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Final Report
Gopher Tortoise Inventory
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Introduction:

Gopher tortoises (*Gopherus polyphemus*) are a keystone species in Florida scrub habitats. Keystone species are defined as a species that has a surprisingly large impact on its ecosystem regardless of the population size, effecting energy flow, community structure and composition (Cain et al. 2008). According to a study done by MacDonald and Mushinsky (1988) on gopher tortoise scat, tortoises prefer scrubby habitats with minimal canopy cover. Scrubby flatwood habitats are characterized by sparse to densely placed knee high saw palmetto (*Serenoa repens*) with shrubby oak species (*Quercus spp),* rusty staggerbush, piedmont staggerbush and fetterbush (*Lyonia spp*), blueberry species (*Vaccinium spp*), pine species (*Pinus spp*) and grass species (*Aristida spp*) dispersed throughout (Menges & Kohfeldt 1995). Without a natural fire regime, and this tortoise species these habitats would not exist. The combination of gopher tortoise dietary habits and periodic fire help to keep Florida scrub canopy cover to a minimum. The majority of the plant matter ingested by adult tortoises is of the Poaceae family (20.7%); 10.6% of these Poaceae grasses are wire grass (*Aristida stricta*) (MacDonald and Mushinsky 1988). In addition to the Poaceae grasses, the tortoise scat study documented an abundance of pine (9.7%) and oak (9.1%) ingested by the gopher tortoises (MacDonald and Mushinsky 1988). Their study supports that gopher tortoises play a major role in keeping these plant species from becoming towering trees in the scrubby flatwoods. Gopher tortoises are a threatened species (November 2007) with critical impacts originating from habitat destruction, deforestation and fragmentation through the development of land by people (FWC FAQ's 2011). They are a burrowing species of

tortoise that prefers dry sandy soil. Each tortoise usually has several burrows in an area so they are not restricted to the small area outside of just one burrow (MacDonald & Mushinsky 1988). Since they are grazers multiple burrows allow them to travel as well as provide safety in more than one location. When a tortoise abandons a burrow, it becomes a possible home for more than 300 other documented species to use. This characteristic behavior is what makes gopher tortoises a keystone species (Carthy et al. 2005). Gopher tortoises prefer locations that have direct sunlight and are at ground level. The sunlight is used as incubation for the reptile and its eggs which can be laid either inside of the burrow, or in a warm area away from the burrow. Additionally, they prefer dry soils like sand, although they can dig through tougher substances like clay (Florida Forestry Association 2008).

The division of Landscape and Natural Resources is interested in documenting gopher tortoise occurrence, health and capacity in the University of Central Florida natural lands. Field observations indicate that the scrubby flatwoods at UCF should support a healthy gopher tortoise population based on observations of the plant species in these areas. Without gopher tortoises in the natural lands the University of Central Florida (UCF) Orlando campus would not have the healthy Florida scrub habitat that is seen today. The purpose of this study was to create an inventory of the gopher tortoises that live in the UCF natural areas on the east side of the Orlando campus. Based on the referenced literature, and field observations in the UCF natural lands it is predicted that since these lands are Florida scrub habitat and managed by fire this area will be prime habitat for the gopher tortoise. It is predicted that a large number of tortoises will be found in this area, but that the area is not at capacity.

Materials and Methods:

- Burrow measuring mechanism

- Aluminum tree caliper
- Trimble Yuma GPS
- Scute file
- Camera
- Machete
- Data sheet

