ratio in populations and used the ratios to isolate and separate the female population into juvenile and adult components (Service 2022, p. 149; Folt et al. 2021, p. 626; Folt 2022, p. e02143). The published iteration of the model resulted in the delineation of 457 local populations that formed 202 landscape populations (metapopulations) and approximated 70,500 female tortoises (Folt et al. 2022, p. e02143). The slight variation in the published model did not substantively change the considerations in our analyses of the gopher tortoise's future condition.

Influences on Gopher Tortoise Future Viability

In coordination with scientists with expert knowledge in both gopher tortoise population biology and habitat management, we identified factors expected to influence gopher tortoise demographics in the future as described in Summary of Biological Status and Threats. We determined the key drivers of the gopher tortoise's future condition that we could incorporate into the model are climate warming, habitat management, urbanization, and sea level rise.

Climate change is predicted to drive warming temperatures and seasonal shifts in precipitation across the Southeast (Carter et al. 2018, entire). Of these two effects, warming temperatures may have the greater impact on gopher tortoises, because gopher tortoise demography is known to be sensitive to temperature gradients across the species' range. Specifically, maturity age and fecundity vary along a north-south latitudinal gradient, where warmer, southern populations have faster growth rates, younger maturity ages, and increased fecundity relative to cooler, northern populations (Ashton et al. 2007, p. 123; Meshaka Jr. et al. 2019, pp. 105–106). We modeled how climate warming may influence gopher tortoise demography by using the estimated linear relationships of mean annual temperature with maturity age and fecundity to predict how warming temperatures experienced by populations in the future will drive concurrent changes in demography.

Although the gopher tortoise exhibits temperature-dependent sex determination, we did not include this effect in the model as gopher tortoises can modify nest site selection and timing of nesting, as discussed in chapter 3 of the SSA (Service 2022, p. 58). We also did not model any potential range expansion or contraction that could occur due to long-term climate change, because we are aware of no consensus or projection framework related to vegetative community changes and climate change projections; also, we expect any significant expansion or contraction of the gopher tortoise range is likely to occur late in or beyond our projection timeframe of 80 years.

Climate change models predict favorable burn window conditions to shift over future decades, with favorable conditions for prescribed fire increasing in the winter but decreasing in the spring and summer (Kupfer et al. 2020, pp. 769–770). Overall, projections show that seasonal shifts in favorable burn window conditions will decrease overall opportunity for management with prescribed fire. We estimated how habitat management influences gopher tortoise populations by modeling use of fire as a management tool and linking the frequency of management to adult survival (Kupfer et al. 2020, entire; Service 2022, appendix B; Folt et al. 2022, pp. 4, 8–11). We modeled four changes in the burn window based on climate shifts projected by Representative Concentration Pathway (RCP) 4.5 and RCP 8.5: (1) decreased fire, (2) very decreased fire, (3) increased fire, and (4) status quo.

Urbanization and development are expected to affect gopher tortoise populations in the future, even those on conservation lands, through reduced connectivity and effects to gene flow and population migration dynamics. Urbanization may also reduce the use of prescribed fire in an area and contribute to road mortality and the introduction of nonnative invasive species. We modeled effects of urbanization pressure on gopher tortoise populations by linking urbanization projections from the SLEUTH urbanization model to habitat management of local populations with prescribed fire and with baseline immigration rates of gopher tortoises across landscape populations (Terando et al. 2014, entire). We modeled three potential thresholds in urbanization: (1) Low urbanization where cells have a 95 percent or greater probability of being developed; (2) moderate urbanization where cells have a 50 percent or greater probability of being developed; and (3) high urbanization where cells have a 20 percent or greater probability of being developed. Modeled cells with a high probability of urbanization are likely to be urbanized under any scenario (higher certainty), while areas with a lower probability of urbanization are likely to be urbanized in scenarios with increased impacts or greater effects. Inclusion of areas with a lower chance of development leads to an overall greater area expected to be developed.

Sea level rise is expected to negatively affect gopher tortoise populations in low-lying coastal areas, such as coastal sand dune environments (Blonder et al. 2021, pp. 6–8). We modeled effects of sea level rise on gopher tortoises using three projections of sea level rise: The ''intermediate-high,'' ''high,'' and ''extreme'' projections correspond to projections from global emission scenarios RCP 6 and RCP 8.5 (IPCC 2022, entire; NOAA 2020, entire). We projected the effects of sea level rise on the gopher tortoise in the future by modeling the height above sea level of local populations and through reduced connectivity between local populations.

Future Scenarios

We developed six plausible scenarios of future climate warming, urbanization, habitat management, and sea level rise to simulate population growth and extinction risk for gopher tortoises for 40, 60, and 80 years into the future (table 3). Specifically, we created three scenarios with different levels of stressors (low stressors, medium stressors, and high stressors) that experienced habitat management consistent with contemporary target management goals. We then held the medium stressor values constant and developed three scenarios that varied in habitat management treatments, ranging from scenarios for the most habitat management to the least habitat management (table 3).

Little information is available describing gopher tortoise immigration rates in wild populations. Given the uncertainty around this parameter, we included four additional scenarios with the medium stressor values and status quo habitat management to understand the effects of varying rates of immigration on the gopher tortoise future condition.

TABLE 3—THREATS, HABITAT MANAGEMENT, AND IMMIGRATION VALUES IN THE NINE PLAUSIBLE SCENARIOS USED TO PROJECT FUTURE POPULATION GROWTH AND ABUNDANCE OF GOPHER TORTOISES

| Scenarios | Stressors | | | Habitat management | Immigration into the population (percent) |
|---|---|---|---|---|---|
| | Climate warming (°C) | Sea level rise (m) | Probability of urbanization | | |
| Low stressors | 1.0 | 0.54 | 95 percent or greater | Status quo | 1 |
| Medium stressors | 1.5 | 1.83 | 50 percent or greater | Status quo | 1 |
| High stressors | 2.0 | 3.16 | 20 percent or greater | Status quo | 1 |
| Decreased management | 1.5 | 1.83 | 50 percent or greater | Less fire | 1 |
| Very decreased management | 1.5 | 1.83 | 50 percent or greater | Much less fire. | 1 |
| Improved management | 1.5 | 1.83 | 50 percent or greater | More fire | 1 |
| No immigration | 1.5 | 1.83 | 50 percent or greater | Status quo | 0 |
| Intermediate immigration | 1.5 | 1.83 | 50 percent or greater | Status quo | 1 |
| High immigration | 1.5 | 1.83 | 50 percent or greater | Status quo | 2 |
| Very high immigration | 1.5 | 1.83 | 50 percent or greater | Status quo | 4 |

[The first three scenarios vary the levels of stressors (climate warming, sea level rise, and urbanization), while holding habitat management and immigration constant.

The second three scenarios vary the levels of habitat management (through prescribed fire), while holding stressors and immigration constant.

The last four scenarios vary only in the level of immigration into the population and hold stressors and habitat management constant.]

To assess future resiliency, redundancy, and representation of the gopher tortoise, we used population projections to estimate changes in gopher tortoise populations in the future under each of the nine scenarios. We assessed the resiliency of future populations to changing environments by estimating persistence probability. Persistence probability is defined in this assessment as a measure of the risk of extinction and is expressed as the percent of current populations projected to occur on the landscape in a given future scenario. Although the SSA report uses the categories of ''extremely likely to persist,'' ''very likely to persist,'' ''more likely than not to persist,'' and ''unlikely to persist'' to characterize the future condition of gopher tortoise populations, these terms represent a portion of our analysis and are not fully representative of the status on the species. We will use the phrase ''remain on the landscape'' or ''not extirpated'' in this finding to indicate the modeled future condition categories of gopher tortoise populations of ''extremely likely to persist,'' ''very likely to persist,'' and ''more likely than not to persist,'' and will indicate the timeframe to which that projection applies.

We assessed redundancy by evaluating projected changes in the total number of individuals (abundance or resiliency), number of local populations, number of landscape populations, and their distribution across the landscape in the future. We summarized population trends by estimating population growth rate as increasing (greater than 1), stable (1), or decreasing (less than 1). We evaluated how representation is predicted to change in the future by examining how population growth of total population size (number of individual female gopher tortoises), number of local populations, and number of landscape populations will vary by the five population genetic groups of tortoises across the species' range.

