Gopher Tortoise Survey at Guana River Wildlife Management Area

Final report to the Florida Fish and Wildlife Conservation Commission

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Photo Credits:

Top: Gopher tortoise basking at the entrance of a burrow; Dan Hipes, FNAI

Middle: Typical view from flatwoods to mash along the intracoastal waterway; Katy NeSmith, FNAI

Bottom: 2008 Aerial photograph showing mosaic of scrub, scrubby flatwoods. mesic flatwoods and depressional wetlands

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Introduction

The Florida Natural Areas Inventory (FNAI) is part of the Florida Resources and Environmental Analysis Center at Florida State University. Our mission is to gather, interpret, and disseminate information that is critical to the conservation of Florida's biological diversity. To further this mission FNAI works cooperatively with the Florida Fish and Wildlife Conservation Commission (FWC) on inventory and monitoring projects throughout Florida. The goal of this project was to determine a baseline tortoise population estimate or index at Guana River Wildlife Management Area through a comprehensive survey of all potentially suitable habitats. Approximately 1,654 acres of potentially suitable habitat at Guana River WMA was identified using a combination of natural community landcover maps produced by FNAI and depth to groundwater modeling produced by FWC. This analysis, conducted by FWC, resulted in the following acreages of potentially suitable tortoise habitat: 912 acres of mesic flatwoods, 140 acres of scrubby flatwoods, 270 acres of scrub, and 332 acres of xeric hammock.

Methods

A shapefile grid of 10 m x 10 m polygons was created for the extent of potential habitat using Hawths Analysis Tools. Transects covering approximately 22 percent of the area were then selected systematically from this grid to evenly cover the area (manually stratified). Although start and end points of the transects were placed close to access points, the transects were unbiased with regard to placement within the potentially suitable habitat. This was generally done by turning off the background aerial photograph during the drawing of transect lines. The resulting transects resemble a maze through suitable habitat that maximizes area covered in the survey habitat while minimizing the travel time between start and end points of the transects. The transect file was loaded onto Trimble Nomad (with Pathfinder XB GPS) or Trimble GeoXT dataloggers, which have a map screen that allows the surveyor to see his/her location in relation to the preselected survey transects. GPS locations were corrected in real time using a WAAS satellite based augmentation signal to ensure that surveyors stayed within the transects. Each transect was searched for tortoise burrows. The path of each surveyor was recorded on the dataloggers to ensure full coverage of the entire survey transect. The location, size (juvenile < 5 in; subadult 5-8 in; adult >8 in), and apparent activity status of all active, inactive, and recently abandoned burrows observed were recorded on an electronic form developed in Trimble Pathfinder Office software for use with Trimble TerraSync software on the dataloggers. Active burrows are characterized by open burrow entrances and clear signs of recent tortoise activity, such as tracks or slide marks in the sand (fresh digging alone may not be attributable to tortoises). Inactive burrows do not show clear signs of very recent tortoise activity but appear to have been maintained within the last few weeks, as evidenced by a clean, passable, flat-bottomed entrance, with leaf litter either absent or appearing to have been deposited recently. Active and inactive burrow were later combined in a "potentially occupied" category; this category may be used in other projects because of potential differences among surveyors in assigning burrows to the active and inactive categories. Abandoned burrows represent a broad range of deterioration: Toward the inactive end of the spectrum, there may be decaying leaf litter in a burrow that otherwise retains functional shape (i.e., tortoise cross-sectional shape); there also may be erosion or evidence of digging by mammals (U-shaped or V-shaped bottom) at the mouth of the burrow. If a burrow showed evidence of armadillo use (higher dome, more rounded in cross-section), it was categorized as abandoned. Burrows that were not clearly made by a tortoise or old burrows that were filled by sediment or debris were not recorded. Following the completion of a

transect or series of transects, FNAI staff returned to burrows recorded as active or inactive and used a burrow camera to determine occupancy. Any additional active or inactive burrows observed outside of the transects also were searched in order to get a sample greater than 200 burrows (set as an arbitrary minimum for the project).

Field data were downloaded and secondarily corrected (post processed) using base station data available from Florida Department of Environmental Protection to further improve the accuracy and precision of the locations recorded. The shapefiles depicting suitable habitat were edited to include additional areas of suitable habitat as determined during the field work. Transect shapefiles also were edited to include the additional area surveyed based on a GPS trail. Tortoise burrows located outside of the transects were excluded from the data using an ArcGIS selection. Area of transect within each to the survey habitats was determined by using the "clip" tool in ArcGIS, clipping the habitat shapefile with the transect shapefile to produce a separate shapefile of habitat covered by the transects for which area (acres) was then calculated. Densities of active, inactive burrows and alternatively potentially occupied burrows (the combined active and inactive burrows) were calculated for each habitat. Burrow densities were then multiplied by acres of corresponding habitat to develop an estimate for the total number of active, inactive and the combined potentially occupied burrows for a site. Occupancy rates were calculated for burrows identified as active, inactive, and potentially occupied by dividing the number of burrows in each of those categories by the number of burrows occupied by tortoises within those categories. Total population estimates were calculated using both the sum of the active burrow estimate multiplied by the corresponding occupancy rate plus the inactive burrow estimate multiplied by the occupancy rate; and simply the estimated potentially occupied burrow estimate multiplied by the overall occupancy rate.