The study was conducted by foot twice a week from 2-5 p.m. The study included searching for, and recording gopher tortoise burrows using the belt transect method. Prior to conducting the study a GIS shapefile was created to establish transect lines, and uploaded onto the Trimble GPS unit. Each transect ran the length of the study area in a north/south direction. The transects were set up 20 meters apart. At each transect line a searched was conducted 5 meters in each direction making each transect line 10 meters in width (Figure 2). The burrows were recorded as active, inactive or abandoned. Burrows that were indicative of use by a tortoise were labeled as active. Those that were not currently in use by a tortoise were either recorded as inactive or abandoned. If a burrow appeared to be active and looked as though it belonged to a tortoise, but had not been visited regularly it was recorded as inactive. Indicators of an abandoned burrow are caving in, debris at the mouth, spider webs in entrance and no disturbed sand around the entrance. Abandoned burrows were recorded on the burrow map, but were not included in the tortoise density calculations. Each burrow that was found within the 10 meter transect width was recorded along with the habitat type, the height and width of the burrow and any notes that were important for the study. Burrow height and width are important measurements because they give an indication of what size tortoise dug the burrow (FWC 2008). The FWC equation for gopher tortoise density ((total potentially occupied burrows/total acres in survey) x 0.5= tortoises/acre) was used to determine the UCF natural area gopher tortoise population (FWC 2008). Any tortoises found during the study were captured and marked with a scute notching system. Previously captured gopher tortoises at UCF have been marked with the

same scute notching system (Figure 3). Using this system, each scute represents a number and multiple scute notches represent a larger number deciphered through adding the numbers of each scute that has been notched.

Results

In total 50 gopher tortoise burrows were recorded in the study area. Of the 50 recorded burrows, 35 were found in scrubby flatwoods and 15 were found in mesic flatwoods (Table 1). Additionally, one female tortoise was encountered during the survey. She was captured using the hand capture method at 2:34 p.m. on March 22, 2011 on transect 3. Tortoise carapace length was 25.3 cm and width was 17.5 cm. Total plastron length was 21.9 cm. Tortoise maturity is classified by carapace length/age; juvenile <10 cm, subadult 10-22.99 cm, and Adult: ≥ 23 cm (FWC 2010). By this classification system, the female tortoise captured was an adult. There were no injuries or scars recorded, nor were there any parasites or Upper Respiratory Tract Disease (URTD) signs present (Figure 4). The female captured had no markings so she was marked as tortoise number 92 following the previous FWC marking protocol.

Discussion

In 2009 a similar survey was conducted that found 47 burrows in comparison to the 50 burrows recorded during the 2011 survey (Table 2). Since there were 47 burrows in 2009 and 50 in 2011, this shows a 6% increase in burrows which indicates that the tortoise population in this area is slightly increasing. It is also possible that the 2011 survey was more thorough. According to the FWC equation for finding the total density of gopher tortoises in an area, the UCF natural lands hold (39/21.02) x 0.5 = 0.928 tortoises/acre (FWC 2008). FWC defines capacity for tortoises as 2 tortoises per acre (FWC 2008). This number indicates that the UCF natural lands

are below capacity and that tortoises could be accepted if necessary. Reasons for accepting tortoises include development of a local area that contains a gopher tortoise population in need of relocation by FWC regulations (FWC 2008). The natural lands at the UCF campus have a healthy number of gopher tortoises, but the land is in fact below capacity by approximately half.

As indicated in Tables 1 and 2, the majority of the burrows were found in scrubby flatwoods, a Florida scrub habitat. This result was expected since the tortoises prefer areas with very little canopy cover. Scrubby flatwoods have no canopy cover and the vegetation is ideal for tortoise foraging habits. The soil type in scrubby flatwoods is also preferable for tortoise burrows, being white sandy soil most of the time.

During the survey, it was expected that more than one tortoise would be encountered however the result is not surprising since the surveys were conducted late in the day. Tortoises are commonly out foraging and sunbathing from late morning to about midafternoon (MacDonald & Mushinsky 1988). The current study surveys were conducted from 2 p.m. until 5 p.m.