We report the rangewide model projections for each scenario at the three future time steps, summarize the results across all populations across the species' range, and describe differences among analysis units in *Summary of Future Analysis,* below. Details regarding future projections may also be found in the SSA report and the peer-reviewed model resulting from the SSA analyses (Service 2022, pp. 159–175; Folt et al. 2022, entire).

*Summary of Future Analysis*

While declines in abundance and number of populations are predicted, overall projections suggest that extinction risk for the gopher tortoise is relatively low in the future. Population projections under six future scenarios (threats and management scenarios) predicted declines in the number of gopher tortoise individuals, local populations, and landscape populations at the 40-, 60-, and 80-year timesteps. Relative to current levels of total population size, projections for total population size suggested declines by 2060 (33–35 percent declines), 2080 (30–34 percent declines), and 2100 (28–33 percent declines). The declines reflect the projected loss of small gopher tortoise populations in the earlier timestep (40 years), while remaining larger populations remain on the landscape longer. The six scenarios varied little in the impact on the total number of individuals, local populations, and landscape populations within each timestep, but impacts increased in each successive timestep. In addition, the 95 percent confidence interval overlapped with 1.0 in all cases, indicating no difference in the scenarios.

Among the future scenario projections, the number of local populations and landscape populations were predicted to decline in each projection interval (40-, 60-, and 80-year timesteps). Declines in local populations and landscape populations were 47–48 percent and 25–27 percent declines among scenarios, respectively, at the 40-year timestep; 60–61 percent and 41–43 percent declines, respectively, at the 60-year timestep; and 68–70 percent and 53–57 percent declines, respectively, at the 80-year timestep. With these declines, mean projections among scenarios at the 80-year timestep indicate 47,202–50,846 adult female gopher tortoises remain on the landscape in 188–198 spatially explicit local populations across the range of the species.

The number of individuals, local populations, and landscape populations varied by analysis unit. Abundance in Units 1, 3, and 5 was projected to decline overall (27–40 percent, 51–53 percent, and 42–48 percent declines, respectively). Unit 4 was projected to experience a more modest decline (2–14 percent decrease in abundance), and Unit 2 was projected to increase in abundance. However, declines in the number of local populations are projected for all units. The predicted declines in number of local populations are greatest in Units 1, 2, and 5. More populations in Units 1 and 2 currently exhibit low resiliency, while Unit 5 contains the highest abundance and number of local populations across the range.

Threats and habitat management scenarios did not strongly affect projections of gopher tortoise total population size (number of females in the total population), or the number of local and landscape populations. No single threat scenario (low, medium, or high stressors) or management scenario (more, less, or much less management) was sufficient to prevent population declines. However, model projections did change substantially based on the immigration rate in the scenario (very high, high, intermediate, or no immigration). For example, the total population size and the number of local and landscape populations projected to remain on the landscape in 2080 under the ''medium stressors'' scenario were reduced substantially when simulated with an immigration rate of 0. Conversely, higher values for immigration (2 and 4 percent) produced projections with substantially increased total population size above initial starting population size and decreased declines in local and landscape populations. In addition to immigration, the initial total population size, areal extent of the population (ha (ac)), and predicted implementation of habitat management through prescribed fire positively affected the chance the population would remain on the landscape in the future. The declines in number of local populations occurred, in part, because many local populations (27.8 percent) had very few individuals to start with in the current conditions. Assuming a 3:1 adult to juvenile ratio and an even sex ratio, local populations with fewer than 8 individuals were functionally extirpated at the start of projections, given our quasi-extinction probability (3 or fewer adult females).

Our analysis simulated the fate of known populations largely on protected conservation lands that we expect will be managed for conservation in the future. Future condition projections based only on data from spatially delineated populations (*i.e.,* do not contain county-level data or gopher tortoises that are present, but not reported) likely substantially underestimate the true number of gopher tortoises present across the species' range. We expect populations on managed conservation lands to be characterized by greater demographic rates and lower extinction risk relative to populations that we were unable to model in our framework (populations with no spatially explicit data). To this end, we did not project the abundance of existing populations not included in our dataset or estimate the formation of new populations outside of conservation lands. While other tortoise populations exist outside of the ones we simulated with our projection model and new tortoise populations may form due to natural dispersal and colonization dynamics, they may occur on lands lacking long-term protection from development, and we did not project those populations into the future under assumptions of land management and protection for wildlife conservation. Similarly, we could not estimate the formation of new populations outside of the sites we projected, or the migration of entire populations to new areas, because we have no guarantee of land available for the formation or migration of populations.

While the numbers of individuals, populations, and landscape populations were all expected to decline across each projection interval, overall projections suggest that extinction risk for the gopher tortoise is relatively low in the future. Of the individuals, local populations, and landscape populations modeled (a small subset of populations likely to occur across the landscape), mean projections among scenarios for 80 years in the future suggested the presence of 47,202–50,846 individuals (females only) among 188–198 local populations within 106–114 landscape populations across most of the range of the species. The presence of relatively large numbers of individuals and populations suggests resiliency of the species in the face of change, and redundancy to buffer from future catastrophic events. The spatial distribution of populations predicted to occur on the landscape in the future are distributed evenly among genetic analysis units, which suggests adaptive capacity or representation in the future as well.

Although we do not project any of the analysis units to be extirpated in any scenario, we do anticipate declines in species' representation and redundancy through the projected loss of total number of individuals and number of local and landscape populations. Gopher tortoise populations are projected to remain on the landscape in all scenarios and included timesteps in each analysis unit, providing genetic variability across the range and adaptive capacity for the species. We expect that future gopher tortoise redundancy will be somewhat reduced from current redundancy due to the loss of some local and landscape populations. For example, in Unit 1, approximately 16 percent of current populations are expected to remain on the landscape at the 80-year timestep, under the medium stressor and less management scenario. Populations in this unit are more isolated, small, and fragmented compared to the remainder of the range.

## Determination of Gopher Tortoise's Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of ''endangered species'' or ''threatened species.'' The Act defines an ''endangered species'' as a species that is in danger of extinction throughout all or a significant portion of its range, and a ''threatened species'' as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The Act requires that we determine whether a species meets the definition of ''endangered species'' or ''threatened species'' because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

### *Status Throughout All of Its Range*

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we determined that the species currently has sufficient resiliency, redundancy, and representation contributing to its overall viability across its range. The primary stressors affecting the gopher tortoise's biological status include habitat loss, degradation, and fragmentation due to land use changes from urbanization (Factor A), climate change (Factor E), and insufficient and/or incompatible habitat management (Factor E). Upper respiratory tract disease and other viral, bacterial, fungal, and parasitic infections (Factor C) affect individual gopher tortoises and can have localized effects, but these threats do not appear to have species-level impacts. Predation of eggs, hatchlings, and juvenile tortoises (Factor C) impacts some gopher tortoise populations. Overutilization for commercial or recreational purposes (harvest and rattlesnake roundups) (Factor B) of gopher tortoises was a historical threat and may affect individuals, but is not currently an impact to the species rangewide. The effects of nonnative invasive species (Factor E) on gopher tortoise habitat also negatively influence gopher tortoise viability. Conservation efforts and regulatory mechanisms are in place across the range of the species and are addressing some of the identified threats by restoring, enhancing, or providing gopher tortoise habitat, relocating tortoises, and augmenting populations through captive propagation.

Urbanization results in a range of impacts that either remove or degrade/fragment remaining habitat, or can impact gopher tortoises directly through development. Urbanization brings road construction and expansion, which may cause direct mortality of gopher tortoises. In addition, this stressor creates conditions beneficial to nonnative invasive species and predators as well as conditions that limit fire management of gopher tortoise habitat. Temperature increases associated with long-term climate change are likely to further constrain use of prescribed fire through a decrease in the number of suitable burn days. Additionally, habitat loss resulting from sea level rise associated with climate change is a risk for coastal populations of gopher tortoise.

A variety of conservation efforts to benefit the gopher tortoise and its habitat have been implemented by Federal and State agencies, nongovernmental organizations, private landowners, and partnerships across the range of the species. These conservation measures and existing regulatory mechanisms also influence gopher tortoise viability through the conservation and restoration of gopher tortoise habitat and prevention of habitat loss, particularly efforts implemented since our July 27, 2011, 12-month finding on the petition to list the eastern portion of the gopher tortoise range as threatened.