Results and Discussion

FNAI staff surveyed 402 acres (24%) of transects within 1654 acres of potential gopher tortoise habitat at Guana River WMA. This habitat includes 912 acres of mesic flatwoods, 140 acres of scrubby flatwoods, 270 acres of scrub, and 332 acres of xeric hammock. Table 1 summarizes the transect data for each of the four habitats. A total of 68 active, 29 inactive, and 48 abandoned tortoise burrows were observed. Of these there were 133 large or adult (>8 in), 10 medium or subadult (5-8 in), and 2 small or juvenile burrows. The high percentage of large burrows is typical for this long-lived animal, but may be a little skewed toward the adult end, possibly indicating past extended periods with low reproduction. Some small and medium burrows also were observed outside of transects further indicating recent reproduction. Table 2 summarizes the activity status by habitat of burrows within the transects. Separate active and inactive categories are shown as well as the potentially occupied category (the combined active and inactive burrows). Table 3 shows the calculated burrow density for each habitat. This density was then multiplied by the corresponding habitat acreage to calculate an estimate for the total number of active and inactive burrows, or alternatively potentially occupied burrows for the WMA (Table 4). Table 5 summarizes the results of the burrow scoping; status and occupancy by habitat are shown. Occupancy rates derived from these results are shown in Table 6. The gopher tortoise population estimate for Guana River WMA based on overall occupancy rates of active and inactive tortoise burrows (multiplied by corresponding total burrow estimates) is 238. The gopher tortoise population estimate for Guana River WMA based on the overall occupancy rate of potentially occupied tortoise burrows (multiplied by corresponding total burrow estimate) is 223. The following shapefiles were appended to a Geodatabase provided to FNAI by FWC: Surveyed

habitat; survey transects; tortoise burrows within transects; and scoped active and inactive (potentially occupied) burrows. This geodatabase is provided along with this report as the final products for this project.

Table 1. Total gopher tortoise habitat and transect acreage at Guana River WMA

Habitat	Total acres	Transect acres	Percent
mesic flatwoods	912.14	206.10	22.59
xeric hammock	331.99	84.33	25.40
scrub	270.14	74.22	27.47
scrubby flatwoods	140.01	37.06	26.47
Total	1654.28	401.71	24.28

Table 2. Summary of burrow status by habitat within transects at Guana River WMA

Habitat	Active	Inactive	Potentially Occupied*	Abandoned	**Total**
mesic flatwoods	5	8	13	21	**34**
xeric hammock	8	12	20	6	**15**
scrub	43	8	51	18	**73**
scrubby flatwoods	12	1	13	3	**23**
Total	**68**	**29**	**97**	**48**	**145**

*Potentially Occupied is the combination of active and inactive burrows.

Table 3. Summary of active and inactive burrow density within transects by habitat at Guana River WMA

Habitat	Active	Density (per acre)	Inactive	Density (per acre)	Potentially Occupied	Density (per acre)
mesic flatwoods	5	.024	8	.039	13	.063
xeric hammock	8	.095	12	.142	20	.237
scrub	43	.579	8	.108	51	.687
scrubby flatwoods	12	.324	1	.027	13	.351

Table 4. Total burrow estimates for active and inactive burrows by habitat at Guana River WMA

Habitat	Acres of habitat	Active burrows per acre	**Estimated active burrows**	Inactive burrows per acre	**Estimated inactive burrows**	Potentially Occupied burrows per acre	**Estimated Potentially Occupied burrows**
mesic flatwoods	912.14	.024	**22**	.039	**36**	.063	**57**
xeric hammock	331.99	.095	**32**	.142	**47**	.237	**79**
scrub	270.14	.579	**156**	.108	**29**	.687	**186**
scrubby flatwoods	140.01	.324	**45**	.027	**4**	.351	**49**
Total			**255**		**116**		**371**

Table. 5. Status and total occupancy of scoped burrows at Guana River WMA*

Habitat	Active - occupied	Active - unoccupied	Inactive - occupied	Inactive - unoccupied	Potentially occupied-occupied	Potentially occupied-unoccupied	**Total**
mesic flatwoods	18	0	0	15	18	15	**33**
xeric hammock	9	2	2	2	11	4	**15**
scrub	58	9	5	27	63	36	**99**
scrubby flatwoods	26	3	0	21	26	24	**50**
ruderal	1	0	0	0	1	0	**1**
Total	**112**	**14**	**7**	**65**	**119**	**79**	**198**

*Undetermined burrows (n=9) were not included in the occupancy rate calculations

Table 6. Occupancy rates for scoped burrows at Guana River WMA

Habitat	Active burrow occupancy rate	Inactive burrow occupancy rate	Potentially occupied occupancy rate
mesic flatwoods	100	0	54.54
xeric hammock	81.81	50	73
scrub	86.57	15.62	63.64
scrubby flatwoods	89.66	0	52
ruderal	100	n/a	100
Total	**88.89**	**9.72**	**60.10**

Table 7. Gopher tortoise population estimates at Guana River WMA based on overall occupancy rates of active and inactive tortoise burrows and corresponding total burrow estimates

status	Estimated burrows	occupancy rate	**Estimated tortoises**
active	255	88.89	**227**
inactive	116	9.72	**11**
Total population estimate			**238**

Table 8. Gopher tortoise population estimates at Guana River WMA based on overall occupancy rates of potentially occupied tortoise burrows and the corresponding total burrow number estimate

Estimated potentially occupied burrows	occupancy rate	**Estimated tortoises**
371	60.1	**223**
Total population estimate		**223**