In conclusion, the results of this study indicate that the UCF natural lands appear to be high quality tortoise habitat. This quality habitat is valuable. Gopher tortoises are a threatened species that thrives in Florida scrub habitat. They contribute to this unique habitat through their foraging habits as well as providing homes for other burrowing species, and an underground escape from forest fires. From previous studies it has been determined that 70 vertebrate species are known to live in the Florida scrub habitat; several of these are known to occur only in this unique habitat (McCoy and Mushinsky 1994). There is a remarkably high concentration of plant species in the scrub habitat, 20 of which are endemic to this habitat. These plant species are

unique because they are capable of rapid regeneration after intense fires (McCoy and Mushinsky 1994). On the UCF campus, the Landscape and Natural Resources division has kept the scrub habitat healthy through prescribed burning. The prescribed fire program has contributed to keeping scrubby flatwoods healthy, as these are fire dependant systems. In May of 2005, the first prescribed fire took place at UCF. Preceding 2005 the UCF forest had gone almost forty years without a fire. When a lightning strike started the first wild fire, prescribed fires were then planned and controlled in order to avoid a more serious fire that could not be controlled (Woo et al. 2009). Several prescribed burns have occurred in the UCF natural areas since the first one in 2005 (L&NR 2011). Without these fires the oak species would take over and the ecosystem would shift away from scrubby flatwoods which would be detrimental to gopher tortoises and other endemic scrub species (Birmingham-Hague et al. 2010).