While threats have acted on the species to reduce available habitat and species abundance, the gopher tortoise occurs in the six States comprising the historical and current range of the species. In addition, based on best available information, we estimate that more than 149,000 gopher tortoises occur in 656 spatially delineated local populations across the range of the species. Approximately 38 percent of local populations exhibit high or moderate current resiliency, and the species is widely distributed across much of its range. In addition, the 360 gopher tortoise populations in low resiliency are widely distributed across the species' range. These low-resiliency populations often occur near other local populations (within a landscape population) and contribute to the resiliency of the landscape populations and the species' redundancy and representation. Despite the historical and current loss of habitat with the open pine conditions required by the gopher tortoise, sufficient quality and quantity of habitat remains to provide adequate resiliency to contribute to the viability of the species. Although the species-level redundancy has likely decreased from historical levels due to loss of habitat and the effects to the 3Rs, the gopher tortoise retains a sufficient number of populations with high or moderate resiliency that are distributed across the range to respond to catastrophic events. The five genetic groups delineated across the species' range provide adaptive capacity and sufficient species-level representation for the gopher tortoise. Thus, after assessing the best available information, we conclude that the gopher tortoise currently exhibits levels of resiliency, redundancy, and representation such that the species is not in danger of extinction throughout all of its range.

Therefore, we proceed with determining whether the gopher tortoise is likely to become an endangered species within the foreseeable future throughout all of its range. We evaluated the future condition of the species based on projections under nine plausible scenarios. We evaluated the viability of the species under these scenarios over the foreseeable future and considered the condition of the species in relation to its resiliency, redundancy, and representation. We analyzed future conditions based on input from species experts, generation time for the species, and the confidence in predicting patterns of climate warming, sea level rise, urbanization, and habitat management, enabling us to reliably predict threats and the species' response over time. Using the best available information, we evaluated future conditions at 40, 60, and 80 years in the future. These timesteps allowed us to project relevant threats to the species in view of its life-history characteristics, including lifespan and reproduction and recruitment. Within this timeframe, these projections are sufficiently reliable to provide a reasonable degree of confidence in the predictions. Details regarding the future condition analyses are available in the SSA report and associated future condition model (Folt et al. 2022; Service 2022, appendix B).

In modeling the future condition of the species, we projected the number of individuals, local populations, and landscape populations, population growth, and the probability that populations will remain on the landscape (percent of current local populations extant on the landscape) under each scenario at timesteps 40, 60, and 80 years into the future as described in *Future Condition,* above. The projection outcomes did not differ significantly by different threat scenarios; however, immigration and management actions did affect model results. The threats included in future condition modeling are projected to result in a decline in the number of individuals, populations, and landscape populations across each projection interval. Of the individuals, local populations, and landscape populations modeled (a subset of populations likely to occur across the landscape), mean projections among scenarios for 80 years in the future suggested the presence of 47,202–50,846 individuals (adult females) among 188–198 local populations within 106–114 landscape populations. We recognize this is likely an underestimation of the gopher tortoise's future condition since only existing populations on protected lands were modeled. In addition, any new populations in the future (formed or translocated) were not included in this future projection modeling. Many of the populations predicted not to remain on the landscape were currently small populations. Although the model projects declines in the future that include the loss of these smaller populations, the overall projections suggest that extinction risk for the gopher tortoise is low in the future.

Although the threats to the species of habitat loss and fragmentation due to urbanization, climate change, sea level rise, and habitat management are expected to persist in the foreseeable future and the effects of these threats on this long-lived species will continue at some level, some threats have been reduced and will continue to be reduced through implemented and ongoing conservation actions and regulatory mechanisms, as discussed above under *Conservation Efforts and Regulatory Mechanisms.* Rangewide, the future condition of the species with relatively large numbers of individuals and populations suggests resiliency to withstand stochastic environmental and demographic change, and redundancy to buffer from future catastrophic events. The spatial distribution of populations predicted to remain extant in the future is distributed among genetic analysis units, which suggests sufficient genetic representation in the future as well.

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we conclude that the risk factors acting on the gopher tortoise and its habitat, either singly or in combination, are not of sufficient imminence, scope, or magnitude to rise to the level to indicate that the species is in danger of extinction now (an endangered species), or likely to become endangered within the foreseeable future (a threatened species), throughout all of its range.

*Status Throughout a Significant Portion of Its Range*

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range. Having determined that the gopher tortoise is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in a significant portion of its range—that is, whether there is any portion of the species' range for which it is true that both (1) the portion is significant; and (2) the species is in danger of extinction now or likely to become so in the foreseeable future in that portion. Depending on the case, it might be more efficient for us to address the ''significance'' question or the ''status'' question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

In undertaking this analysis for the gopher tortoise, we chose to address the status question first. We began by identifying any portions of the range where the biological status of the species may be different from its biological status elsewhere in its range. The range of a species can theoretically be divided into portions in an infinite number of ways, so we focus our analysis on portions of the species' range that contribute to the conservation of the species in a biologically meaningful way. For this purpose, we considered information pertaining to the geographic distribution of (a) individuals of the species, (b) the threats that the species faces, and (c) the resiliency condition of populations. For the gopher tortoise, we considered whether the threats or their effects are occurring in any portion of the species' range such that the species is in danger of extinction now or likely to become so in the foreseeable future in that portion of the range.

We examined the following past, ongoing, and future anticipated threats: habitat loss and fragmentation due to urbanization, climate warming, sea level rise, habitat management, disease, predation, and nonnative invasive species, including cumulative effects. The location and magnitude of some threats varies across the species' range and accordingly may impact the species differently in different portions. For example, sea level rise influences gopher tortoise viability primarily in coastal areas.

Less habitat management to benefit gopher tortoise has been implemented in the western portion of the range (Units 1 and 2) compared to the remainder of the range; therefore, the effects of lack of habitat management influences gopher tortoise populations in the westernmost unit to a greater extent. Although threats to the gopher tortoise's viability differ spatially and in magnitude, we find that the overall level of threats is similar in populations or analysis units across the range of the species. These threats are certain to occur, and in those analysis units with fewer populations that exhibit predominantly low resiliency, these populations are facing the same level of threats. In those analysis units with populations that are overall less resilient compared to those in other units, we expect that a similar level of threats will have a disproportionate impact in these areas with lower resiliency populations. These low resiliency populations (or analysis units) will be impacted or have a stronger negative response to threats than moderate or high resiliency populations (or analysis units). We looked across the range of the gopher tortoise and identified three portions of the range where the biological status may be different than the rangewide status. The three areas we found to warrant further evaluation were the two westernmost analysis units corresponding to Unit 1 (Western; west of the Mobile and Tombigbee Rivers) and Unit 2 (Central; west of the Apalachicola and Chattahoochee Rivers and east of Unit 1) and Unit 5 (Florida).

The impacts of habitat loss and fragmentation, climate change, and habitat management combined with other stressors are expected to reduce the viability of the populations to withstand stochastic and catastrophic events. Although most threats occur at a similar level throughout the range of the species, the threats of habitat management and sea level rise differ across the range.

Sea level rise primarily affect populations along the coast in Unit 5 (Florida). Although sea level rise is projected to affect coastal populations of gopher tortoise, the number of populations affected varies by location and elevation of the population, site-specific characteristics, and climate change scenario. Unit 5 currently has 43 populations that exhibit high resiliency and 50 populations that exhibit moderate resiliency. Even though declines are predicted to be more significant in this unit than others, future condition modeling projects between 58 and 62 local populations and 37 to 43 landscape populations will remain on the landscape in Unit 5, including the very large populations (exceeding 1,000 individuals). The current and future condition analyses of gopher tortoise indicate sufficient resiliency, representation and redundancy in Unit 5. Given the species' current and future condition within this unit, we determined that the gopher tortoise in Unit 5 does not have a different status than the remainder of the range.

The best available information indicates that less habitat management occurs in the western portion of the range (Units 1 and 2) compared to the remainder of the range. The populations in the western two units (particularly Unit 1) are characterized by ecological and physiological characteristics that lead to lower resiliency. Populations in Units 1 (Western) and 2 (Central) experience lower abundance, smaller clutch size, lower hatch rate, slower growth, and less extensive suitable habitat leading to lower resiliency for a higher proportion of populations in the two units. In Units 1 (Western) and 2 (Central), approximately 11 and 33 percent of populations exhibit moderate or high resiliency, respectively, compared to 45 percent rangewide. A higher proportion of populations in Units 1 (Western) and 2 (Central) exhibit low resiliency, with 88 percent of populations in Unit 1 (Western) and 67 percent of populations in Unit 2 (Central) in low resiliency. Less habitat management beneficial to gopher tortoise occurs in Units 1 and 2, and the overall lower resiliency of populations in these units is lower. As a result of lower resiliency, the species' response is more pronounced, and the rangewide threats and lower levels of habitat management are having a greater impact than elsewhere in the range. Despite the lower current resiliency of populations in Units 1 (Western) and 2 (Central), the gopher tortoise is still widespread throughout this extensive geographic area and high and moderate resiliency populations also occur throughout the units. In addition, given the current population distribution across these units, it is not likely that a single catastrophic event would currently place the species from this portion of its range at risk of extinction.

Modeling of future conditions projects declines in abundance and fewer extant local and landscape populations in Units 1 (Western) and 2 (Central) compared to the rest of the range in the foreseeable future. For example, Unit 1 (Western) and Unit 2 (Central) are projected to have 15 and 14 local populations, respectively, on the landscape in 2100 under the medium stressors and less habitat management scenario. These projected declines would significantly increase the risk of extirpation of Units 1 (Western) and 2 (Central) from a catastrophic or stochastic event. Although the species currently has sufficient resiliency and distribution to withstand a stochastic or catastrophic event, projected declines in resiliency or extirpation of populations will further reduce the species redundancy and representation in this portion of the range. Given the species' future condition within these units, we have identified Units 1 (Western) and 2 (Central) of the gopher tortoise as an area that has a different status than the remainder of the range.

We then proceeded to the significance question, asking whether this portion of the range (*i.e.,* Units 1 (Western) and 2 (Central)) is significant. The Service's most recent definition of ''significant'' within agency policy guidance has been invalidated by court order (see *Desert Survivors* v. *U.S. Department of the Interior,* 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018)). In undertaking this analysis for the gopher tortoise, we considered whether this portion of the species' range is significant based on its biological importance to the overall viability of the gopher tortoise. Therefore, for the purposes of this analysis, when considering whether this portion is significant, we considered whether the portion may (1) occur in a unique habitat or ecoregion for the species, (2) contain high-quality or high-value habitat relative to the remaining portions of the range, for the species' continued viability in light of the existing threats, (3) contain habitat that is essential to a specific life-history function for the species and that is not found in the other portions, or (4) contain a large geographic portion of the suitable habitat relative to the remaining portions of the range for the species.

We evaluated the available information about this portion of the species to assess its significance. The portion of the range that comprises Units 1 (Western) and 2 (Central) contains approximately 20 percent of the suitable habitat currently occupied by the species, with approximately 103,582 ac (41,918 ha) in Unit 1 (Western) and 68,430 ac (27,692 ha) in Unit 2 (Central). Although these units contribute to the rangewide representation and redundancy of the gopher tortoise, Units 1 (Western) and 2 (Central) do not constitute a large geographic area relative to the remaining portions of the range of the species. This portion does not contribute high-quality habitat or constitute high value habitat for gopher tortoise. The best available science indicates this portion generally contains lower quality or less extensive habitat for gopher tortoises than in the remainder of the range. In addition, this portion does not constitute an area of habitat that is essential to a specific life-history function for the species that is not found in the remainder of the range.

Overall, we found no substantial information that would indicate this portion of the gopher tortoise's range is significant in terms of the above habitat considerations. As a result, we determined that the portion comprising Units 1 (Western) and 2 (Central) does not represent a significant portion of the gopher tortoise's range. Therefore, we conclude that the species is not in danger of extinction now or likely to become so in the foreseeable future in any significant portion of its range. This finding does not conflict with the courts' holdings in *Desert Survivors* v. *Department of the Interior,* 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018), and *Center for Biological Diversity* v. *Jewell,* 248 F. Supp. 3d 946, 959 (D. Ariz. 2017) because, in reaching this conclusion, we did not apply the aspects of the Final Policy's definition of ''significant'' that those court decisions held to be invalid.

We have carefully assessed the best scientific and commercial information available regarding the current and future threats to the gopher tortoise. Because the species is neither in danger of extinction now nor likely to become so in the foreseeable future throughout all or any significant portion of its range, the gopher tortoise does not meet the definition of an endangered species or threatened species. Therefore, we find that listing the gopher tortoise as an endangered or threatened species rangewide under the Act is not warranted at this time.

## Distinct Population Segment (DPS) Analysis

Under the Act, we have the authority to consider for listing any species, subspecies, or, for vertebrates, any distinct population segment (DPS) of these taxa if there is sufficient information to indicate that such action may be warranted. The term ''species'' includes any subspecies of fish or wildlife or plants and any DPS of any species of vertebrate fish or wildlife that interbreeds when mature (16 U.S.C. 1532(16)). To guide the implementation of the DPS provisions of the Act, we and the National Marine Fisheries Service (National Oceanic and Atmospheric Administration—Fisheries), published the Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act (DPS Policy) in the **Federal Register** on February 7, 1996 (61 FR 4722). Under our DPS Policy, we use two elements to assess whether a population segment under consideration for listing may be recognized as a DPS: (1) The population segment's discreteness from the remainder of the species to which it belongs, and (2) the significance of the population segment to the species to which it belongs. If we determine that a population segment being considered for listing is a DPS, then the population segment's conservation status is evaluated based on the five listing factors established by the Act to determine if listing it as either endangered or threatened is warranted.

Based on the information available regarding potential discreteness and significance for the species, we determined it was appropriate to review the status of the gopher tortoise by conducting a DPS analysis for the species. The western portion of the gopher tortoise range (Western) where the species is currently listed as threatened (52 FR 25376, July 7, 1987)) consists of those populations of gopher tortoise found west of the Mobile and Tombigbee Rivers in Alabama, Louisiana, and Mississippi. The eastern portion of the range (Eastern), where the species was identified as a candidate in 2011, consists of those gopher tortoise populations east of the Mobile and Tombigbee Rivers in Alabama, Georgia, Florida, and South Carolina. Below, we evaluate the western and eastern portions of the gopher tortoise range as population segments to determine whether they meet the definition of a DPS under our DPS Policy.

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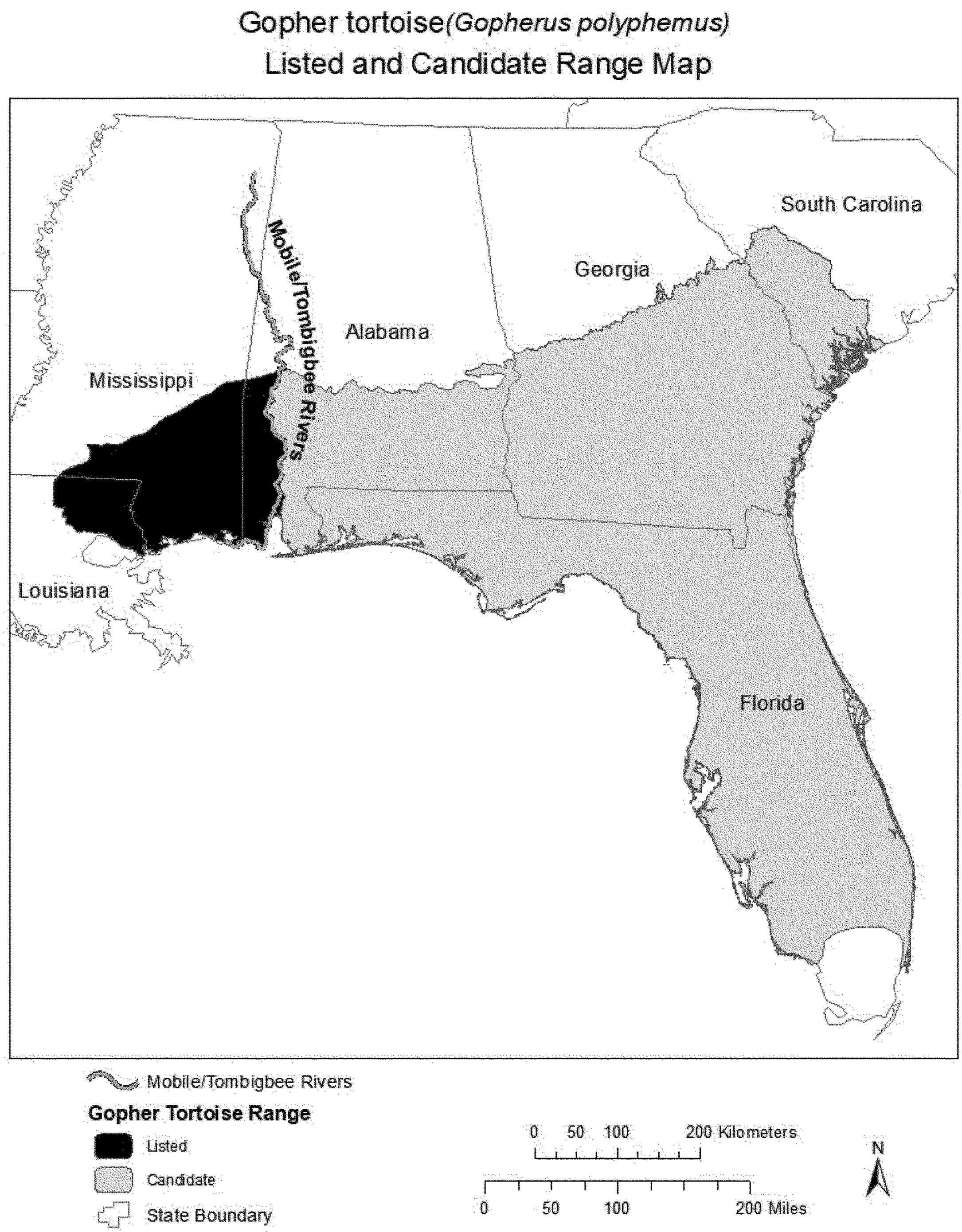