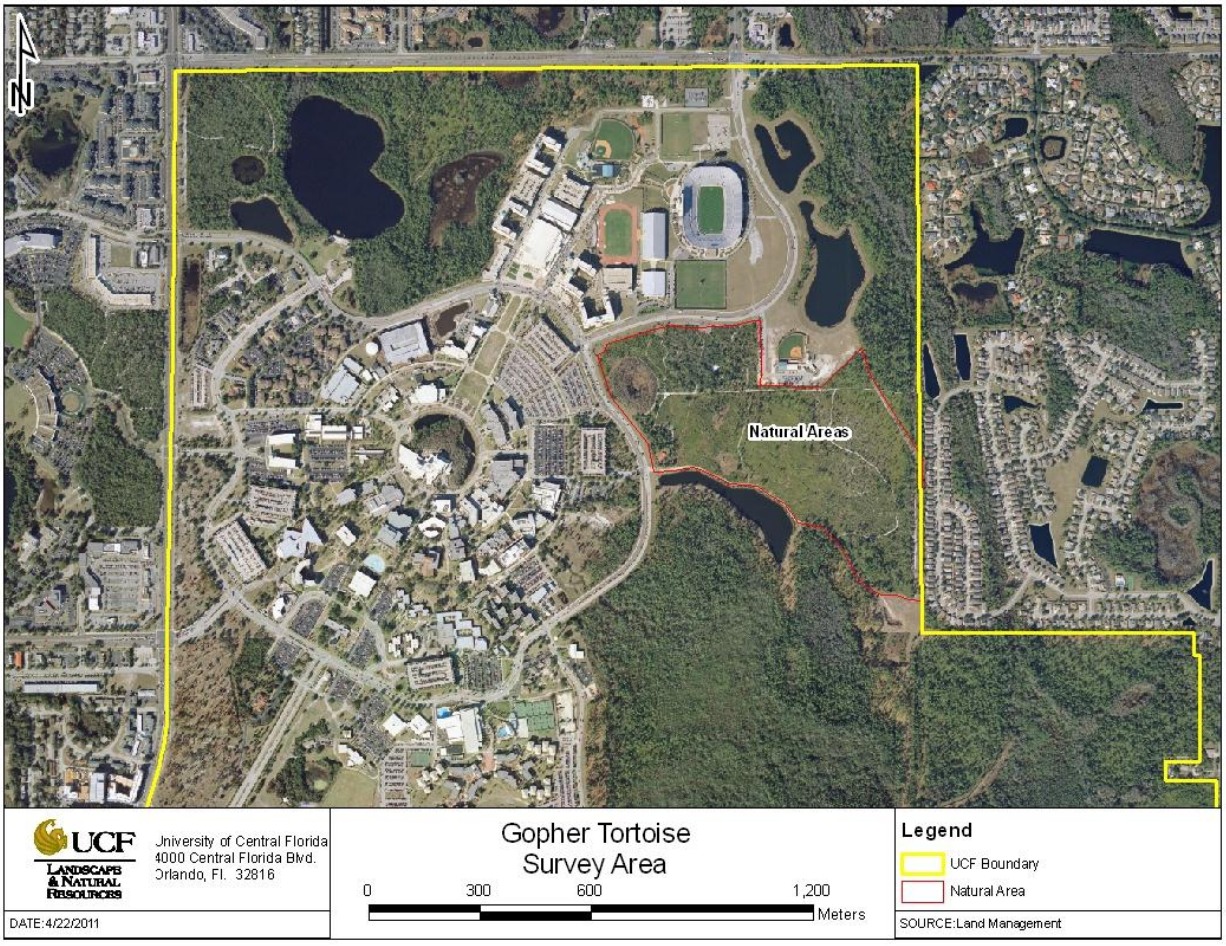

Figure 1 Map of the UCF Orlando campus (Natural Areas where tortoise study was conducted outlined in red)