Figure 3. The gopher tortoise is listed as threatened under the Act in the western portion of the species' range (west of the Mobile and Tombigbee Rivers). The gopher tortoise was identified as a candidate species (listing is warranted but precluded) in the eastern portion of the species' range in 2011 (east of the Mobile and Tombigbee Rivers).

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*Discreteness*

Under our DPS Policy, a population segment of a vertebrate taxon may be considered discrete if it satisfies either of the following conditions: (1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors (Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.); or (2) it is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act. In determining whether the test for discreteness has been met under the DPS policy, we allow, but do not require genetic evidence to be used.

*Significance*

Under our DPS Policy, once we have determined that a population segment is discrete, we consider its biological and ecological significance to the larger taxon to which it belongs. This consideration may include, but is not limited to: (1) Evidence of the persistence of the discrete population segment in an ecological setting that is unusual or unique for the taxon, (2) evidence that loss of the population segment would result in a significant gap in the range of the taxon, (3) evidence that the population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere as an introduced population outside its historical range, or (4) evidence that the discrete population segment differs markedly from other populations of the species in its genetic characteristics. Of particular note, as we explained in our draft (76 FR 76987, December 9, 2011, p. 76998) and final (79 FR 37577, July 1, 2014, pp. 79 FR 37579, 37585) Policy on Interpretation of the Phrase ''Significant Portion of Its Range'' in the Endangered Species Act's Definitions of ''Endangered Species'' and ''Threatened Species'' (SPR Policy), the definition of ''significant'' for the purpose of significant portion of the range analysis differs from the definition of ''significant'' found in our DPS Policy and used for DPS analysis. Considering the potential results of using the same standard for significance under the DPS policy to define ''significant'' in the SPR Policy led us to conclude that the two provisions cannot use the same definitions for ''significant.'' Accordingly, the analysis for ''significant'' under the DPS Policy differs from the analysis of ''significant'' under the SPR provision. While the definition contained in the SPR Policy has been vacated, our consideration of ''significant'' in the ''significant portion of its range'' provision for this analysis is also different than the standard for significance under the DPS Policy for the same reasons.

The DPS Policy requires that for a vertebrate population to meet the Act's definition of ''species,'' it must be discrete from other populations and must be significant to the taxon as a whole. The significance criterion under the DPS Policy is necessarily broad and could be met under a wider variety of circumstances even if it could not be met under the SPR Policy. For example, in this case, we determined (see section below) that the western and eastern population segments are ''significant'' for the purposes of DPS, and we did not, as discussed above, conclude that the western portion constituted a ''significant'' portion of the gopher tortoise's range.

*Discreteness of the Western and Eastern Population Segments of the Gopher Tortoise Range*

The western and eastern population segments of the gopher tortoise range are markedly separated from each other (other populations) geographically (physical) and genetically. The western and eastern population segments of the range are separated by the Mobile and Tombigbee Rivers. Thus, the western population segment includes all gopher tortoises occurring in southwestern Alabama, southern Mississippi, and southeastern Louisiana, and the eastern population segment includes all gopher tortoises occurring in the remainder of Alabama and all of Georgia, South Carolina, and Florida (figure 3). These rivers act as a physical impediment to crossing by gopher tortoises in either direction and represent a barrier to dispersal and gene flow. The rivers are wide and deep year-round, and human development (*e.g.,* roads and towns) is adjacent to some areas of the rivers. Due to the physical separation of these two population segments by the Mobile and Tombigbee Rivers, gopher tortoises in these portions do not, and will likely never, naturally interact with individuals or populations in the other population segment.

In terms of genetic separation, there is a phylogenetic break (difference in genetics) between the western and eastern population segments of the gopher tortoise's range (Ennen et al. 2012, pp. 113–116). Several studies show genetic assemblages across the geographic range, but these studies are not entirely congruent in their delineations of western and eastern genetic assemblages (Osentoski and Lamb 1995, p. 713; Clostio et al. 2012, pp. 617–620; Ennen et al. 2012, pp. 113–120; Gaillard et al., 2017, pp. 501–503). No shared haplotypes on a mitochondrial gene were noted in populations found on opposite sides of the Mobile and Tombigbee Rivers (Clostio et al. 2012, pp. 619–620). However, the phylogenetic break does not entirely correspond to a particular geographic barrier with some shared haplotypes found in both the western portions of the tortoise's range and the panhandle of Florida and Georgia populations in a similar study (Ennen et al. 2012, pp. 113–116). Recent microsatellite analysis suggests there are five main genetic groups in the taxon, delineated by the Tombigbee and Mobile Rivers, Apalachicola and Chattahoochee Rivers, and the transitional areas between several physiographic province sections of the Coastal Plains (*i.e.,* Eastern Gulf, Sea Island, and Floridian) (Gaillard et al. 2017, pp. 505–507).

Based on our review of the best available information, we conclude the western and eastern population segments of the gopher tortoise range are markedly separated from each other due to geographic (physical) and genetic separation. Therefore, we have determined that the western and eastern population segments of the gopher tortoise range each meet the condition of discreteness under our DPS policy.

*Significance of the Western and Eastern Population Segments of the Gopher Tortoise Range*

We determine that the western and eastern discrete population segments are significant based, in part, upon evidence that loss of portions would result in a significant gap in the range of the taxon. The loss of either the western or eastern population segment would result in a substantial change in the overall range and distribution of the gopher tortoise. The loss of the western portion would shift the taxon's western range boundary eastward and result in the loss of species' presence west of the Mobile and Tombigbee Rivers, which are natural barriers to the eastern portion. A loss of the eastern portion of the range would result in a significant gap in the range by losing 98 percent of the current estimated rangewide abundance (in spatially explicit populations), 88 percent of the geographic area of the range, and the core of the current species' distribution (Service 2022, pp. 119–120).

In addition, the western and eastern population segments differ markedly from each other in their genetic characteristics (unique haplotypes and pronounced nuclear differentiation), as described in *Discreteness,* above. The loss of the western population segment would result in a substantial reduction in the presence of these genetic characteristics in the species. The eastern population segment is genetically valuable to the taxon, because it contains the greatest genetic diversity and may contribute more to the overall adaptive capacity of the species. Therefore, we have determined that the western and eastern population segments differ markedly in the genetic characteristics, and loss of this genetic diversity would likely impact the species' adaptive capacity.

Given the evidence that the western and eastern population segments would result in a significant gap in the gopher tortoise's range if lost, and that these population segments differ markedly from each other based on their genetic characteristics, we consider the western and eastern population segments to be significant to the species as a whole. Thus, the western and eastern population segments of the gopher tortoise's range meet the criteria for significance under our DPS Policy.

*DPS Conclusion for the Western and Eastern Portions*

Our DPS Policy directs us to evaluate the significance of a discrete population in the context of its biological and ecological significance to the remainder of the species to which it belongs. Under our DPS policy, the standard for discreteness does not require absolute separation because such separation can rarely be demonstrated for any population of organism. Based on an analysis of the best available scientific and commercial data, we conclude that the western and eastern portions of the gopher tortoise's range are discrete due to marked separation geographically, ecologically, and genetically from one another. Furthermore, we conclude that the western and eastern portions of the range are significant for the reasons described above, including that loss of either portion would result in a significant gap in the range of the taxon. Therefore, we conclude that the western and eastern portions of the gopher tortoise's range are both discrete and significant under our DPS policy, and, therefore, these populations are listable entities under the Act. We will subsequently refer to them as the Western DPS and the Eastern DPS.

As mentioned above, we have determined the gopher tortoise in the western portion of its range, the current listed entity of gopher tortoise, meets the criteria of a DPS, but the best available information does not support any taxonomic change for the species. This document does not propose a revision of the defined entity. We will take regulatory action in the future to assign the correct nomenclature to the listed entity if we deem this action to be necessary for clarity.

Based on our DPS Policy, if a population segment of a vertebrate species is both discrete and significant relative to the taxon as a whole (*i.e.,* it is a distinct population segment), its evaluation for endangered or threatened status will be based on the Act's definition of those terms and a review of the factors enumerated in section 4(a) of the Act. Having found that the western and eastern portions of the gopher tortoise's range each meet the definition of a distinct population segment, we now evaluate the status of each DPS to determine whether it meets the definition of an endangered or threatened species under the Act.

*Status Throughout All of the Western DPS's Range*

In the analysis above for the gopher tortoise as a whole, we have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Western DPS (*i.e.,* Unit 1) of the species. We considered whether the Western DPS of the gopher tortoise is presently in danger of extinction throughout all of its range. As described above under *Status Throughout a Significant Portion of its Range,* the ongoing and future impacts of habitat loss and fragmentation, climate change, and habitat management in combination with secondary threats act to reduce the viability of the Western DPS. Other secondary, rangewide threats, including disease, predation, and nonnative invasive species, also have some effect on the Western DPS. However, the magnitude and impacts of these threats are exacerbated by population characteristics in this DPS.

The local gopher tortoise populations in the Western DPS are generally smaller than in the Eastern DPS; in particular, the local populations have lower abundance, decreased reproduction, and decreased recruitment compared to the remainder of the range. However, 106 spatially explicit local populations at varying levels of resiliency occur in the Western DPS and are distributed across the geographic area of the DPS. Approximately 87 percent of local populations in the Western DPS currently exhibit low resiliency, with 10 percent (12 populations) in moderate or high resiliency. Populations in the Western DPS occur in habitat that is more fragmented than in the Eastern DPS with the De Soto National Forest in southern Mississippi as one of the few extensive reaches of suitable habitat.

More than 103,000 ac (41,682 hectares) of habitat with gopher tortoise occurrences are currently known in the Western DPS with almost 2 million ac (809,371 ha) of potential habitat where gopher tortoise occupancy is unknown. The best available information indicates that less habitat management occurs in the Western DPS compared to the Eastern DPS, although fire implementation has more than doubled since 1994 (Service 2022, p. 130). Gopher tortoises are a long-lived species and populations in high (2) or moderate (10) resiliency currently occur in the Western DPS with reproduction and recruitment reported from populations on public and private lands. We expect individuals will remain on the landscape for several decades despite current and ongoing threats. Despite the lower current resiliency of populations in the Western DPS, the gopher tortoise is still widespread throughout this extensive geographic area. In addition, it is not likely that a single catastrophic event would result in the extirpation of the species from this portion, but loss of populations would reduce gopher tortoise representation and redundancy. We have determined that the Western DPS is not currently in danger of extinction throughout its range.

We next analyzed whether the Western DPS is likely to become an endangered species within the foreseeable future throughout its range. In our consideration of foreseeable future, we evaluated how far into the future we could reliably predict the threats to this unit, as well as the gopher tortoise's response to those threats. Based on the modeling and scenarios evaluated, we considered our ability to make reliable predictions in the future and the uncertainty in how and to what degree the unit could respond to those risk factors in this timeframe. We determined a foreseeable future of 80 years for the Western DPS. We analyzed future conditions based on input from species experts, generation time for the species, and the confidence in predicting patterns of climate warming, sea level rise, urbanization, and habitat management, enabling us to reliably predict threats and the species' response over time. Details regarding the future condition analyses are available in the SSA report and associated future condition model (Folt et al. 2022, SSA 2022, appendix B).

In future condition models, the populations in the Western DPS show low or no recruitment and population growth, leading to projected loss of populations, particularly small populations, in the foreseeable future. As described above, we developed nine plausible future scenarios to include varying levels of stressors and habitat management to project the future number of individuals, population growth rate, and number of local and landscape populations. The Western DPS is predicted to decline overall with reduced abundance and reductions in local and landscape populations. We included spatially explicit populations with current population estimates of more than three tortoises in our analysis of future conditions. In the Western DPS, 102 spatially explicit local populations met this criteria and were modeled in our future condition analysis. In the moderate stressors and status quo habitat management scenario, 84 percent of modeled populations in the Western DPS are unlikely to remain on the landscape in 2100.

For example, with the exception of one population, the model projects the remaining six spatially explicit populations in Louisiana were unlikely to remain on the landscape in 80 years in the future. Mississippi was projected to lose 77 percent of current local populations, but maintain 71 percent of its landscape populations (landscape populations will be composed of fewer local populations). Further, approximately 80 percent of spatially explicit local populations in the Western DPS are projected as unlikely to remain on the landscape in 80 years under the status quo threats, less management (prescribed fire), and immigration scenario. As mentioned above, less habitat management currently occurs in the Western DPS compared to the Eastern DPS. Therefore, we expect that status quo threats (medium stressors) and less habitat management are reasonable and a plausible mechanism to project future species' condition in the Western DPS. The low resiliency of these populations significantly increases the impact of current and ongoing threats to the populations in the Western DPS. In addition to reduced resiliency, the impact of a catastrophic or stochastic event would reduce representation and redundancy in the Western DPS within the foreseeable future.

After assessing the best available information, we conclude that the Western DPS of gopher tortoise is likely to become endangered within the foreseeable future throughout the Western DPS.

*Status Throughout a Significant Portion of the Western DPS's Range*

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. The court in *Center for Biological Diversity* v. *Everson,* 435 F. Supp. 3d 69 (D.D.C. 2020) (*Everson*), vacated the aspect of the Final Policy on Interpretation of the Phrase ''Significant Portion of Its Range'' in the Endangered Species Act's Definitions of ''Endangered Species'' and ''Threatened Species'' (Final Policy) (79 FR 37578; July 1, 2014) that provided that the Service does not undertake an analysis of significant portions of a species' range if the species warrants listing as threatened throughout all of its range. Therefore, we proceed to evaluating whether the species is endangered in a significant portion of its range—that is, whether there is any portion of the species' range for which both (1) the portion is significant; and (2) the species is in danger of extinction in that portion. Depending on the case, it might be more efficient for us to address the ''significance'' question or the ''status'' question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

Following the court's holding in *Everson,* we now consider whether there are any significant portions of the species' range where the species is in danger of extinction now (that is, endangered). In undertaking this analysis for the Western DPS, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify any portions of the range where the species is endangered.

Habitat loss, degradation and fragmentation affect gopher tortoise populations in the Western DPS at a similar level rangewide. In the Western DPS, urbanization, climate change, and incompatible and/or insufficient habitat management influence the current and future condition of the species at a level comparable to the remainder of the range across the DPS. Therefore, we found that the threats are acting on the species relatively uniformly across the Western DPS's range. However, we identified one portion of the Western DPS range where the effects may have a more pronounced effect and, accordingly, that may have a different status than the remainder of the DPS. The portion we considered was the geographic area of the Western DPS in the State of Louisiana, which has seven spatially explicit local populations and five landscape populations. The seven local populations in the Louisiana portion of the Western DPS exhibit low current resiliency. This low resiliency and limited distribution within this geographic area may increase the impact of a catastrophic or stochastic event on the representation and redundancy of the gopher tortoise in Louisiana. We have identified the Louisiana portion as one that has a different status than the remainder of the Western DPS.