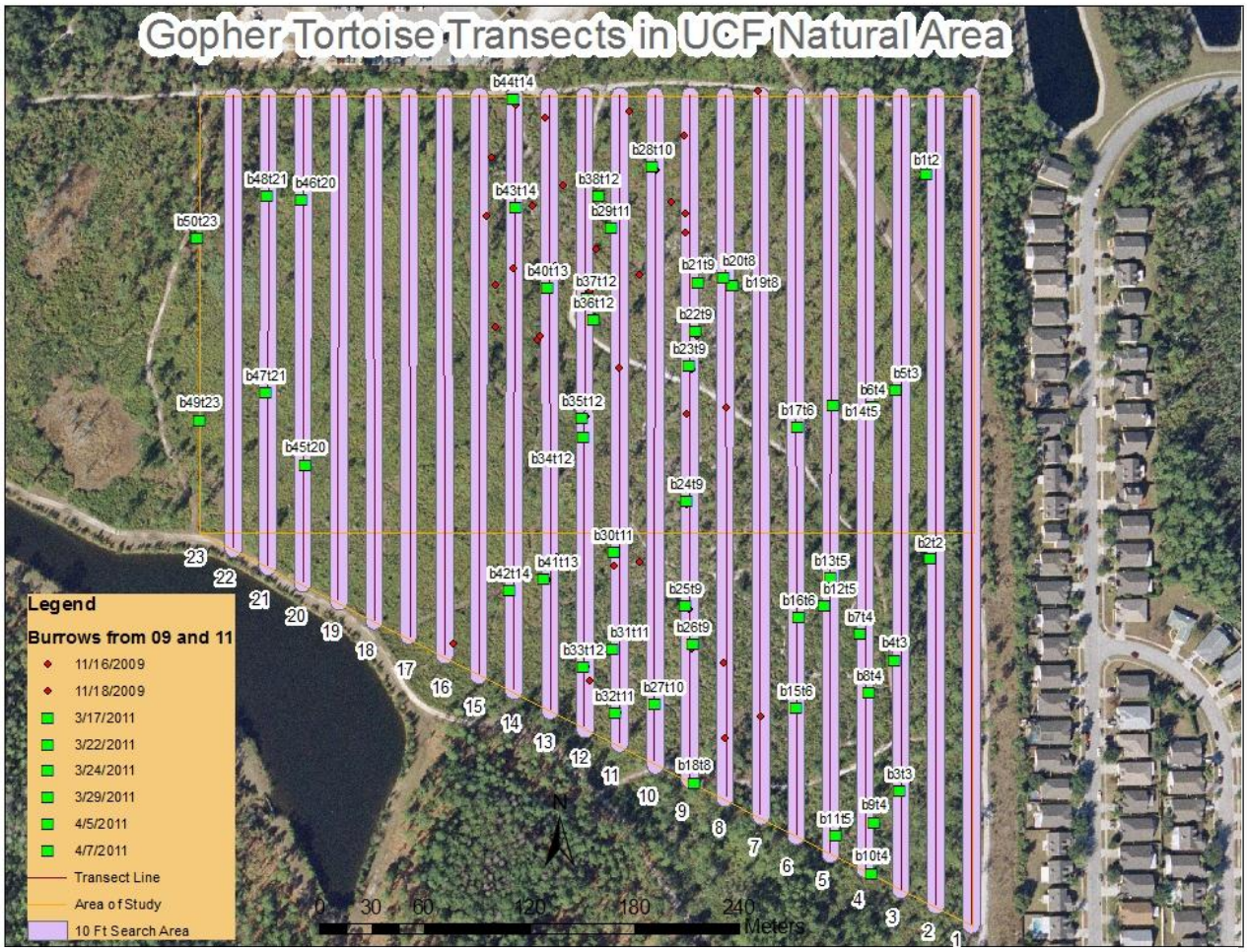

Figure 2 Map of transects and gopher tortoise burrows found in 2009 and 2011

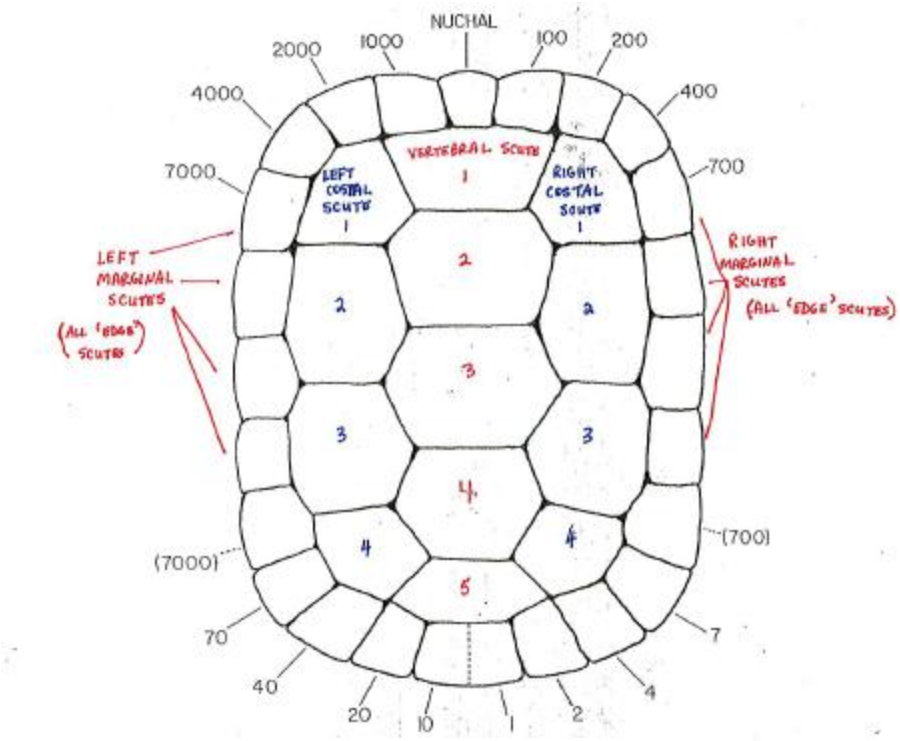

Figure 3 Gopher tortoise scute numbering system

Figure 4 Tortoise #92 found at 2:34 pm on March 22, 2011 in transect 3

Table 1: Gopher tortoise burrow type and habitat

Scrubby Flatwoods:	Active	17
	Abandoned	7
	Inactive	11
Mesic Flatwoods:	Active	9
	Abandoned	4
	Inactive	2
		50