We then proceeded to the significance question, asking whether this portion of the Western DPS (*i.e.,* Louisiana) is significant. The Service's most recent definition of ''significant'' within agency policy guidance has been invalidated by court order (see *Desert Survivors* v. *U.S. Department of the Interior,* 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018)). In undertaking this analysis for the Western DPS, we considered whether the Louisiana portion of the species' range may be significant based on its biological importance to the overall viability of the Western DPS. Therefore, for the purposes of this analysis, when considering whether this portion is significant, we considered whether the portion may (1) occur in a unique habitat or ecoregion for the Western DPS of gopher tortoise, (2) contain high-quality or high-value habitat relative to the remaining portions of the Western DPS' range, for the gopher tortoise's continued viability in light of the existing threats, (3) contain habitat that is essential to a specific life-history function for the species and that is not found in the other portions of the DPS, or (4) contain a large geographic portion of the suitable habitat relative to the remaining portions of the Western DPS.

This area does not act as a refugia or an important breeding area for this portion. It does not contain proportionally higher quality habitat or higher value habitat than the remainder of the DPS. It does not act as an especially important resource to a particular life-history stage for the gopher tortoise than elsewhere in the Western DPS.

Overall, there is little evidence to suggest that the Louisiana portion of the Western DPS' range has higher quality or higher value habitat or any other special importance to the species' life history in the Western DPS. In addition, this portion constitutes a small proportion of the Western DPS range (approximately 17 percent of Western DPS. Thus, based on the best available information, we find that this portion of the Western DPS's range is not significant in terms of the habitat considerations discussed above. Therefore, no portion of the Western DPS's range provides a basis for determining that it is in danger of extinction in a significant portion of its range. This finding does not conflict with the courts' holdings in *Desert Survivors* v. *Department of the Interior,* 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018), and *Center for Biological Diversity* v. *Jewell,* 248 F. Supp. 3d 946, 959 (D. Ariz. 2017) because, in reaching this conclusion, we did not apply the aspects of the Final Policy's definition of ''significant'' that those court decisions held to be invalid.

*Determination of the Western DPS's Status*

We have determined that the western portion of the gopher tortoise range is a valid DPS, and the Western DPS of the gopher tortoise is likely to become endangered within the foreseeable future throughout all of its range. On the basis of this status review, we continue to find the western portion (Western DPS) of the gopher tortoise is a threatened species.

*Status Throughout the Eastern DPS's Range*

We identified the eastern portion of the gopher tortoise range as a candidate species in the July 27, 2011, 12-month finding (76 FR 45130) and have included it in the Candidate Notices of Review in subsequent years. At the time of the 12-month finding, our assessment indicated the species was being impacted by the primary threat of habitat destruction and modification (Factor A) due to land conversion, urbanization, and habitat management. Other important threats to the species at that time included overutilization through rattlesnake roundups (Factor B), predation (Factor C), incompatible use of silvicultural herbicides (Factor E), and inadequacy of existing regulatory mechanisms (Factor D). We had determined disease (Factor C), road mortality (Factor E), and the effects of climate change (Factor E) to be additional stressors to the species.

In subsequent CNORs, we reviewed the status of the eastern portion of the range (now Eastern DPS) and described additional information and conservation actions needed. In addition, we noted that the extent to which the many potentially viable gopher tortoise populations are sufficient in number, arrangement, and security to ensure the long-term viability of the species was unknown. In development of the SSA, we compiled and analyzed the best available information including population information and conservation measures. We also developed a new population viability model based on the best available information; this model was not considered in previous CNORs or the original petition finding.

Currently, the Eastern DPS comprises the majority of gopher tortoise populations (approximately 84 percent) and habitat with known gopher tortoise occurrences (approximately 88 percent) of the gopher tortoise range, and, as such, the discussion of threats and the species' response to those threats in *Status Throughout All of Its* Range may be applied to the Eastern DPS as well. The Eastern DPS also includes the majority of spatially explicit local gopher tortoise populations across the range (84 percent or 550 populations), with 127 populations (19 percent) exhibiting high current resiliency and 169 populations (21 percent) exhibiting moderate resiliency (table 2). With many highly and moderately resilient populations widely distributed across the Eastern DPS's geographic area, the species' current level of redundancy provides the ability to withstand catastrophic events. The Eastern DPS includes four of the identified genetic groups for the species, conveying much of the species' representation and adaptive capacity. More than 741,330 ac (300,006 hectares) are currently known to be occupied by gopher tortoise in the Western DPS with more than 14.4 million ac (5.8 million ha) of potential habitat where gopher tortoise occupancy is unknown. The best available information indicates that a greater degree of habitat management occurs in the Eastern DPS compared to the Western DPS. Implementation of prescribed fire has increased from 3 to 14 times the number of acres burned in 1994, and 44 to 83 percent of landowners are carrying out additional beneficial practices for gopher tortoise (Service 2022, pp. 126–140). Therefore, the Eastern DPS is not currently in danger of extinction throughout its range.

Accordingly, we next analyze whether the Eastern DPS is likely to become an endangered species within the foreseeable future throughout its range. In our consideration of foreseeable future, we evaluated how far into the future we could reliably predict the threats to these units, as well as the gopher tortoise's response to those threats. Based on the modeling and scenarios evaluated, we considered our ability to make reliable predictions in the future and the uncertainty in how and to what degree the units could respond to those risk factors in this timeframe. We determined a foreseeable future of 80 years for the Eastern DPS. The methodology and timeframe used to determine the foreseeable future for the Eastern DPS followed the process described in *Status Throughout All of the Western DPS's Range,* above. We analyzed future conditions based on input from species experts, generation time for the species, and the confidence in predicting patterns of climate warming, sea level rise, urbanization, and habitat management, enabling us to reliably predict threats and the species' response over time. Details regarding the future condition analyses are available in the SSA report and associated future condition model (Folt *et al.* 2022, SSA 2022, appendix B).

Rangewide threats continue to impact the Eastern DPS in the future, including the key drivers of habitat loss and fragmentation due to urbanization, climate warming, sea level rise, and habitat management. Conservation efforts by Federal, State, and private partners benefit the gopher tortoise and its habitat in the Eastern DPS and these actions are expected to continue into the future. Although the Eastern DPS (Units 2, 3, 4, and 5) is projected to decrease in the number of local and landscape populations in the future, 46,176 to 49,697 individuals, 167 to 175 local populations, and 101 to 107 landscape populations are projected to remain across the Eastern DPS into the foreseeable future. These populations are distributed across the Eastern DPS in the foreseeable future similar to the current distribution.

Based on our analysis of the five factors identified in section 4(a)(1) of the Act, we conclude that the previously recognized threats to the eastern portion of the gopher tortoise range (Eastern DPS) from present or threatened destruction, modification, or curtailment of its habitat or range (Factor A) (urbanization and development, major road construction, incompatible and/or insufficient habitat management, and certain types of agriculture) are not impacting the species such that the species is in danger of extinction now or in the foreseeable future. We evaluated additional potential threats under the five listing factors stated above. In that evaluation, we found potential impacts such as URTD and other diseases (Factor C), predation (Factor C), overutilization (harvest and rattlesnake roundups) (Factor B), and nonnative invasive species (Factor E) impact individuals or populations, but do not have an impact at the species level at this time. Additionally, conservation measures and protection provided by a variety of conservation efforts to benefit the gopher tortoise and its habitat have been implemented by Federal and State agencies, nongovernmental organizations, private landowners, and partnerships across the range of the species, and we anticipate these conservation measures and protections will continue to benefit the gopher tortoise into the foreseeable future (in part due to other sensitive and federally listed species occurring in these areas). These conservation efforts and regulatory mechanisms are in place across the range of the species and are addressing some of the identified threats by restoring, enhancing, or providing gopher tortoise habitat, relocating tortoises, and augmenting populations through captive propagation. See the SSA for a thorough discussion of all potential and current threats (Service 2022, pp. 46–102).

Conservation efforts by the Service, State agencies, nongovernmental organizations, and private groups as described in *Conservation Efforts and Regulatory Mechanisms,* above, have informed our analysis of the species' condition by providing additional information regarding species abundance, density, and habitat conditions within the range of the species. In addition, habitat restoration actions and species-specific conservation measures including translocation of individuals and improved awareness of the species' needs and threats have contributed to the improved condition of the species. In particular, Service-approved plans or other plans including the gopher tortoise CCA, CCAA, rangewide conservation strategy with the DoD, and the Gopher Tortoise Initiative have resulted in the protection of gopher tortoise habitat and populations across the range of the species. Many of the management actions and conservation easements under these plans are expected to remain in place in the future, benefiting the species. The BMPs implemented on working forests benefit the gopher tortoise and its habitat; these BMPs are expected to continue to be implemented in the future and will continue to benefit the species and its habitat.

Based on our analysis of the five factors identified in section 4(a)(1) of the Act, we conclude that the Eastern DPS is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range.

### *Status Throughout a Significant Portion of the Eastern DPS's Range*

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range. Having determined that the Eastern DPS is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so in the foreseeable future in a significant portion of its range—that is, whether there is any portion of the species' range for which it is true that both (1) the portion is significant; and (2) the species is in danger of extinction now or likely to become so in the foreseeable future in that portion. Depending on the case, it might be more efficient for us to address the "significance" question or the "status" question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

In undertaking this analysis for the Eastern DPS, we chose to address the status question first. We began by identifying any portions of the range where the biological status of the species may be different from its biological status elsewhere in its range. The range of a species can theoretically be divided into portions in an infinite number of ways, so we focus our analysis on portions of the species' range that contribute to the conservation of the species in a biologically meaningful way. For this purpose, we considered information pertaining to the geographic distribution of (a) individuals of the species, (b) the threats that the species faces, and (c) the resiliency condition of populations. For the Eastern DPS, we considered whether the threats or their effects are occurring in any portion of the DPS' range such that the Eastern DPS is in danger of extinction now or likely to become so in the foreseeable future in that portion of the range.

The Eastern DPS comprises the majority of gopher tortoise populations and habitat across the range of the species, and, therefore, threats that affect the species rangewide also affect the gopher tortoise in the Eastern DPS. We evaluated the past, ongoing, and anticipated threats affecting the species including habitat loss, degradation, and fragmentation due to land use changes from urbanization, climate warming, sea level rise, and insufficient and/or incompatible habitat management. We also considered effects from URTD and other diseases, predation, overutilization, and nonnative invasive species, and cumulative effects. Conservation efforts and regulatory mechanisms also influence the gopher tortoise and its habitat in the Eastern DPS. These factors and threats influence the gopher tortoise similarly rangewide; however, we identified two portions of the Eastern DPS range where the impact of these factors may have a more pronounced effect such that it may have a different status than the remainder of the DPS. The portions we considered were the geographic area described as Unit 5 (Florida) and Unit 2 (Central; west of the Apalachicola and Chattahoochee Rivers and east of Unit 1) in the SSA report.

Sea level rise primarily affect populations along the coast in Unit 5 (Florida). Although sea level rise is projected to affect coastal populations of gopher tortoise, the number of populations affected varies by location and elevation of the population, site-specific characteristics, and climate change scenario. Of the 21 local populations occurring in coastal areas rangewide, 18 of these populations occur in Unit 5. Of these 18 coastal populations, 5 currently exhibit high resiliency and 13 exhibit moderate resiliency. Overall, Unit 5 currently has 43 populations that exhibit high resiliency and 50 populations that exhibit moderate resiliency. In our future projections, small populations in coastal areas decline in the same proportion as small populations throughout Unit 5 and rangewide. Future condition modeling projects between 58 and 62 local populations and 37 to 43 landscape populations will remain on the landscape in Unit 5, including the very large populations (exceeding 1,000 individuals). The current and future condition analyses of gopher tortoise indicate sufficient resiliency, representation and redundancy in Unit 5. Given the species' current and future condition within this unit, we determined that the gopher tortoise in Unit 5 does not have a different status than the remainder of the Eastern DPS.

As described in *Status Throughout a Significant Portion of Its Range,* populations in Unit 2 are generally less resilient and are characterized by low abundance, smaller clutch size, lower hatch rate, slower growth, and less extensive suitable habitat. Within the Eastern DPS, 26.7 percent of the populations in current low resiliency are found in Unit 2, which holds 5.9 percent of the abundance in the DPS. Although threats are similar throughout the Eastern DPS, the species' response is more pronounced in Unit 2 (Central) due to lower resiliency, and threats are having a greater impact than elsewhere in the DPS. For example, 14 local populations are projected to remain on the landscape in Unit 2 (Central) in 2100 under the medium stressors and less habitat management scenario. This projected decline in the number of populations would increase the impact of a catastrophic or stochastic event on the representation and redundancy in Unit 2 (Central) Given the species' future condition within this units, we have identified Unit 2 (Central) within the Eastern DPS as an area that has a different status than the remainder of the Eastern DPS.

We then proceeded to the significance question, asking whether this portion of the DPS (*i.e.,* Unit 2) is significant. The Service's most recent definition of ''significant'' within agency policy guidance has been invalidated by court order (see *Desert Survivors* v. *U.S. Department of the Interior,* 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018)). In undertaking this analysis for the Eastern DPS, we considered whether the Unit 2 (Central) portion of the Eastern DPS is significant based on its biological importance to the overall viability of the Eastern DPS. Therefore, for the purposes of this analysis, when considering whether this portion is significant, we considered whether the portion may (1) occur in a unique habitat or ecoregion for the DPS, (2) contain high-quality or high-value habitat relative to the remaining portions of the DPS, for the species' continued viability in light of the existing threats, (3) contain habitat that is essential to a specific life-history function for the species and that is not found in the other portions of the DPS, or (4) contain a large geographic portion of the suitable habitat relative to the remaining portions of the DPS.

Although Unit 2 (Central) contributes to the condition of the species within the Eastern DPS, it does not represent a large area of suitable habitat relative to the remainder of the Eastern DPS. Unit 2 (Central) holds approximately 9.2 percent of suitable habitat with known gopher tortoise occurrences in the Eastern DPS, and this habitat is of generally lower quality and is less extensive than in the remainder of the Eastern DPS. It does not contain proportionally higher quality habitat or higher value habitat than the remainder of the range. This area does not act as a refugia or an important breeding area for this portion. The area does not act as an especially important resource to a particular life-history stage for the gopher tortoise than elsewhere in the Eastern DPS.

Overall, there is little evidence to suggest that the geographical area of Unit 2 (Central) of the Eastern DPS's range has higher quality or higher value habitat to the species' life history in the Eastern DPS. In addition, this unit constitutes a small portion of the gopher tortoise habitat in the Eastern DPS (approximately 14 percent of this portion of the range). Thus, based on the best available information, we find that this portion of the Eastern DPS's range is not biologically significant in terms of the habitat considerations discussed above. Therefore, no portion of the Eastern DPS's range provides a basis for determining that the species is in danger of extinction now or within the foreseeable future in a significant portion of its range. This finding does not conflict with the courts' holdings in *Desert Survivors* v. *U.S. Department of the Interior,* 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018) and *Center for Biological Diversity* v. *Jewell,* 248 F. Supp. 3d 946, 959 (D. Ariz. 2017) because, in reaching this conclusion, we did not need to consider whether any portions are significant and, therefore, did not apply the aspects of the Final Policy's definition of ''significant'' that those court decisions held were invalid.

*Determination of the Eastern DPS's Status*

Our review of the best available scientific and commercial information indicates that the Eastern DPS of the gopher tortoise does not meet the definition of an endangered species or a threatened species in accordance with sections 3(6) and 3(20) of the Act. Therefore, we find that listing the Eastern DPS of the gopher tortoise is no longer warranted for listing under the Act. With the publication of this document, the eastern portion of the gopher tortoise range (now the Eastern DPS) will be removed from the list of candidate species.

## References Cited

A complete list of references cited is available on the internet at *https://www.regulations.gov* and upon request from the Florida Ecological Services Field Office (see **ADDRESSES**).

## Author(s)

The primary authors of this notice are the staff members of the Florida Ecological Services Field Office and the Species Assessment Team.

## Signing Authority

Martha Williams, Director of the U.S. Fish and Wildlife Service, approved this action on September 20, 2022, for publication. On September 30, 2022, Martha Williams authorized the undersigned to sign the document electronically and submit it to the Office of the Federal Register for publication as an official document of the U.S. Fish and Wildlife Service.

**Madonna Baucum,**

*Chief, Policy and Regulations Branch, U.S. Fish and Wildlife Service.*

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