Table 2: Collection of gopher tortoise data

Habitat Type	**Notes**	**Date Recorded**	**Burrow Activity**	**Height**	**Width**	**Burrow /Transect**
Mesic Flatwoods		3/17/2011	active	14	23	b1t2
Mesic Flatwoods		3/17/2011	active	20.1	14.7	b2t2
Mesic Flatwoods		3/22/2011	abandoned	15.5	21.1	b3t3
Scrubby Flatwoods	Tortoise #92	3/22/2011	active	18	25.6	b4t3
Scrubby Flatwoods		3/22/2011	abandoned	13	16.6	b5t3
Scrubby Flatwoods	caved in	3/22/2011	abandoned	7.8	13.2	b6t4
Scrubby Flatwoods		3/22/2011	active	11.3	21	b7t4
Scrubby Flatwoods		3/22/2011	abandoned	12.2	15.7	b8t4
Mesic Flatwoods		3/22/2011	abandoned	8	29.3	b9t4
Mesic Flatwoods	very large	3/22/2011	active	18.1	34.7	b10t4
Mesic Flatwoods		3/22/2011	abandoned	18.5	12	b11t5
Scrubby Flatwoods		3/22/2011	inactive	12	17.5	b12t5
Scrubby Flatwoods		3/22/2011	active	13.5	26.8	b13t5
Scrubby Flatwoods		3/22/2011	inactive	13.5	20.8	b14t5
Mesic Flatwoods		3/24/2011	active	18.6	22.6	b15t6
Mesic Flatwoods		3/24/2011	inactive	140	20.6	b16t6
Scrubby		3/24/2011	abandoned	12.5	16	b17t6

Flatwoods						
Mesic Flatwoods		3/24/2011	active	13.5	31	b18t8
Scrubby Flatwoods		3/24/2011	inactive	6	22.3	b19t8
Scrubby Flatwoods		3/24/2011	inactive	13	29.1	b20t8
Scrubby Flatwoods		3/24/2011	active	9.5	20	b21t9
Scrubby Flatwoods		3/24/2011	active	9.4	22.7	b22t9
Scrubby Flatwoods		3/24/2011	active	14.3	18.2	b23t9
Scrubby Flatwoods	not sure if active, possible slide marks	3/24/2011	active	10.6	15.2	b24t9
Scrubby Flatwoods	bright white but entrance has some debris	3/24/2011	inactive	7.7	17.5	b25t9
Scrubby Flatwoods		3/24/2011	abandoned	15.2	29	b26t9
Scrubby Flatwoods		3/24/2011	active	10.7	26.7	b27t10
Scrubby Flatwoods		3/24/2011	inactive	7	14.3	b28t10
Scrubby Flatwoods		3/29/2011	inactive	12.8	18.9	b29t11
Scrubby Flatwoods	spider webs and debris	3/29/2011	abandoned	12.8	18.8	b30t11
Scrubby Flatwoods		3/29/2011	active	20.2	27.1	b31t11
Scrubby Flatwoods		3/29/2011	active	9.9	37.6	b32t11
Mesic Flatwoods		3/29/2011	active	11.5	27.3	b33t12
Scrubby Flatwoods	abandoned or active, hard to tell	3/29/2011	active	14	22.2	b34t12
Scrubby Flatwoods		3/29/2011	active	9.3	14.2	b35t12
Scrubby Flatwoods		3/29/2011	active	13.5	20.2	b36t12
Scrubby Flatwoods		3/29/2011	inactive	10.3	17.3	b37t12
Scrubby Flatwoods		3/29/2011	active	16.2	27.2	b38t12
Scrubby Flatwoods		3/29/2011	active	5.4	21	b39t13
Scrubby Flatwoods		3/29/2011	abandoned	7.2	9.9	b40t13
Scrubby Flatwoods		3/29/2011	abandoned	10.5	17.3	b41t13
Scrubby		3/29/2011	inactive	10.3	20.4	b42t14

Flatwoods						
Scrubby Flatwoods		3/29/2011	active	5.2	12.2	b43t14
Scrubby Flatwoods		3/29/2011	inactive	10.1	18.1	b44t14
Mesic Flatwoods	just rained, hard to tell	4/5/2011	inactive	10	20.1	b45t20
Mesic Flatwoods	tree roots= weird shape	4/5/2011	abandoned	15.6	12	b46t20
Scrubby Flatwoods		4/7/2011	active	16.2	26.3	b47t21
Mesic Flatwoods		4/7/2011	active	11	17.2	b48t21
Mesic Flatwoods		4/7/2011	active	7.5	17.1	b49t23
Mesic Flatwoods		4/7/2011	active	14.3	24.5	b50t23

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